D19-334480

TPA/45209
For the purpose of compliance with the provisions of Clause 43.04 (DPOS) of the Monash Planning Scheme Ordinance this drawing comprising DEVELOPMENT PLAN - DPO5 for 29 BROWNS ROAD, CLAYTON is to the satisfaction of the City of Monash
Signed:
Date: 27.6.17

Development Plan

29 Browns Road Clayton

Surplus Education Land
Clayton Primary School

February 2017

mecone

D19-334480

Development Plan

29 Browns Road Clayton

Surplus Education Land
Clayton Primary School

February 2017

mecone

This Development Plan has been prepared by:

Mecone

And

Mushan Design Studio

In association with:

John Patrick Landscape Architects

Bosco Jonson Surveyors

Ratio Traffic Consultants

Waste Tech Services

Irwinconsult

Energylab

Treelogic

Contents

1 Introduction

This Development Plan has been prepared on behalf of Mushan Design Studio in accordance with the requirements of Clause 43.04 (Development Plan Overlay – Schedule 5) of the Monash Planning Scheme.

The purpose of this Development Plan is to provide a land use and development framework for the former Clayton Primary School (now surplus education land) at 29 Browns Road, Clayton. The Development Plan includes objectives for a range of dwelling types, sustainable design, varied building forms and heights, internal and off-site amenity, pedestrian permeability and native vegetation management. The land which is subject to this Development Plan is shown in Figure 1 – Context Plan.

The Development Plan consists of the Architectural Drawings prepared by Mushan Design Studio and Landscape Concept Plans prepared by John Patrick Pty Ltd (Appendix A) and this report. It has been informed by various background documents which have been prepared for the site. These documents include:

- Site Survey Plan prepared by Bosco Jonson Pty Ltd (Appendix B).
- Traffic Impact Report prepared by Ratio Traffic Consultants (Appendix C).
- Environmentally Sustainable Design (ESD) Report prepared by Energy Lab (Appendix D).
- Stormwater management plan prepared by Irwinconsult Pty Ltd (Appendix E).
- Waste Management Plan prepared by Waste Tech Services Pty Ltd (Appendix F).
- Arboricultural assessments prepared by Tree Logic (dated 30 April 2013 and 29 April 2015) (Appendix G).
- Development Summary prepared by Mushan Design Studios (Appendix H)

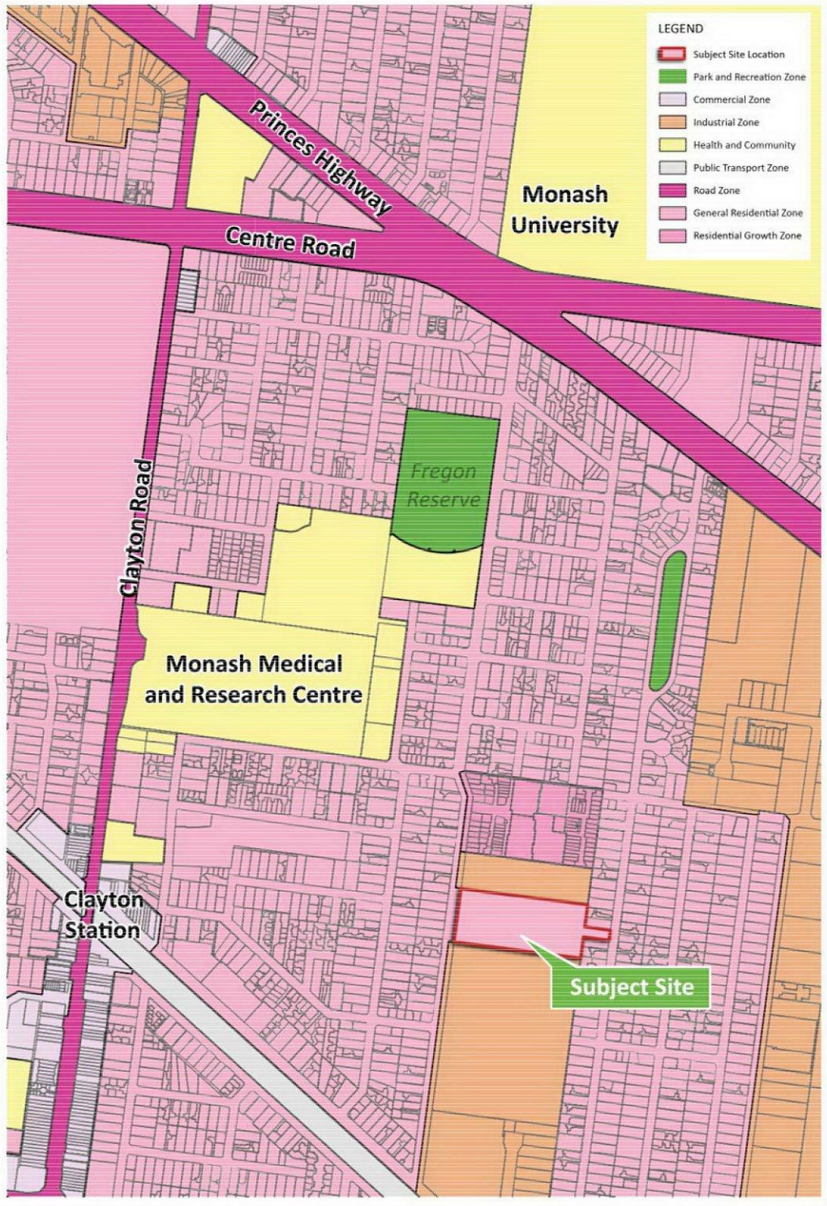

Figure 1 Site Context Plan

1.1 The Development Plan Overlay

The preparation of this Development Plan is consistent with Plan Melbourne, which encourages the preparation of overarching plans to give effect to State and Local Policy objectives. The Development Plan will guide land use, built form, sustainability, landscape, traffic and waste management aspects for the site to achieve a high quality residential development which increases residential density in accordance with the purpose of the zone while responding to the surrounding neighbourhood character.

Pursuant to Schedule 5, Clause 3.0 of the Development Plan Overlay, this Development Plan includes:

- A range of dwelling types to cater for a variety of housing needs.
- Sustainable design features to address water and waste management, solar access and energy saving initiatives, to deliver lower living costs for future residents.
- A composition of varied building forms and heights across the site.
- High quality internal amenity for future residents.
- A design that respects the amenity of adjoining interfaces by providing for a maximum 2 storey built form adjacent to or opposite any existing single storey residential development.
- Taller buildings that are carefully graduated with reference to analysis of shadow, visual amenity impacts and the character of the area.
- Appropriate buffer treatments at the interface with non- residential uses on adjoining properties.
- Opportunities for local permeability through the site.
- Incorporation of any significant vegetation into the design of the development.

The Development Plan is informed by:

- Existing conditions plan, showing surrounding land uses and development, adjoining roads and pedestrian links, public transport routes, topography, and infrastructure provision.
- Concept plans for the site which show:
  - New building orientation and location, indicative uses for each building, car parking areas, public roads, vehicle access locations, pedestrian and bike paths and areas and locations of private and public open space.
  - Three-dimensional building envelope plans including maximum building heights and setbacks.
  - The design philosophy for the site and indicative architectural themes including car parking areas and garages so that they do not dominate the street or any public open space.
  - Shadow diagrams of proposed building envelope conditions at 10.00am, 1.00pm and 3.00pm at 22 September.
  - An indicative development schedule including the minimum number, type and density of dwellings and the floor area of any proposed non-residential uses.
- A traffic management report and car parking plan which includes:
  - Identification of roads, pedestrian, cyclist and vehicle access locations, including parking areas, both internal and external to the site.
  - Traffic management measures, where required.
  - Location and linkages to public transport.
  - Car parking rates for all uses, including visitor parking.
  - Provision for bicycle facilities.
- A landscaping plan which:
  - Shows the landscape concept for the site.
  - Incorporates any significant vegetation including trees rated as ‘moderate’ or ‘high’ in the 2013 Tree Logic assessment.

2 Strategic Planning Context

2.1 Plan Melbourne

Plan Melbourne outlines the vision for Melbourne's growth to the year 2050.

The Development Plan Area is located within/adjacent to the 'Monash Employment Cluster' identified under the following directions and initiatives of the Plan:

- Direction 1.6 – Enable an Investment Pipeline of Transit-Oriented Development and Urban-Renewal
- Initiative 1.6.2 – Identify new development and investment opportunities on the planned transport network.

Direction 1.6 advocates transit-oriented development as a key way to achieve employment and population growth, as well as achieve a broad range of economic, social and environmental benefits from co-locating employment population and public transport.

The Monash Employment Cluster is Melbourne's largest established employment cluster, with a unique mix of education, research and industry participants. It is the largest concentration of employment outside the central city and includes world- leading research and innovation which will continue to contribute significantly to Melbourne's economy.

Figure 2 Location of Site within Monash Employment Cluster

2.2 State Planning Policy Framework

The following clauses of the State Planning Policy Framework (SPPF) are of most relevant to this Development Plan:

Clause 10 – Operation of the State Planning Policy Framework

The purpose of the State Policy in Planning Schemes is to inform planning authorities and responsible authorities of those aspects of State Planning Policy which they are to take into account and give effect to in planning and administering their respective area. The planning policies are directed to land use and development, as circumscribed by the Planning and Environment Act 1987, a primary objective of which is to provide for the fair, orderly, economic and sustainable use and development of land. The SPPF seeks to balance the objectives of planning for Victoria in favour of net community benefit and sustainable development.

Clause 11 – Settlement

Planning is to anticipate and respond to the needs of existing and future communities through provision of zoned and serviced land for housing, employment, recreation and open space, commercial and community facilities and infrastructure. Planning should recognise the need for, and as far as practicable contribute towards: Health and safety, diversity of choice, adaptation in response to changing technology, economic viability, a high standard of urban design and amenity, energy efficiency, prevention of pollution to land, water and air, protection of environmentally sensitive areas and natural resources, accessibility, land use and transport integration. Of particular relevance to this Development Plan are: Clause 11.04-2 (Housing choice and affordability) which seeks a diversity of housing in defined locations that cater for different households and are close to jobs and services; Clause 11.04-3 (A more connected Melbourne) which seeks improved access and connected to job-rich areas; and Clause 11.04-4 (Liveable communities and neighbourhoods) to create a city of 20-minute neighbourhoods that area safe and promote healthy lifestyles.

Clause 12 – Environmental and Landscape Values

Planning should help to protect the health of ecological systems and the biodiversity they support (including ecosystems, habitats, species and genetic diversity) and conserve areas with identified environmental and landscape values.

Clause 14 – Natural Resource Management

Planning is to assist in the conservation and wise use of natural resources including energy, water, land, stone and minerals to support both environmental quality and sustainable development. Clause 14.02 (Water) seeks protection of water bodies and groundwater, the protection of water quality and sustainable use of water.

Clause 15 – Built Environment and Heritage

All new land use and development should appropriately respond to its landscape, valued built form and cultural context, and protect places and sites with significant heritage, cultural, architectural, aesthetic, scientific and cultural value. Planning should achieve high quality urban design and architecture that:

- Contributes positively to local urban character and sense of place.
- Reflects the particular characteristics, aspirations and cultural identity of the community.
- Enhances liveability, diversity, amenity and safety of the public realm.
- Promotes attractiveness of towns and cities with broader strategic contexts.
- Minimises detrimental impact on neighbouring properties.

Clause 16 – Housing

Planning should provide for housing diversity, and ensure the efficient provision of supporting infrastructure. New housing should have access to services and be planned for long term sustainability, including walkability to activity centres, public transport, schools and open space. Clause 16.01-1 (Integrated housing) facilitates increased housing yield in appropriate locations, including under-utilised urban land. Clause 16.01-

- 2 (Location of residential development) and Clause 16.01-3 (Strategic redevelopment sites) direct housing to activity centres, employment corridors and other strategic redevelopment sites that offer good access to services and transport. Clause 16.01-
- 4 (Housing diversity) seeks to ensure housing stock matches changing demand by widening housing choice, particularly in the middle and outer suburbs.

Clause 18 – Transport

Planning should ensure an integrated and sustainable transport system that provides access to social and economic opportunities, facilitates economic prosperity, contributes to environmental sustainability, coordinates reliable movements of people and goods, and is safe.

Clause 19 – Infrastructure

This clause address a range of social infrastructure issues including provision of health, education and cultural facilities as well as physical infrastructure considerations including supply of water, sewerage and drainage.

2.3 Local Planning Policy Framework

The following policies and strategies within the Local Planning Policy Framework (LPPF) are relevant.

2.3.1 Municipal Strategic Statement

The Municipal Strategic Statement (MSS) provides the strategic planning framework for the City of Monash. It discusses elements of local planning policy and identifies issues, objectives and strategies for each. Those that are most relevant to the Development Plan are outlined below.

Clause 21.02 – Key Influences

Issues for land use planning and development as a result of the key influences affecting the Council area include: consideration of the current suburban form of predominantly single dwellings on large blocks; appropriate locations for and design of multi-dwelling housing and new development; the continued success of and activities associated with the Monash University and Monash Medical Centre precinct; the need for more sustainable transport patterns maintaining and enhancing the City's natural areas and managing the changes that will occur within Monash's activity centres. Relevant clauses for this Development Plan include:

- Clause 21.02-1 (Moving towards sustainability) which identifies the importance of considering social, environmental and economical sustainability.
- Clause 21.02-2 (Maintaining the Garden City Character), which seeks to maintain large front setbacks to retain and augment the leafy, treed ambiance of the City;
- Clause 21.02-3 (Changing lifestyle choices and the demands of an ageing population) which recognises the change in demographics and housing demands from traditional family
- homes (single storey detached dwellings) to smaller household numbers in multi-dwelling developments in locations close to transport, jobs and community services/facilities;
- Clause 21.02-4 (Activity Centre growth) which identifies land within the Monash Technology Precinct surrounding the Development Plan Area as a Specialised Activity Centre (SAC) in Metropolitan Melbourne which performs a specialised function outside of retailing, commercial and residential uses. It is considered to be an important location for further development of high technology, research and development institutions and businesses; and
- Clause 21.02-6 (The importance of neighbourhood character and heritage) which seeks to facilitate redevelopment of current underutilised land, including former school sites, for multi-unit development while managing the existing and developing areas which protects and enhances the physical, economic and social environment.

Clause 21.03 – A Vision for Monash

The Council Plan and Municipal Strategic Statement share Council's Vision for a Thriving Community:

"Our City will promote a sustainable, quality environment where the community is actively encouraged to participate in community and civic life to enrich the cultural, social, environmental and economic viability of our City."

Clause 21.03 (Strategic Framework Plan) identifies locations where specific land use outcomes are encouraged including redevelopment, higher densities and mixed-use developments. The Strategic Framework Plan locates the Development Plan Area in close proximity to the 'Technology Precinct' which includes the Monash University, CSIRO Clayton, Monash Business Park, Synchrotron and Melbourne Centre for Nanofabrication and Monash Medical Centre, and the Clayton Major Activity Centre.

Clause 21.04 – Residential Development

Like the rest of metropolitan Melbourne, the City of Monash is experiencing a change in the housing structure and dwelling requirements of its population, with a noticeable shift towards increased density forms of housing. Council's goal is for residential development to be balance in providing a variety of housing styles whilst remaining sympathetic to existing neighbourhood character.

This Clause identifies that there is increasing demand for a variety of different housing styles to cater for changing household sizes and structures and that neighbourhood character in residential areas will be enhanced by the identification of preferred areas for medium to high rise residential development within the municipality. The Development Plan area has been specifically identified as a location suitable for higher density residential development.

The City of Monash commissioned the Urban Character Study (1997) to identify, evaluate and manage the urban character of the municipality. The subject site is not included within this study, as it does not form part of an established residential area.

Clause 21.06 – Activity Centres

Activity centres provide attractive environments and a focus for community activities and life within Monash. They provide jobs, investments and goods and services for residents and business.

The Development Plan Area is located within close proximity of two activity centres, being a 'Specialised Activity Centre' – the Monash Technology Precinct and Clayton Major Activity Centre.

The Monash Technology Precinct is central to Monash's economic strength and is recognised as a key employment hub for south eastern Melbourne. The Clayton Major Activity Centre includes a variety of commercial uses including specialty retail and entertainments with a focus on encouraging arts, cultural and restaurant uses as well as increased residential densities.

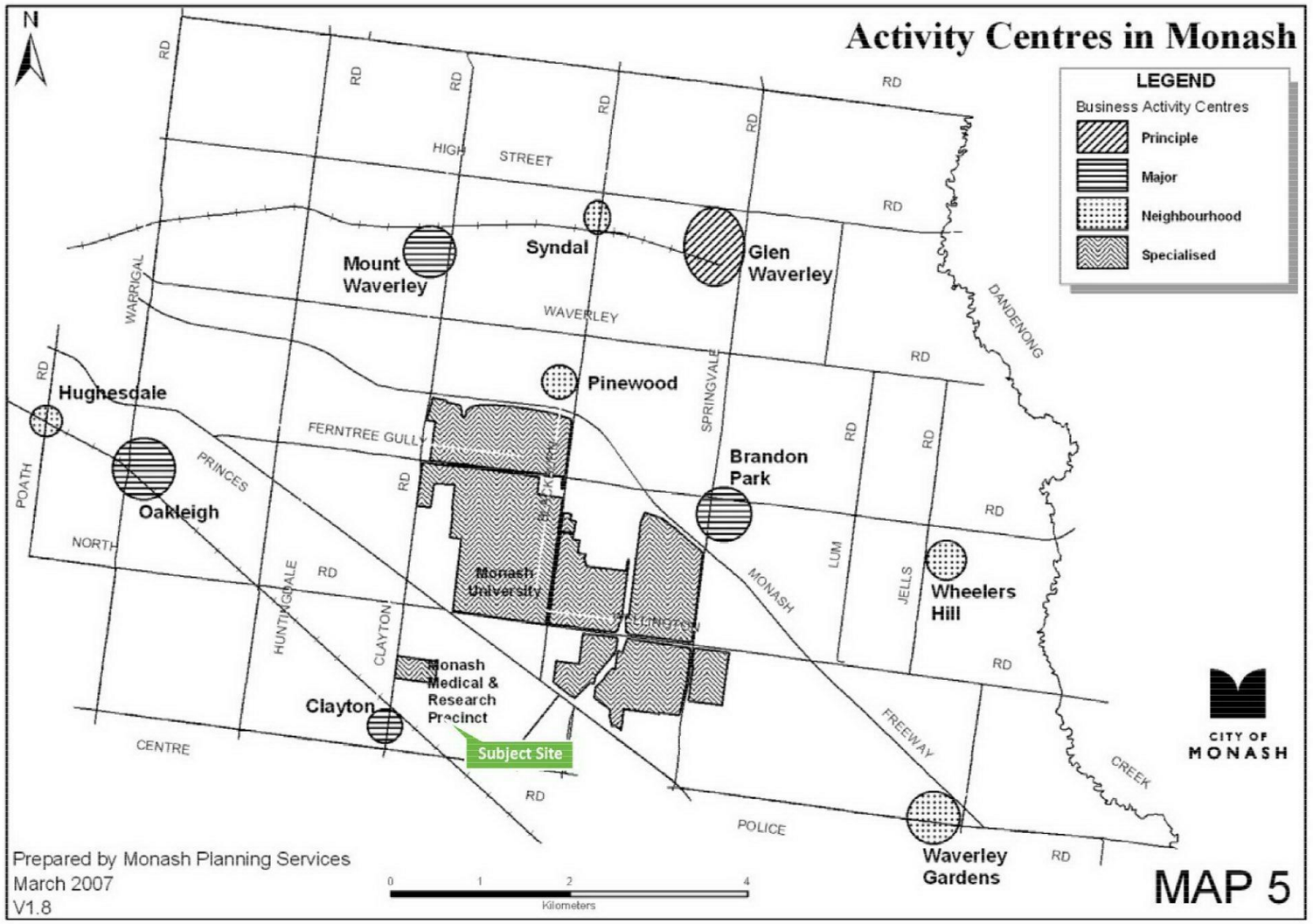

Figure 3 Location of Site within Monash Employment Cluster – Activity Centres in Monash – Clause 21.06 of Monash Planning Scheme

Clause 21.07 – Business Parks and Industry

The City of Monash, as one of the largest employment destinations in Melbourne's southeast sector, contains substantial areas for industry and related activities. Clause 21.07 identifies the Monash Medical and Research Centre as part of the Monash Technology Precinct, which is within close proximity of the development plan area.

Clause 21.08 – Transport and Traffic

The City of Monash comprises a well-maintained road network, two rail lines and a network of bus routes. The Monash Freeway is the major arterial freeway and is supported by the princes Highway and Springvale Road.

The Development Plan area is well located to existing transport routes of Wellington Road, Dandenong Road, Centre Road and Clayton Road. Clayton Train Station is located approximately 530m west of the subject site. A 'Smart Bus' route operates along Clayton Road and Wellington Road. Plan Melbourne also identifies potential future public transport upgrades within close proximity of the site (refer Map 13 – Monash Employment Cluster of Plan Melbourne) including a potential Rowville Rail extension along Wellington Road alignment, and an upgrade to Clayton Station, within walking distance of the site.

Key bicycle routes area also identified along Wellington Road, Browns Road and Clayton Road close to the site.

Clause 21.09 – Key Regional Assets

A number of Melbourne's best known land marks are found in the City of Monash. Monash Medical Centre is a major health care facility within the eastern suburbs and is located approximately 260m north-west of the subject site. Monash University is the key tertiary institution in the eastern suburbs and is located approximately 1.5km north of the subject site. Its role as an educational establishment as well as a major employer and business centre is vital to the economic viability of the region.

Relevant strategies under this Clause include facilitation of appropriate industry, business and residential projects that cater for the needs of users of key regional assets.

Clause 21.10 – Open Space

The Development Plan area is located within walking distance of Fregon Reserve, located 600m to the north. Further north, a number of recreation facilities associated with Monash University are located. Accessible public open space which is within easy walking distance for residents is one of the key objectives under this Clause.

Clause 21.11 – Physical Infrastructure

Physical infrastructure covers all utility services, telecommunication facilities and roads. Increases in dwelling density have resulted in increase in hard surface area which has impacted the drainage system. Objectives include, amongst other things, a desire to improve stormwater management so that it is used effectively and manages flows for major and minor drainage systems. Promotion of best practice water sensitive design and reuse of stormwater are relevant strategies under this clause.

Clause 21.13 – Sustainability and Environment

This clause addresses a wide range of issues including water quality management, air quality and noise, soils, flora and fauna, open space, waste management, energy use, transport, heritage, urban design and public health and safety. Objectives include reducing energy use, renewable energy, designing for accessibility, maintaining biodiversity, increasing water conservation and improving water quality, encouraging best practice waste management and recycling and maximising use of alternative modes of transport such as walking, cycling and public transport.

2.3.2 Local Planning Policies

Clause 22.04 – Stormwater Management

It is policy under this clause to ensure that stormwater flows generated from increased pervious areas are managed by on-site retention systems. Best practice environmental management is to be used in the design, construction and operation of drainage systems to reduce impacts on surface waters and groundwater.

Clause 22.05 – Tree Conservation Policy

It is Policy that existing semi-mature and mature canopy trees be retained wherever possible to ensure maintenance of the tree canopy. Existing street trees are to be retained and semi-mature canopy trees with spreading crowns are to be planted for any new development in open space areas, along boundaries adjacent to neighbouring open space and in front setback areas to reinforce the Garden City Character of the area.

3 Site Context and Existing Conditions

3.1 Location

The location of the 29 Browns Road, Clayton – Clayton Primary School Development Plan is identified in Figure 1 – Context Plan.

3.2 The Development Plan Area

The Development Plan area comprises the land formerly used by the Clayton Primary School. The site is located between Browns Road and Moriah Street and has frontages to both streets. The location of the development plan area is identified at Figure 4 – Development Plan Area.

The site currently contains old school building and associated recreation areas and is proposed to be for exclusive residential use, consistent with the General Residential Zone that applies to the land.

3.3 Existing Site Features

The Existing Site Conditions Plans prepared by Mushan Design Studio at Drawing DP01 identify the existing site features. The Development Plan Area consists of:

- Two allotments held in single ownership.
- Existing infrastructure associated with the previous use including large classroom buildings and outdoor play equipment.
- A total of 34 trees are located within the site, the majority of which are located around the site's boundaries. Three street trees are located along the site's Browns Road frontage.
- Existing vehicle access via an existing crossover along the Browns Road frontage and one existing crossover on the Moriah Street frontage.

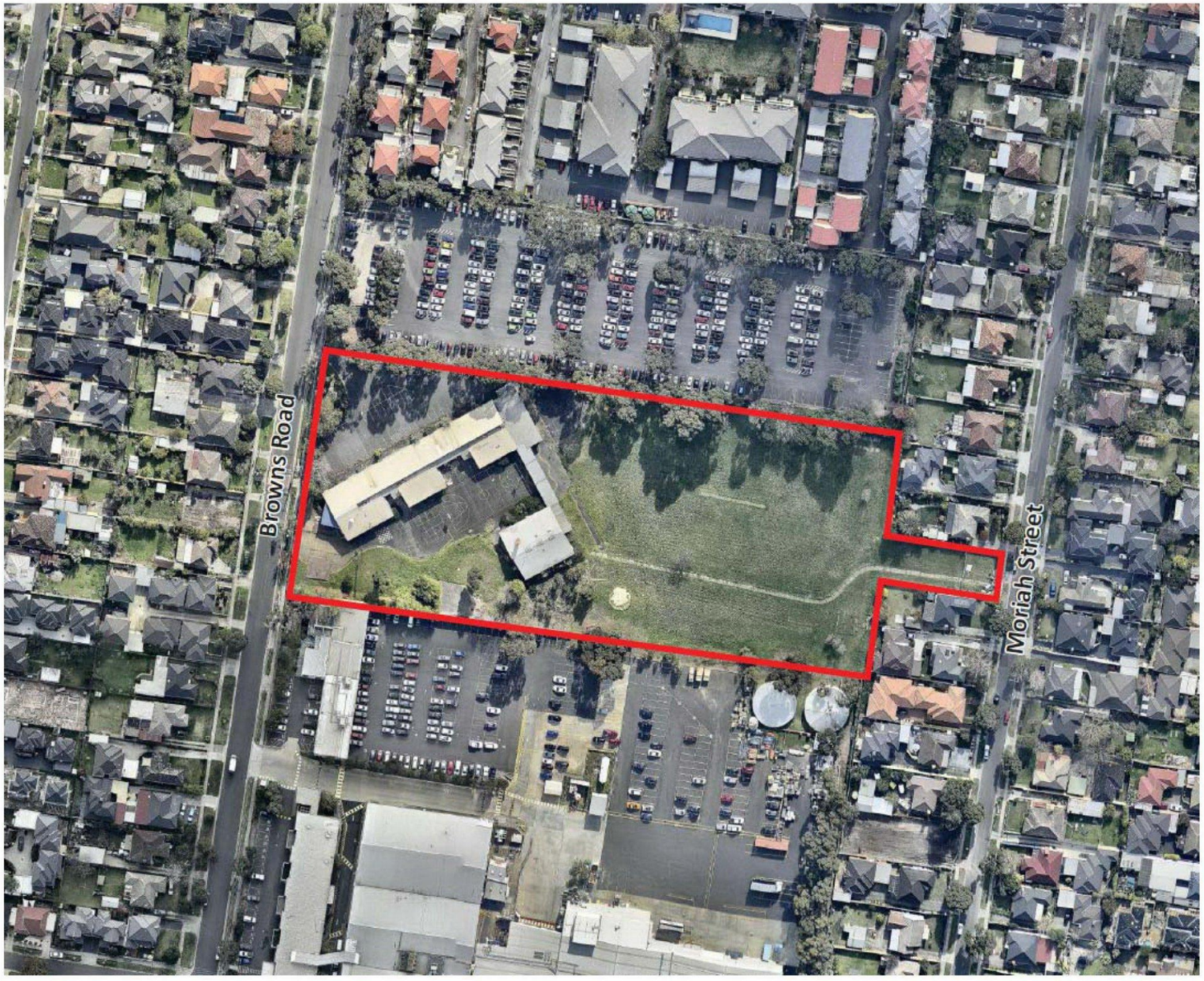

Figure 4 Development Plan Area

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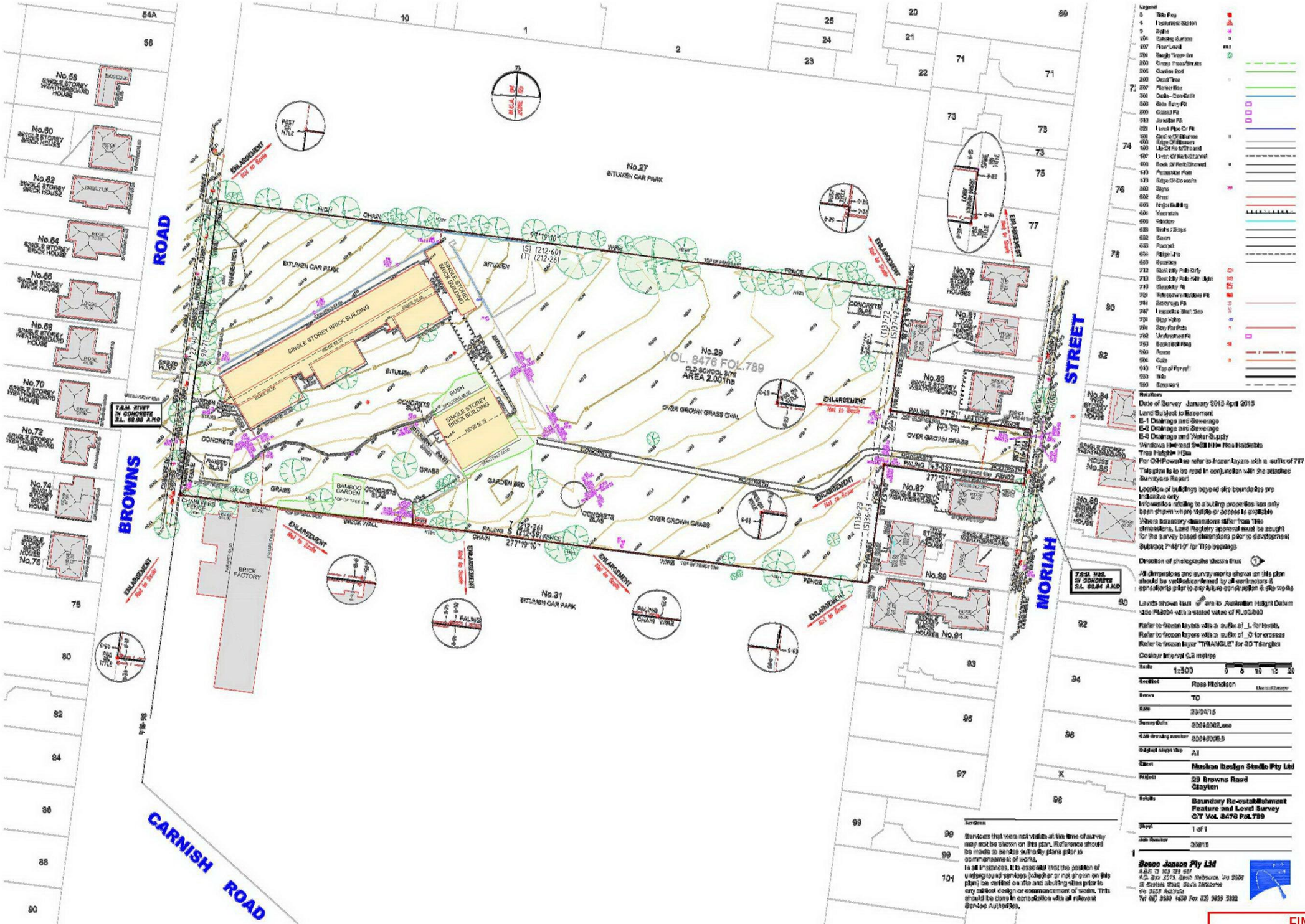

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NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
EXISTING SITE SURVEY PLAN

DATE	SEPTEMBER 2015
SCALE	NTS @ A3
PROJECT NO.	M023
DRAWING NO.	- DP01

D19-334480


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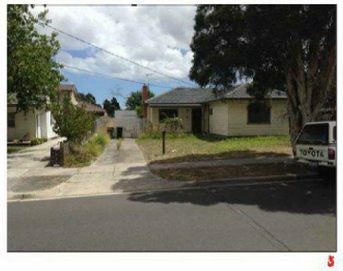
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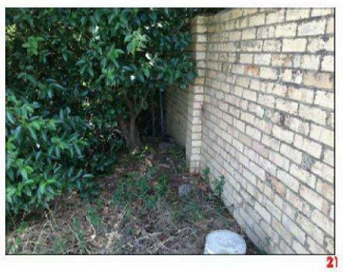
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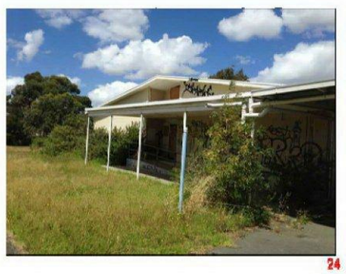
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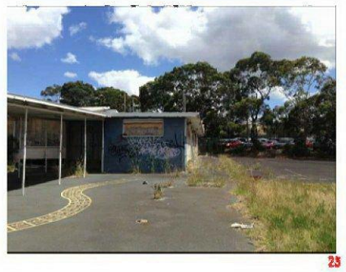
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
EXISTING SITE PHOTOGRAPHS

DATE	SEPTEMBER 2015
SCALE	NTS @ A3
PROJECT NO.	M023
DRAWING NO.	- DP02

D19-334480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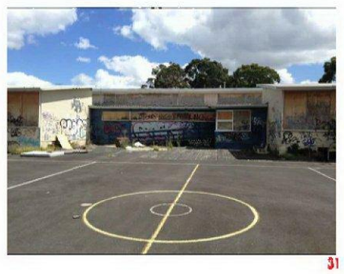
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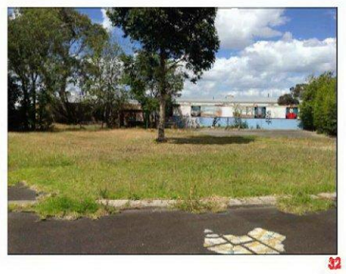
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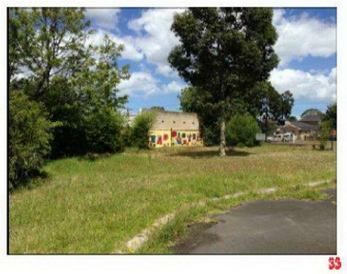
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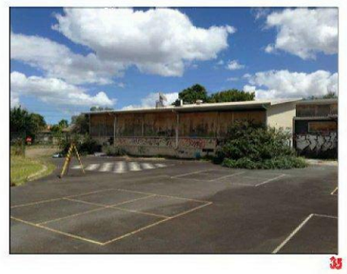
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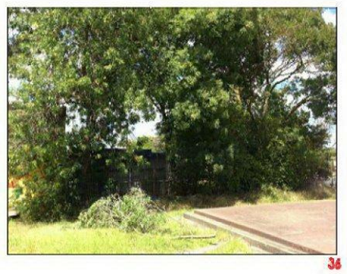
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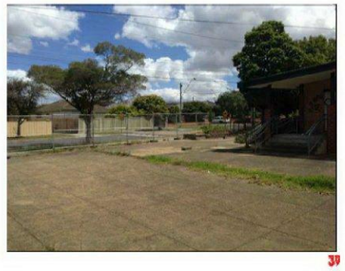
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29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
EXISTING SITE PHOTOGRAPHS

DATE	SEPTEMBER 2015
SCALE	NTS @ A3
PROJECT NO.	M023
DRAWING NO.	- DP03

3.4 Context Plan Analysis

The context plan analysis prepared by Mushan Design Studio at Drawings DP05 to DP06 provides an overview of the physical features of the surrounding area, including:

- Surrounding land uses and development.
- Adjoining roads and pedestrian links.
- Public transport routes.
- Existing infrastructure.
- Local community Services.
- Distances and connections to nearby andregional facilities. The site is well positioned to:
- Utilise existing public transport networks (Clayton Train Station and Bus interchange).
- Support the 'Monash Employment Cluster' identified by Plan Melbourne with higher density housing co-located with employment generating uses in the Monash Technology Precinct.
- Utilise and support the Clayton Major Activity Centre.

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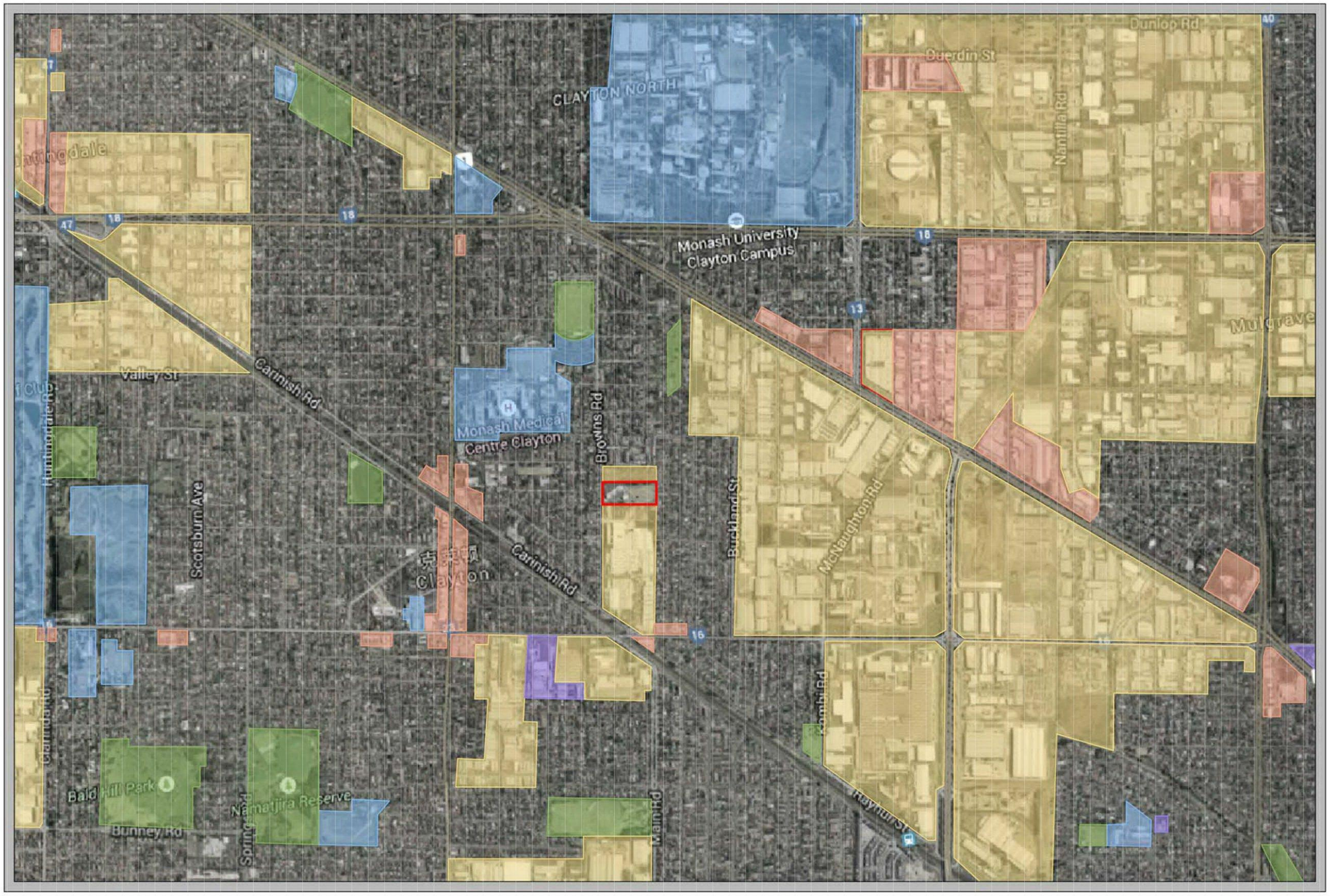

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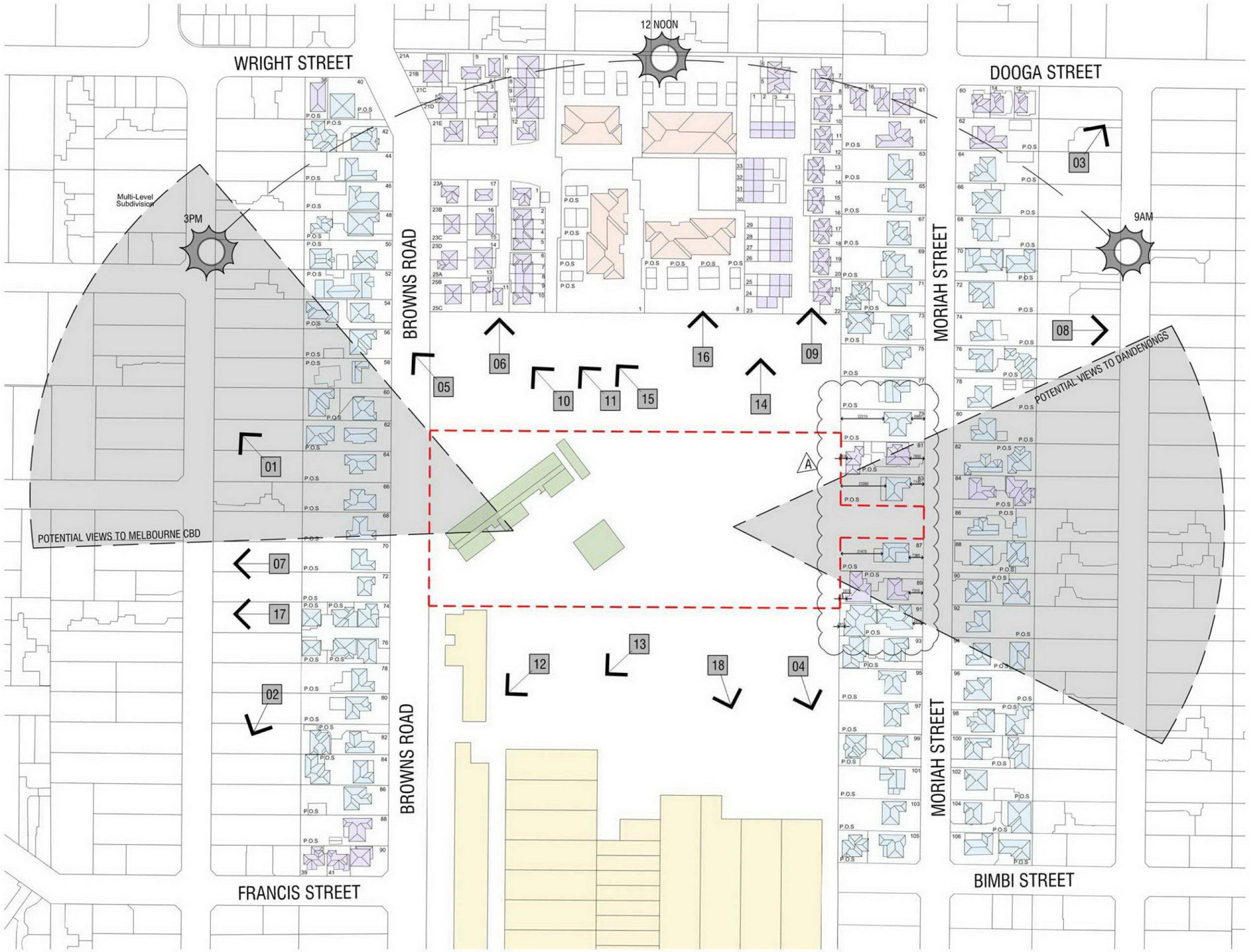
NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
SITE CONTEXT PLAN

DATE	SEPTEMBER 2015
SCALE	NTS @ A3
PROJECT NO.	M023
DRAWING NO.	- DP05

D19-334480



SUBJECT SITE
1 STOREY RESIDENTIAL
2 STOREY RESIDENTIAL
3 STOREY RESIDENTIAL
COMMERCIAL / INDUSTRIAL
SCHOOLS / ACADEMIC

01 DISTANCE TO THE MELBOURNE CBD 23KM
02 CLAYTON RAIL WAY STATION 0.8KM
03 PRINCES HIGHWAY BUS ROUTE 0.5KM
04 CENTER ROAD BUS ROUTE 0.7KM
05 CLAYTON ROAD BUS ROUTE 0.9KM
06 PRINCES HIGHWAY 1.0KM
07 CLAYTON ROAD 1.0KM
08 MONASH FREEWAY 5KM
09 MONASH UNIVERSITY CLAYTON CAMPUS 1.6KM
10 CLAYTON NORTH PRIMARY SCHOOL 1.7KM
11 ST. PETER'S PRIMARY SCHOOL 0.8KM
12 CLAYTON LIBRARY 0.8KM
13 CLAYTON SHOPPING CENTER 0.7KM
14 FREGON RESERVE 0.9KM
15 MONASH MEDICALCENTRE CLAYTON 0.9KM
16 BUNNINGS 2.4KM
17 CLAYTON TOWN HALL 0.9KM
18 SPRINGVALE HOMEMARKER CENTER 4.6KM

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PROJECT
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29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
CONTEXT ANALYSIS PLAN

DATE	SEPTEMBER 2015
SCALE	1:2000 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP06

3.5 Opportunities and Constraints

Key opportunities and constraints associated with future development of the Development Plan area include:

Opportunities

- Access to the Principal Public Transport Network.
- Access to the Clayton Major Activity Centre.
- Access to established areas of employment including the Monash Medical Centre and Monash University.
- The regular dimensions of the site with limited residential abuttals.
- The topography of the site, which is generally flat but falls away from Browns Road to conceal taller development towards the centre of the site.
- The location of vegetation, which is generally around the boundaries of the site.

Constraints

- Single and double storey streetscapes to Browns Road and Moriah Street.
- Interfaces to neighbouring industrial development and at- grade parking.

3.6 Design Response

From the above analysis of the site, and the opportunities and constraints presented, the following Design Responses are to be provided:

- Facilitate the development of the land for a range of dwelling types including townhouse and apartment styles to increase housing diversity in the well located and highly accessible location.
- Ensure that car parking is located away from the street frontage wherever possible and screened from view.
- Responding the existing streetscape scale and rhythm of Browns Road by setting buildings back behind landscaped front gardens, providing a two storey maximum height to all dwellings fronting Browns Road, providing a built form width the responds to the existing character and providing landscaped spacing between built forms.
- Providing a lower scale and lower intensity town houses along the eastern boundary which is shared with existing residential development.
- Providing communal landscaped areas between buildings of at least 9m to prevent overlooking between dwellings and provide shared outdoor spaces to promote social interaction.
- Locating larger apartment forms towards the lower portion of the site and adjacent to less sensitive industrial and commercial interfaces to the south to prevent off site amenity impacts.
- Include a common landscaped space adjacent the apartment buildings to complement balcony space and provide high quality amenity and outlook for residents.
- Cluster townhouses in defined groups for legibility and sense of place.

4 Development Plan

The strategic directions for the Development Plan Area are detailed in the drawings in the following sections of the report. The drawings describe the:

- Land Use and Built Form (Drawing DP08-DP11)
- Shadow Analysis and Amenity (Drawing DP26-DP28)
- Pedestrian and Vehicle Access and Parking (Drawing DP08-DP13)
- Landscape Concept (Appendix A)

These figures have been prepared by Mushan Design Studio Pty Ltd, and John Patrick, and are accompanied by explanatory text prepared in accordance with Schedule 5 to the Development Plan Overlay.

5 Land Use and Built Form

5.1 Land Use

Drawings DP14 outlines the proposed residential use of the land and the existing surrounding land uses and their zoning.

The proposed land use for the site is residential, consistent with the General Residential Zone that applies to the land.

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NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
ACTIVITY AND LAND USE

DATE	APRIL 2016
SCALE	1:2000 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP14

5.2 Built Form

Drawings DP08-DP13 and DP25 describe the built form principles for the Development Plan.

The built form seeks to prioritise the current and desired future potential for higher density residential development with building forms up to a height of 4 storeys towards the centre of the site and along the non-sensitive industrial/commercial interface, stepping down to 2 storey forms along the other interfaces of the site.

The key elements of the plan are:

- Provision of a range of apartments and townhouses to cater for a variety of housing needs.
- Respecting the amenity of adjoining interfaces by providing for 2 storey built form adjacent to existing single storey residential development.
- Respecting the existing 1 and 2 storey streetscape character by providing for 2 storey built form fronting Browns Road.
- Creating a composition of varied building forms and heights across the site with lower building forms towards the edges of the site, stepping up to taller forms towards the centre.
- Generous landscaped front building setbacks to existing public streets to maintain and enhance the existing landscaped front yard character of residential development along Browns Road.
- Building forms to be broken up into a series of building components with spaces between them to complement the existing repeated spacing of development with landscaped side setbacks existing along Browns Road and Moriah Street.
- Townhouses designed to front Browns Road with front doors and windows facing the public road and garaging located to the rear.
- Buildings separated by at least 9 metres to avoid screening of windows and balconies within the development and therefore provide outlook and amenity for the future residents.
- Consolidate vehicle access to one entry and exit point from Browns Road and no through vehicle access.
- Provide well defined pedestrian entries and landscaped spaces for pedestrian amenity.
- Private open space provided in the form of balconies for all dwellings. Ground level open space from communal landscaped areas for the enjoyment of all residents.
- Car parking for the apartment building to be located with a basement via a double vehicle entry.

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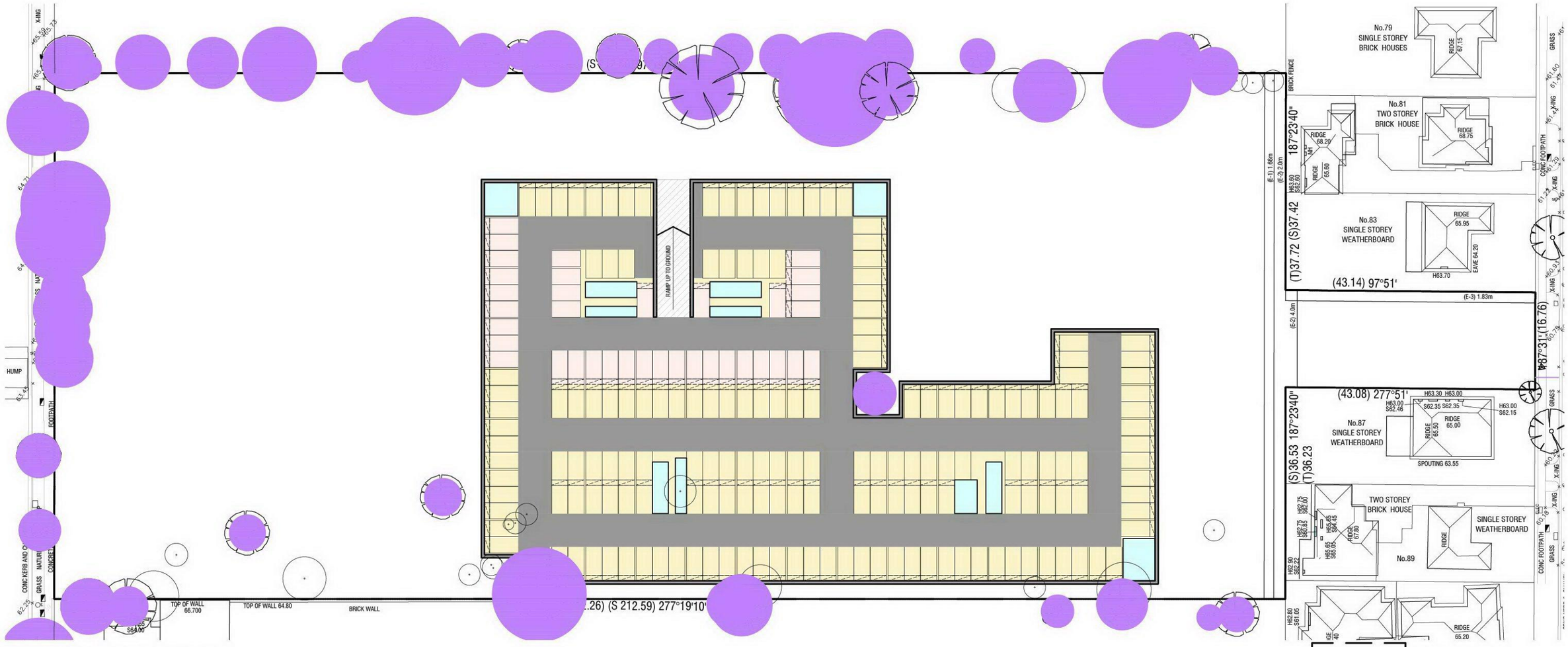

BASEMENT LEVEL

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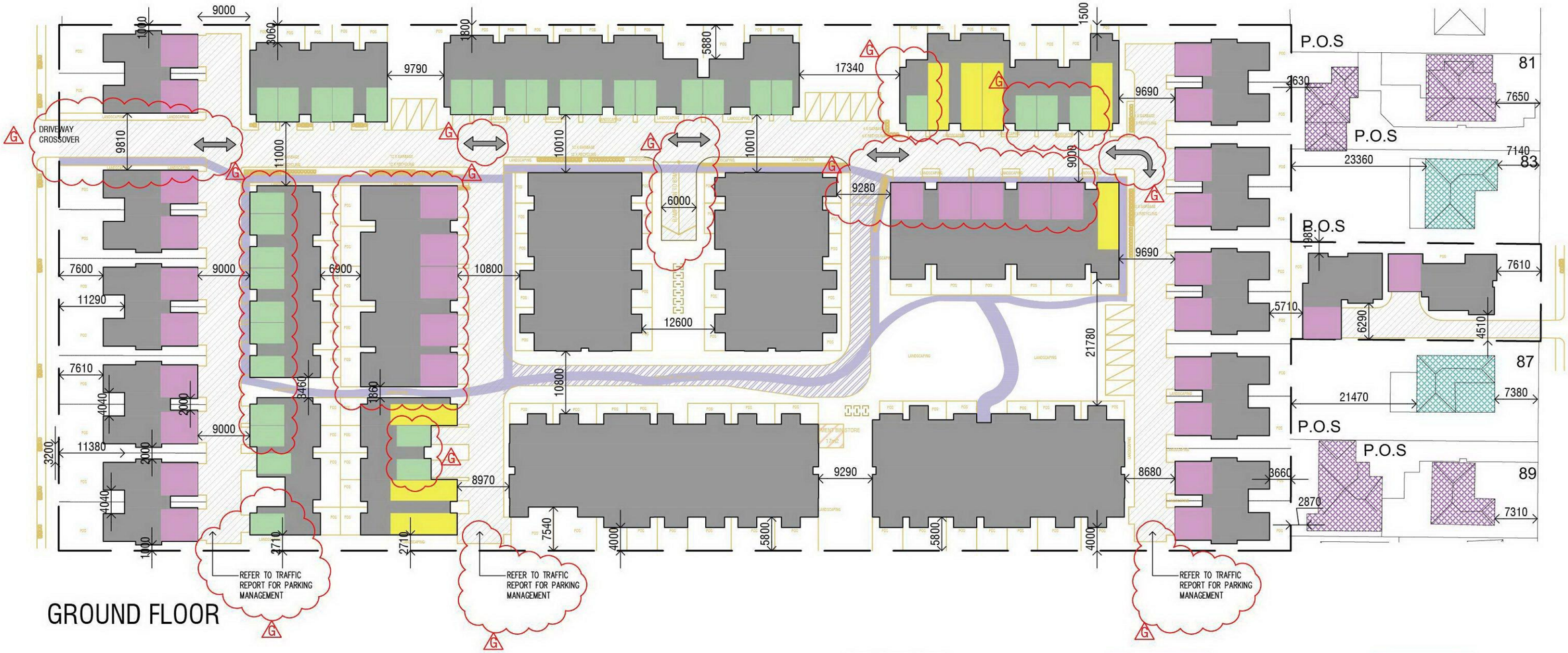
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
VEHICLE CIRCULATION & PARKING (BL)

DATE	APRIL 2016
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	B DP13

D19-334480



TANDEM GARAGES

SINGLE GARAGES

DOUBLE GARAGES

NOTE
ALL ROADS TO BE PRIVATE INTERAL ROADS

SITE BOUNDARY

DRIVE WAY

FOOTPATH MIN 1.4m WIDE

WASTE COLLECTION / EMERGENCY ONLY

2-STOREY NEIGHBOR

1-STOREY NEIGHBOR

GROUND LEVEL

2 STOREY

3 STOREY

4 STOREY

REFER TO TRAFFIC REPORT FOR DETAIL OF VEHICLE PRIORITY ESTABLISHMENT

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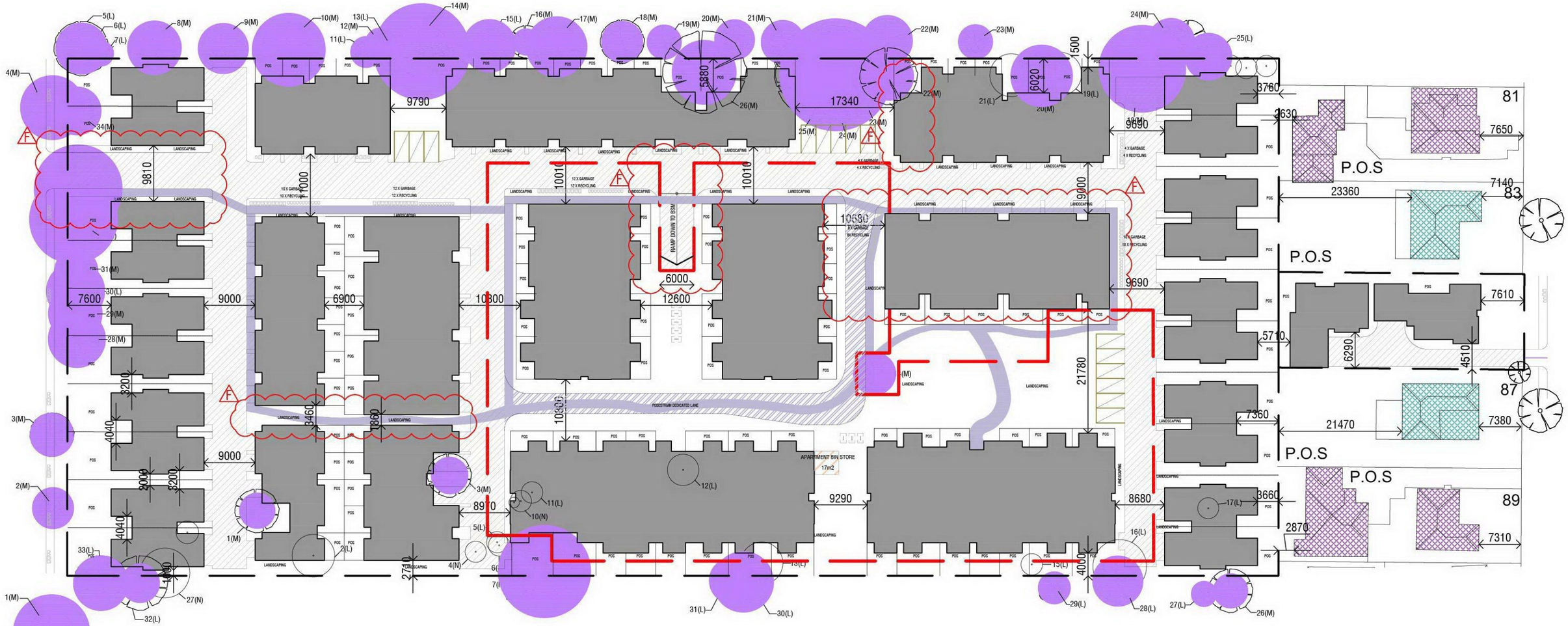
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
PROPOSED BUILT FORM AND CIRCULATION

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	G DP08

D19-334480



GROUND FLOOR

SUMMARY	
TOTAL EXIST STREET TREES 04	
TREES TO BE REMOVED	04
TOTAL EXIST SITE TREES 66	
TREES TO BE REMOVED	18
TREES TO BE RETAINED	34
HIGH RETENTION TOTAL	00
HIGH RETENTION TO BE REMOVED	00
MODERATE RETENTION TOTAL	16
MODERATE RETENTION TO BE REMOVED	00
LOW RETENTION TOTAL	08
LOW RETENTION TO BE REMOVED	08

58 (L)

TREES TO BE REMOVED

TREE PROTECTION ZONE

TREES TO BE RETAINED

BASEMENT OUTLINE

SITE BOUNDARY

CIRCULATION

WASTE / EMERGENCY VEHICLES ONLY

FOOTPATH MIN 1.4m WIDE

GROUND LEVEL MASS

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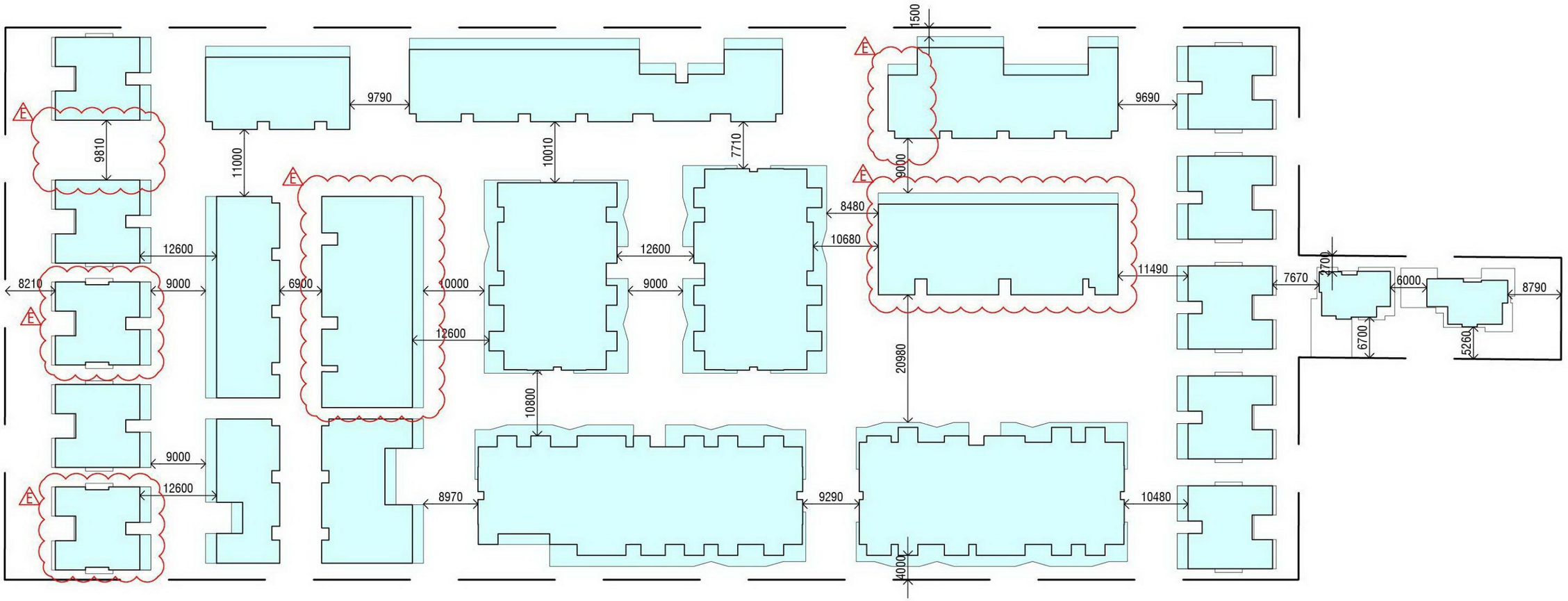
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
TREE RETENSION DIAGRAM

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	

F DP08A

D19-334480



FIRST FLOOR

SITE BOUNDARY
DRIVE WAY
GROUND LEVEL
2 STOREY
3 STOREY
4 STOREY

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NORTH

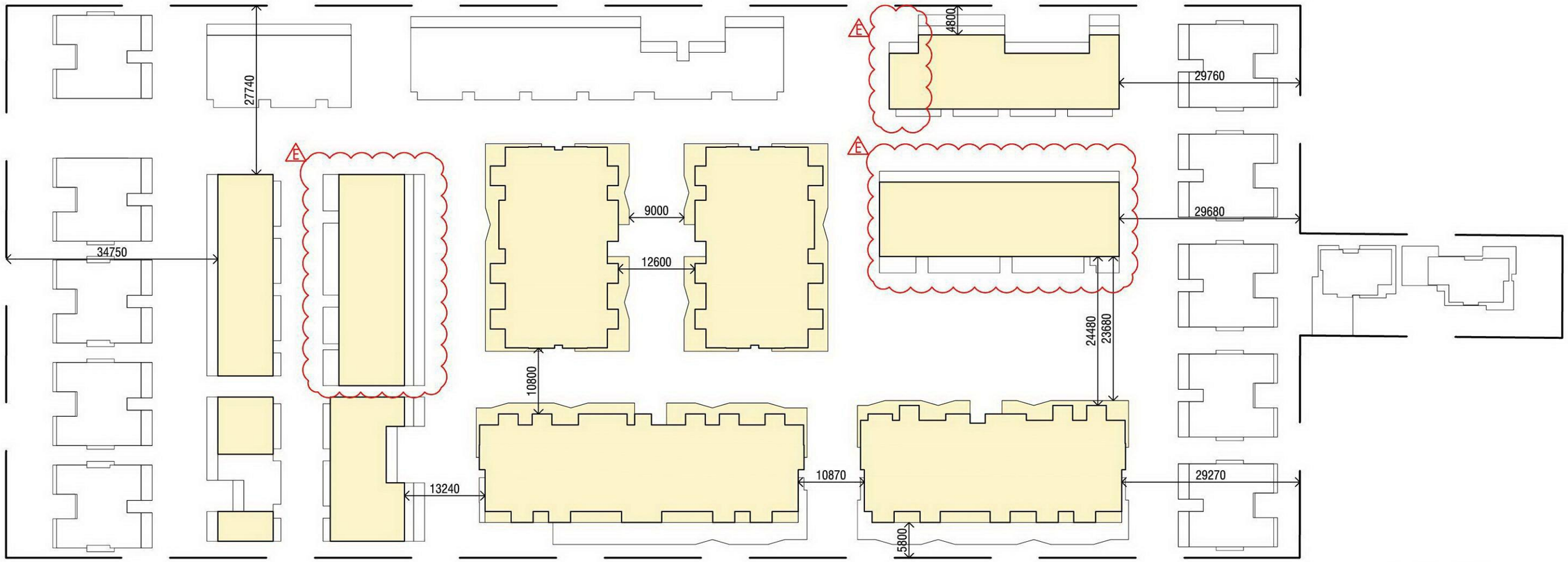
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
PROPOSED BUILT FORM (LEVEL 1)

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	

E DP09

D19-334480



SECOND FLOOR

SITE BOUNDARY
DRIVE WAY
GROUND LEVEL
2 STOREY
3 STOREY
4 STOREY

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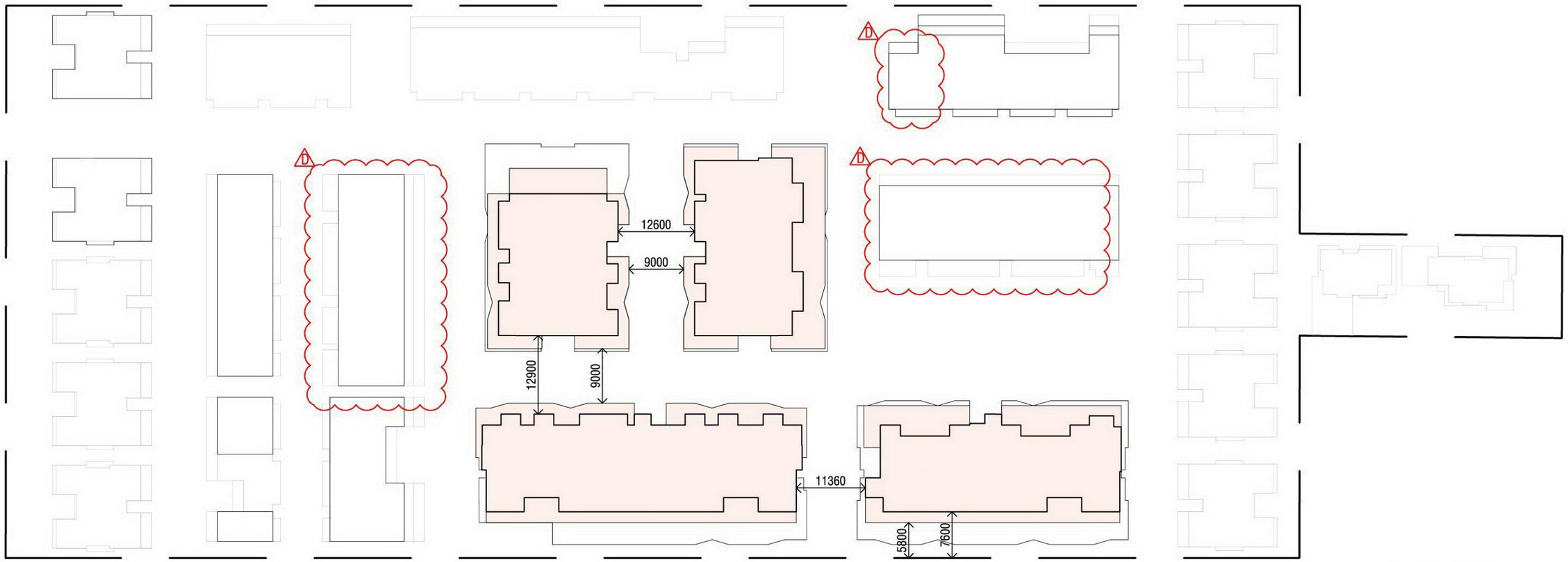
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
PROPOSED BUILT FORM (LEVEL 2)

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	E DP10

D19-334480



THIRD FLOOR

SITE BOUNDARY
DRIVE WAY
GROUND LEVEL
2 STOREY
3 STOREY
4 STOREY

FINAL

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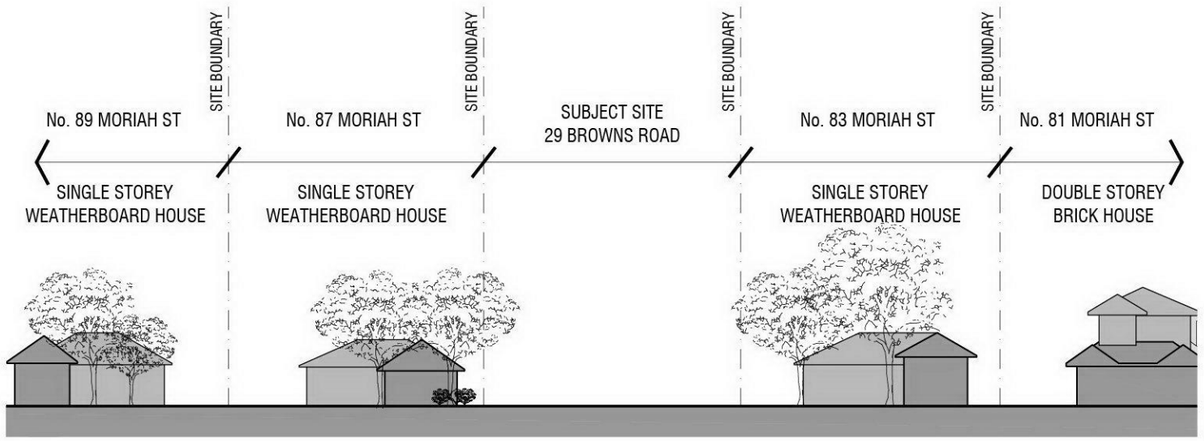
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

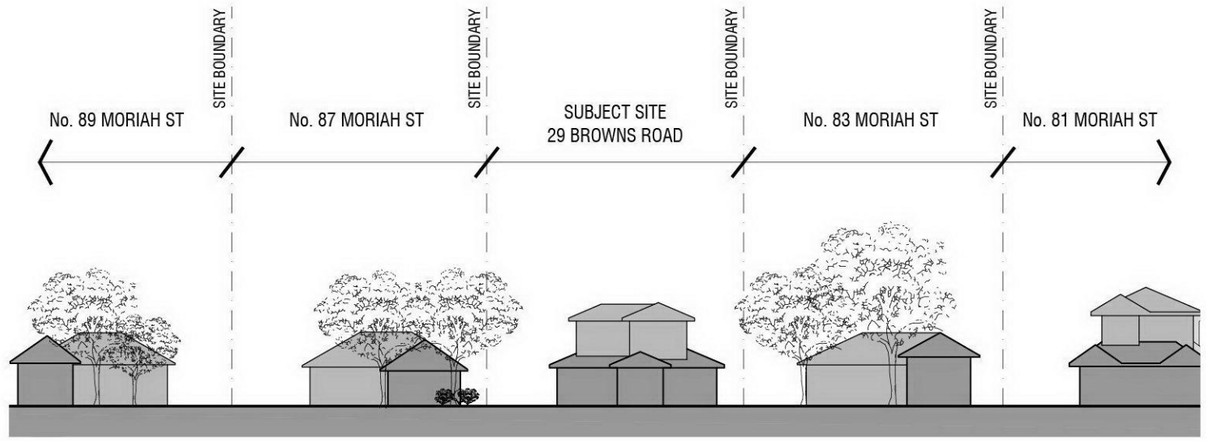
TITLE
PROPOSED BUILT FORM (LEVEL 3)

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	D DP11

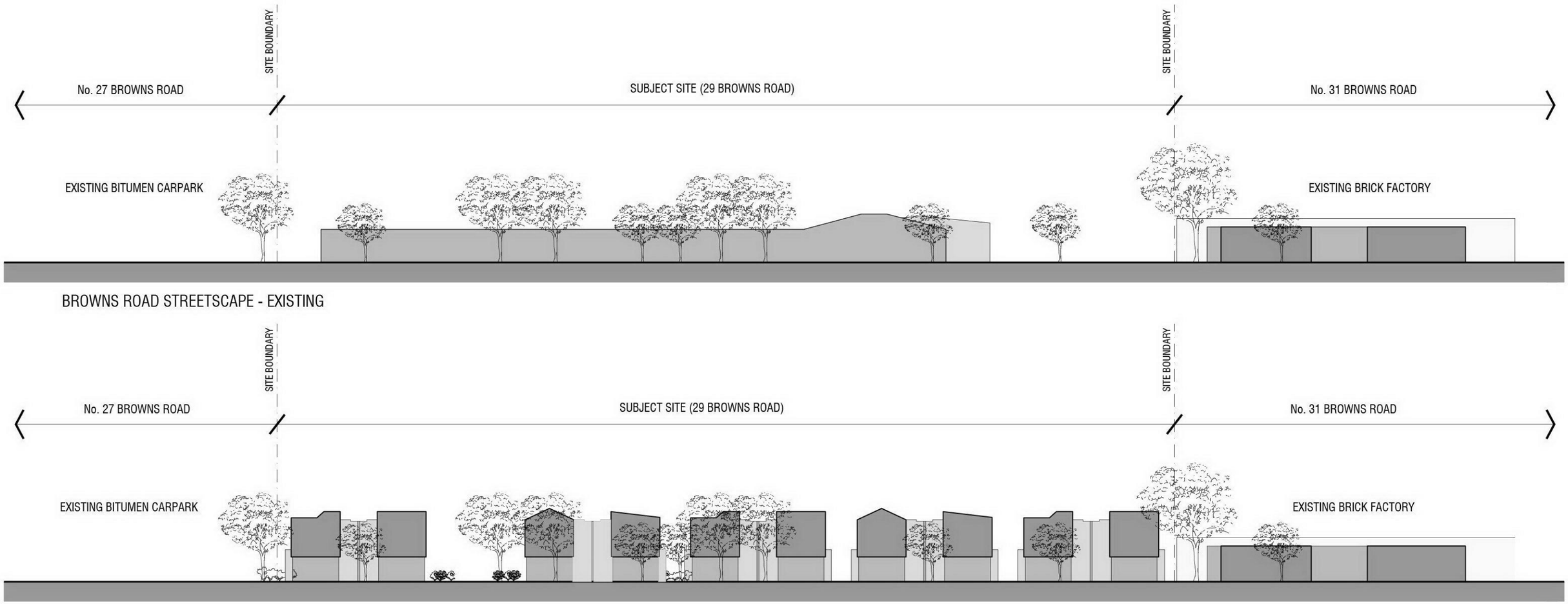
D19-334480



MORIAH STREET STREETSCAPE - EXISTING



MORIAH STREET STREETSCAPE - PROPOSED



BROWNS ROAD STREETSCAPE - EXISTING

BROWNS ROAD STREETSCAPE - PROPOSED

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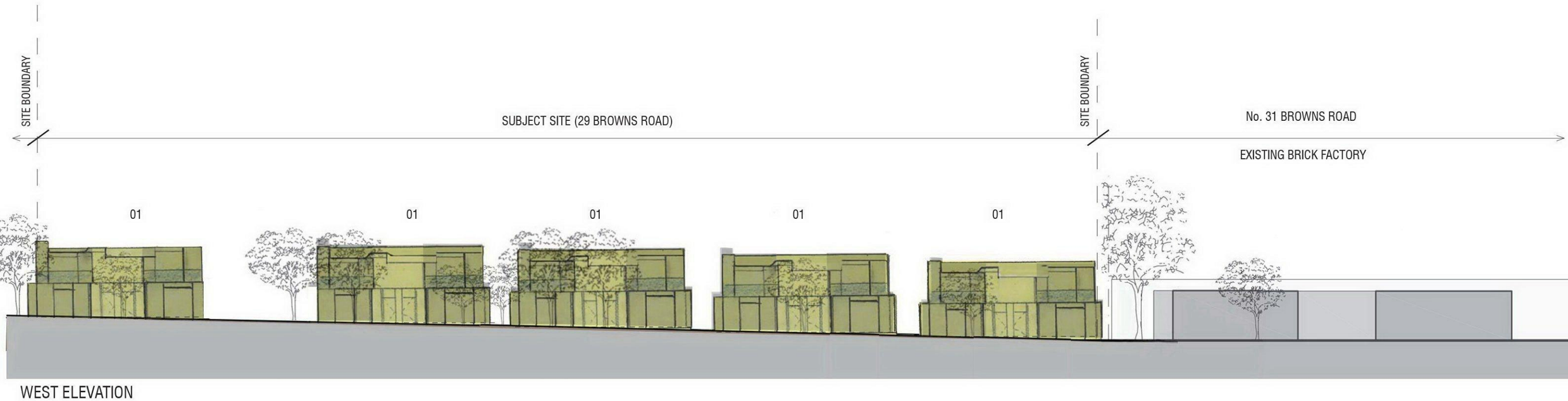
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
STREETSCAPE ELEVATIONS

DATE	FEBRUARY 2017
SCALE	1:400 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP15

D19-334480



WEST ELEVATION

EAST ELEVATION

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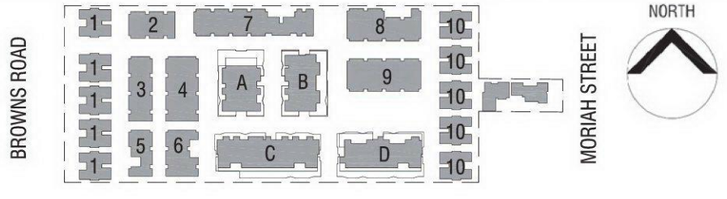
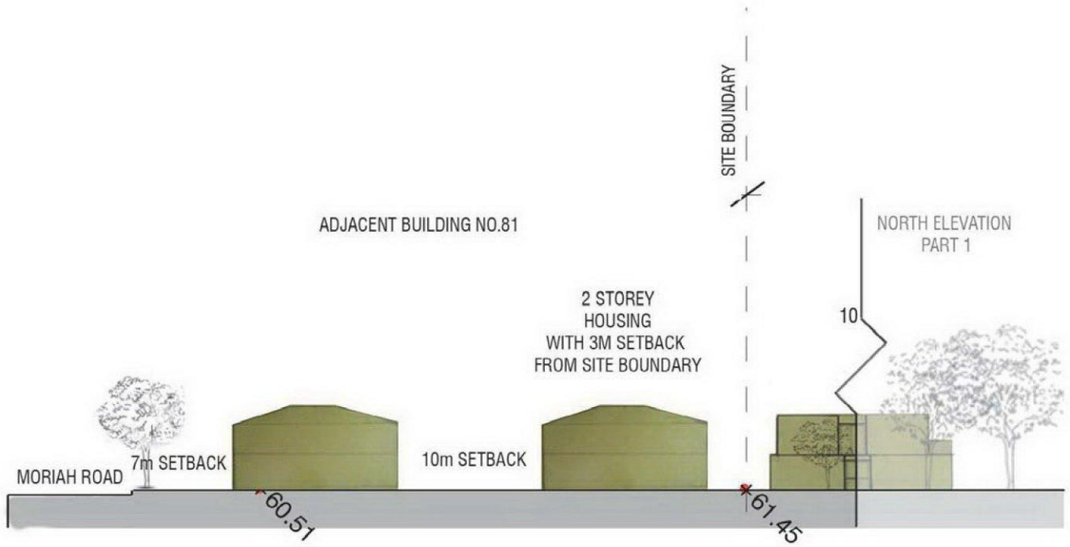


PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

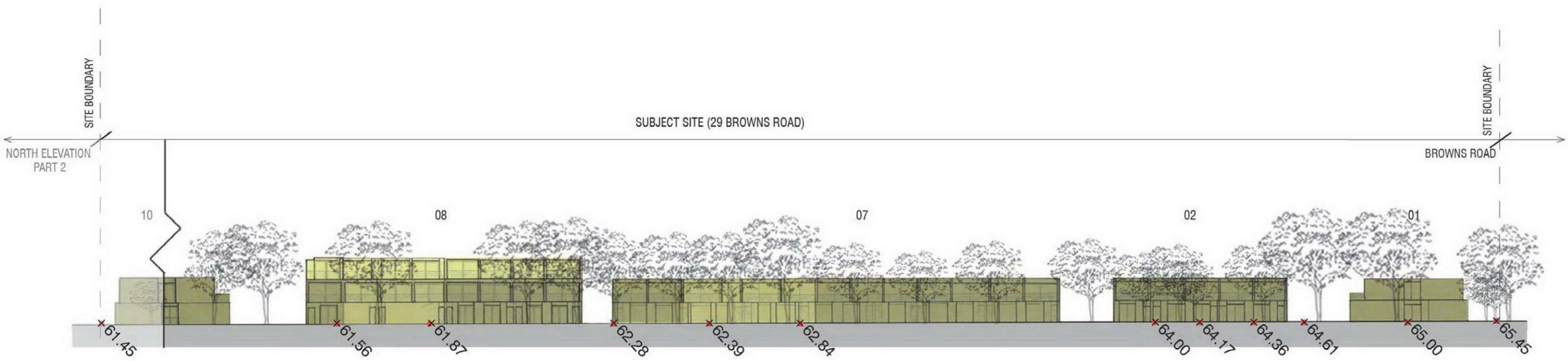
TITLE
WEST & EAST ELEVATION

DATE	FEBRUARY 2017
SCALE	1:300@A3
PROJECT NO.	M023
DRAWING NO.	C DP15A

D19-334480



NORTH ELEVATION PART 1



NORTH ELEVATION PART 2

FINAL

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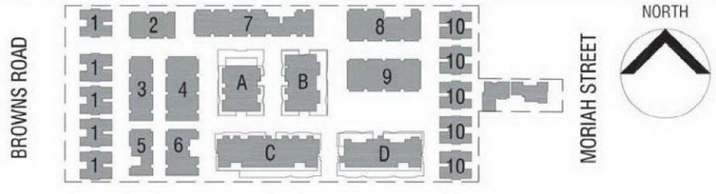
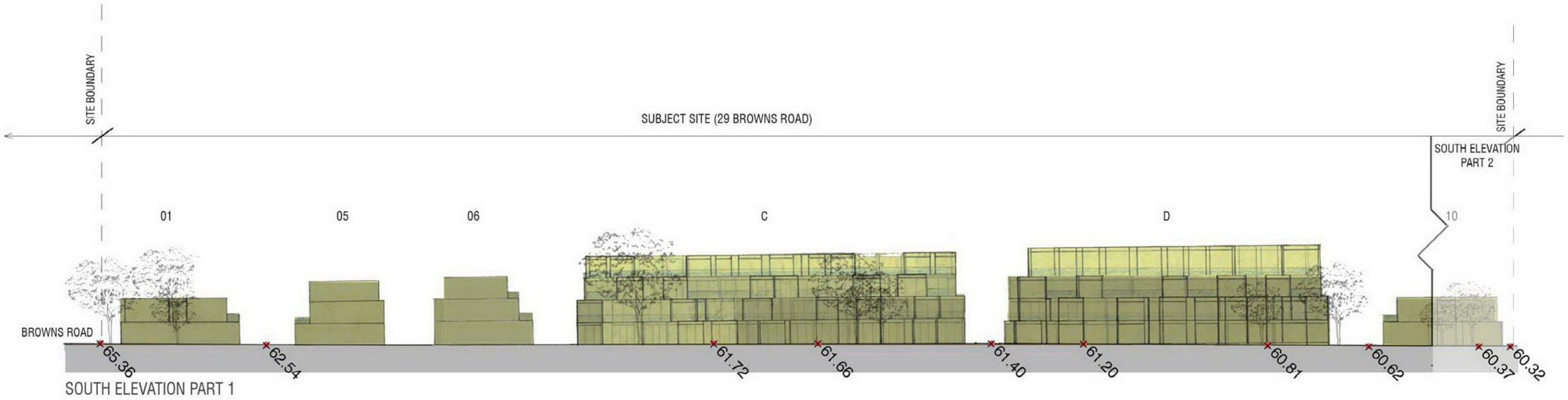


PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
NORTH ELEVATION

DATE	SEPTEMBER 2015
SCALE	1:700@A3
PROJECT NO.	M023
DRAWING NO.	B DP15B

D19-334480



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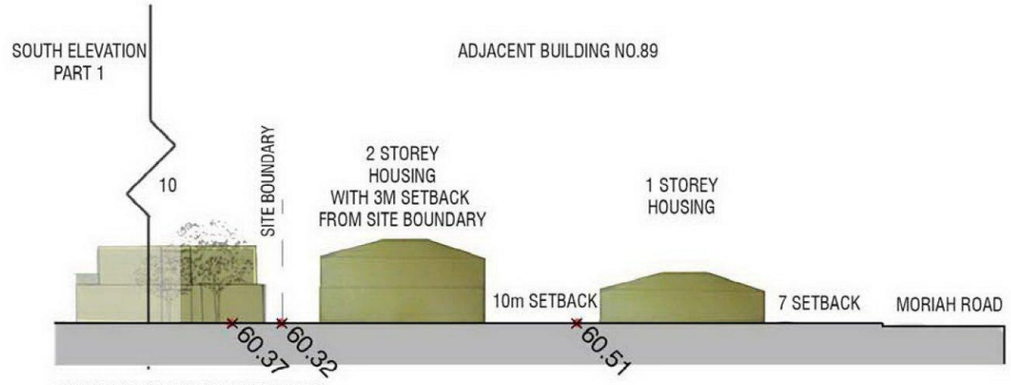

SOUTH ELEVATION PART 2

FINAL

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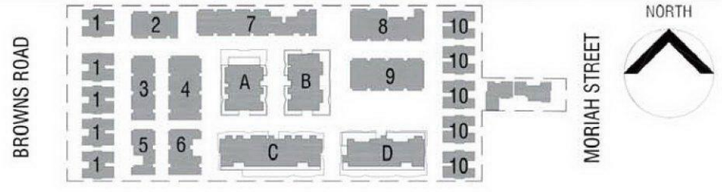
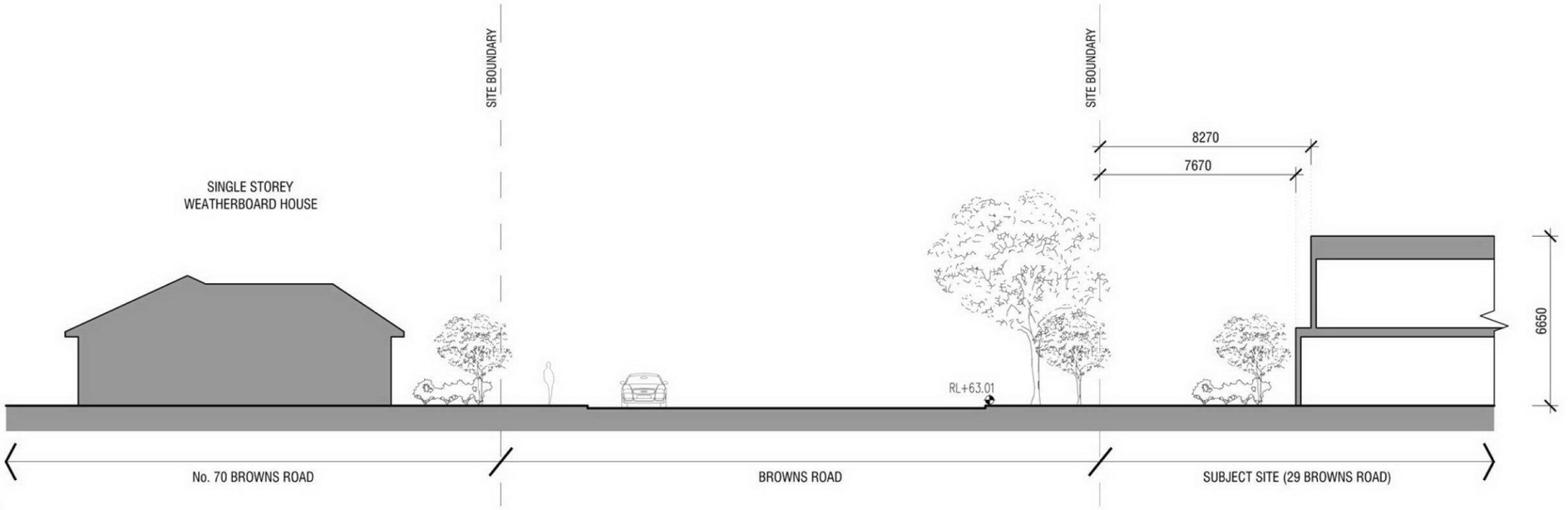


PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

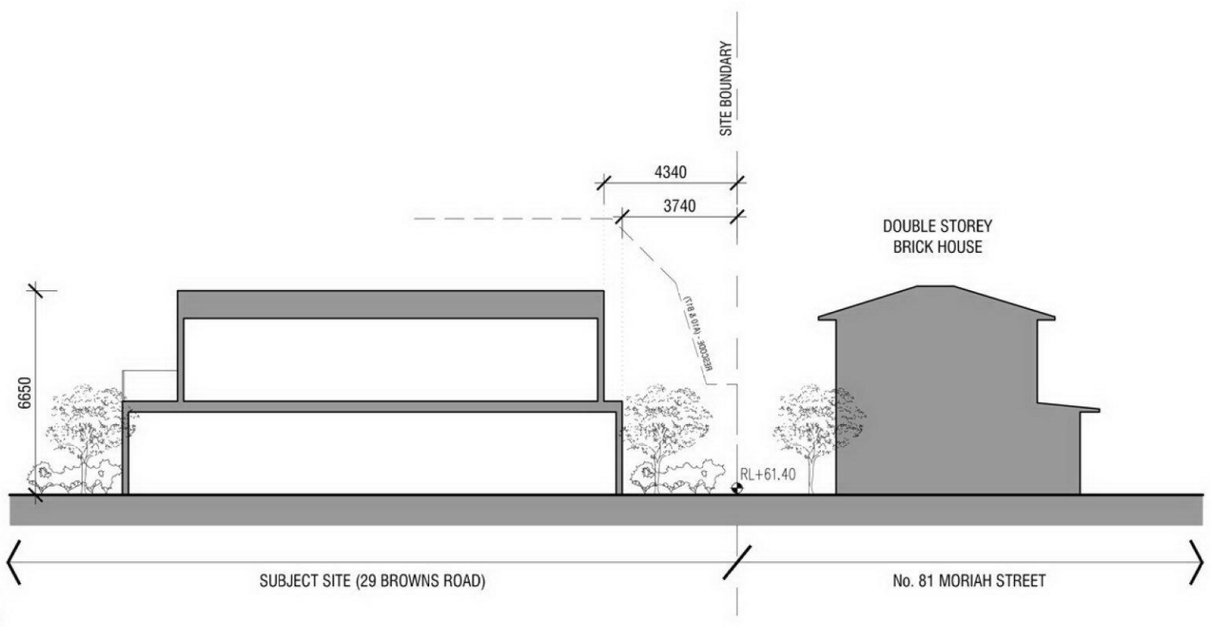
TITLE
SOUTH ELEVATION

DATE	SEPTEMBER 2015
SCALE	1:700@A3
PROJECT NO.	M023
DRAWING NO.	B DP15C

D19-334480



SECTION A



SECTION B

FINAL

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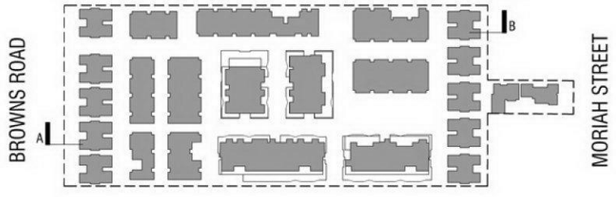


NORTH

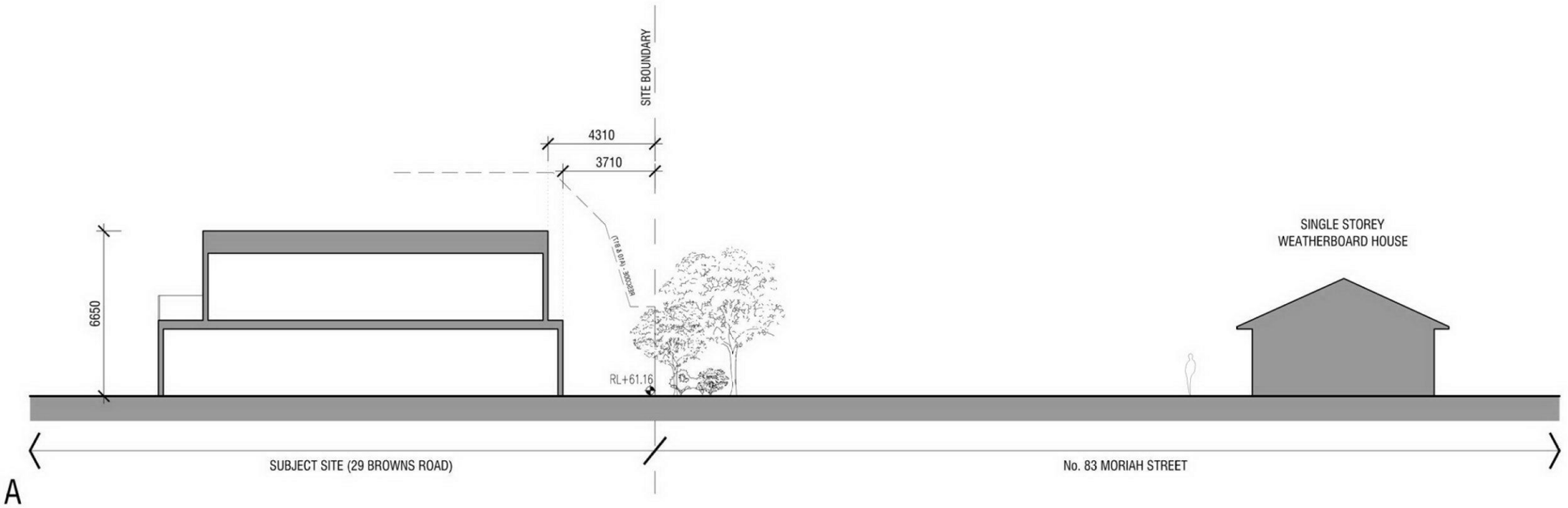
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
SITE SETBACK DIAGRAMS

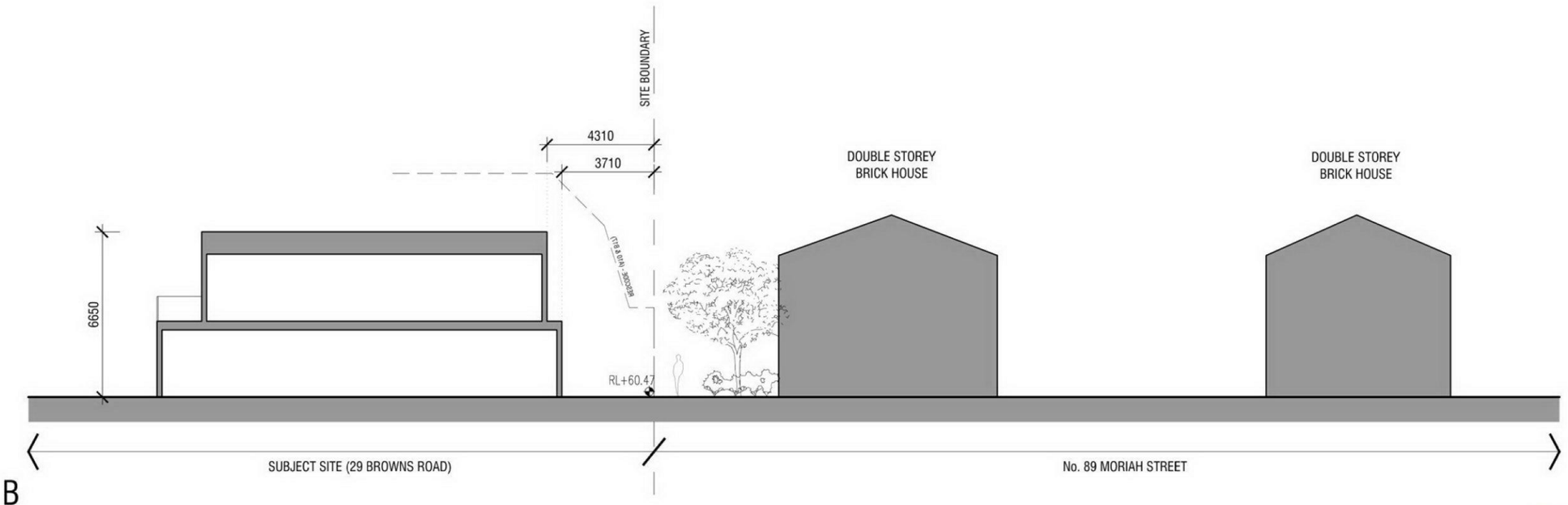
DATE	SEPTEMBER 2015
SCALE	1:200 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP16

D19-334480



SECTION A



SECTION B

FINAL

MUSHAN DESIGN STUDIO PTY LTD
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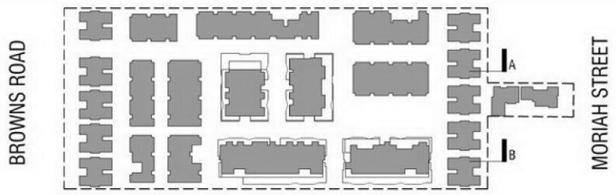


NORTH

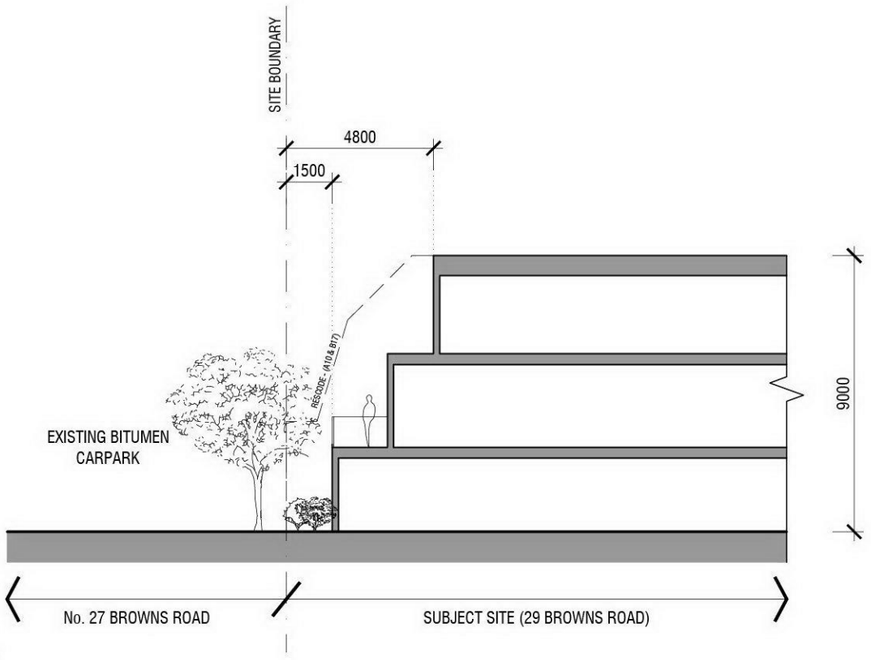
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
SITE SETBACK DIAGRAMS

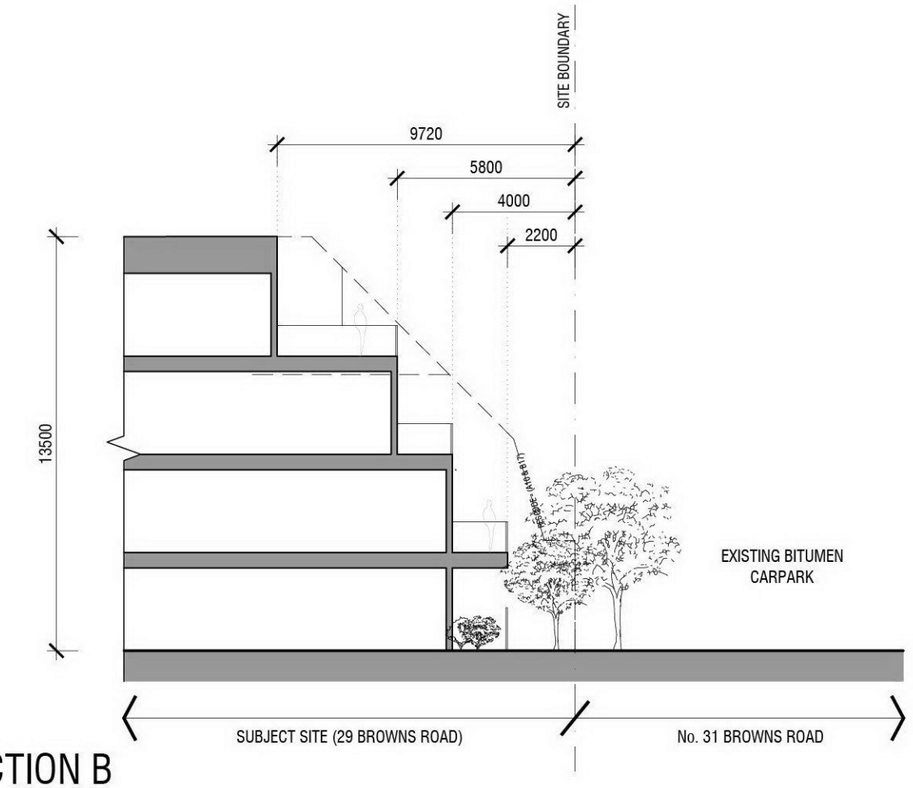
DATE	SEPTEMBER 2015
SCALE	1:200 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP17

D19-334480



SECTION A



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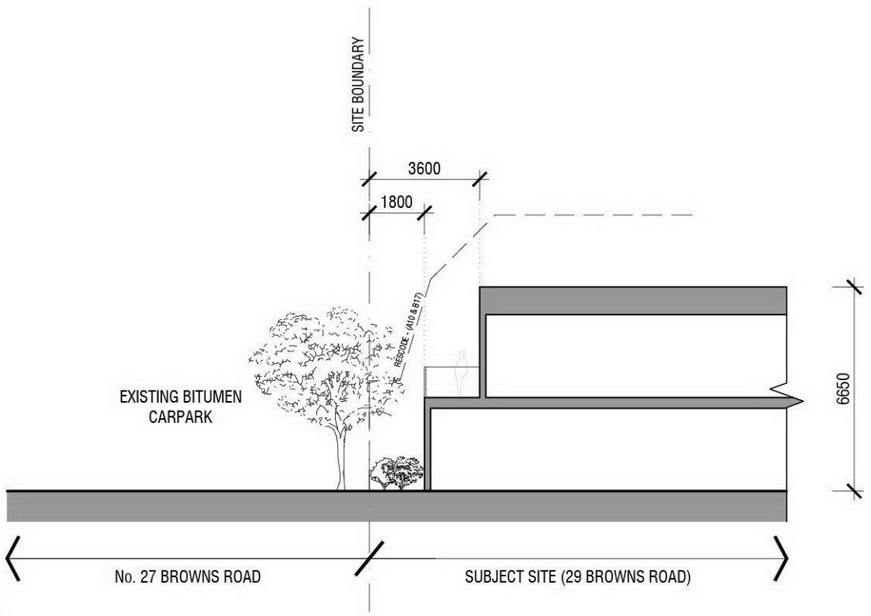

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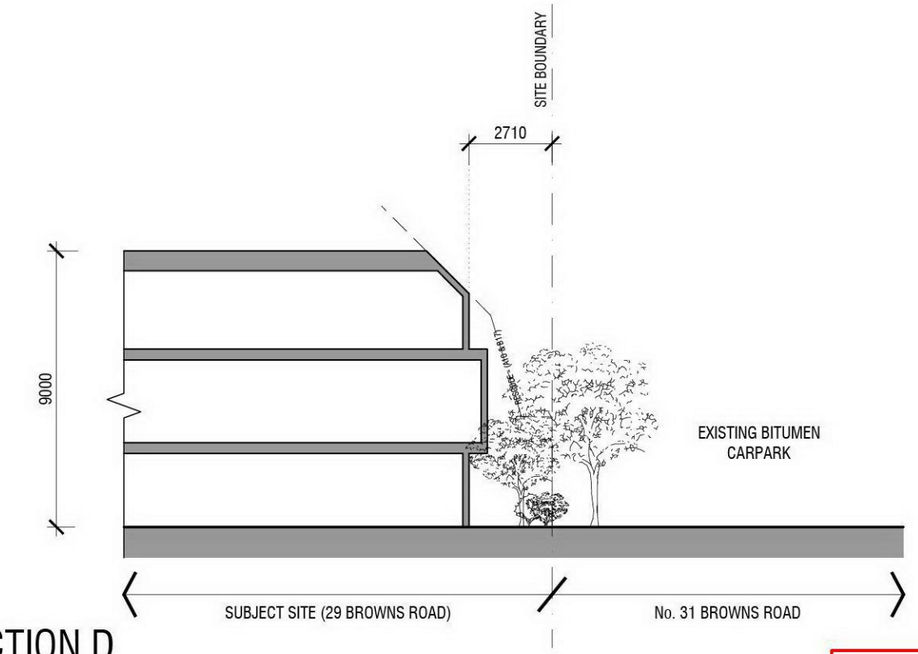

SECTION D

FINAL

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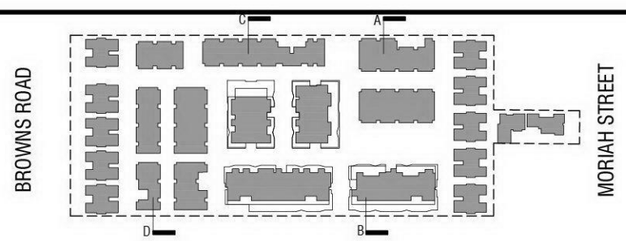


NORTH

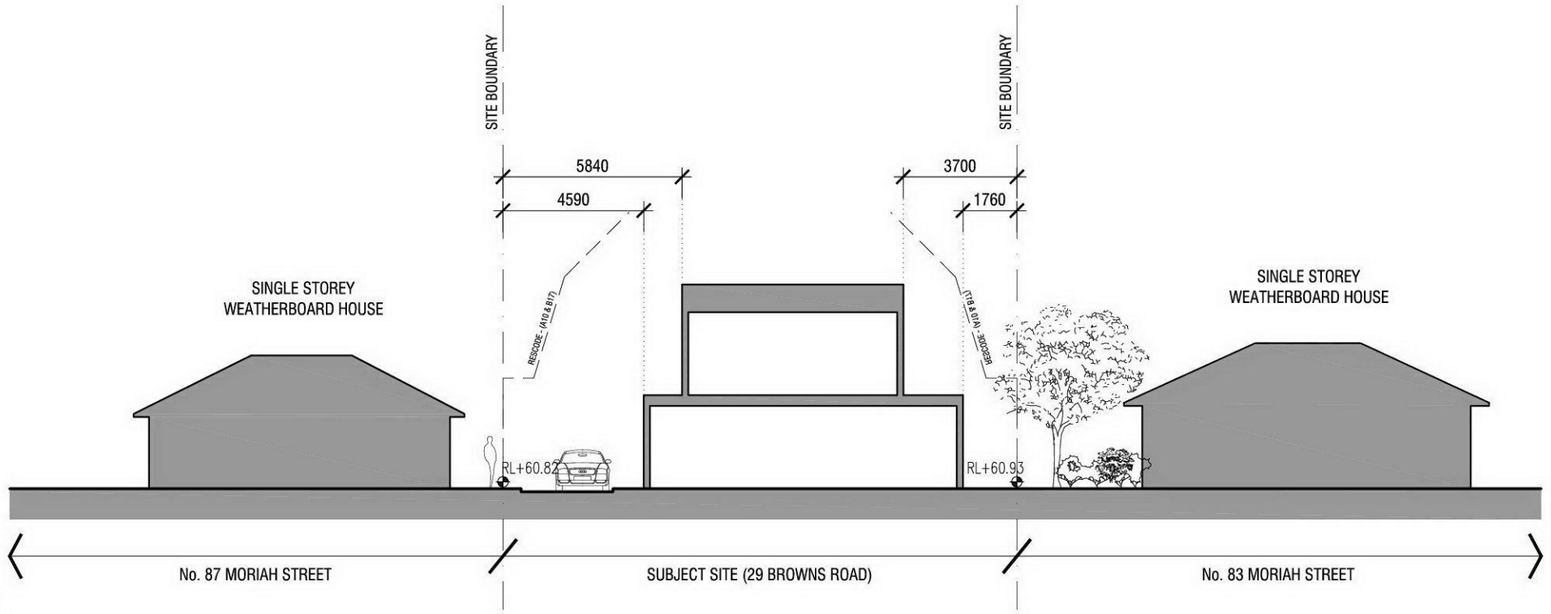
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
SITE SETBACK DIAGRAMS

DATE	APRIL 2016
SCALE	1:200 @ A3
PROJECT NO.	M023
DRAWING NO.	

B DP18

D19-334480



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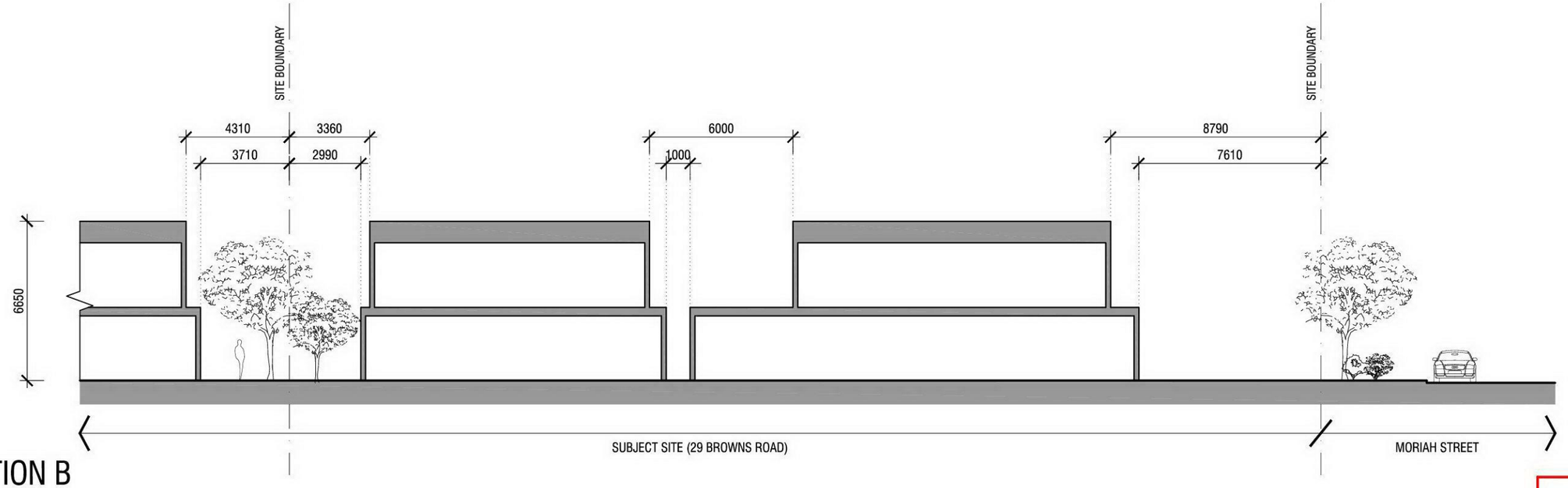

SECTION B

FINAL

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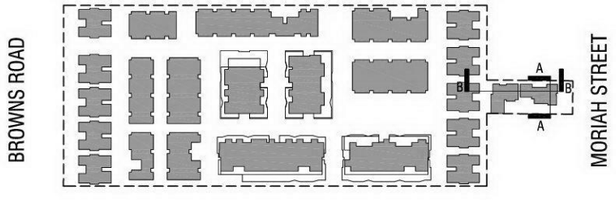


NORTH

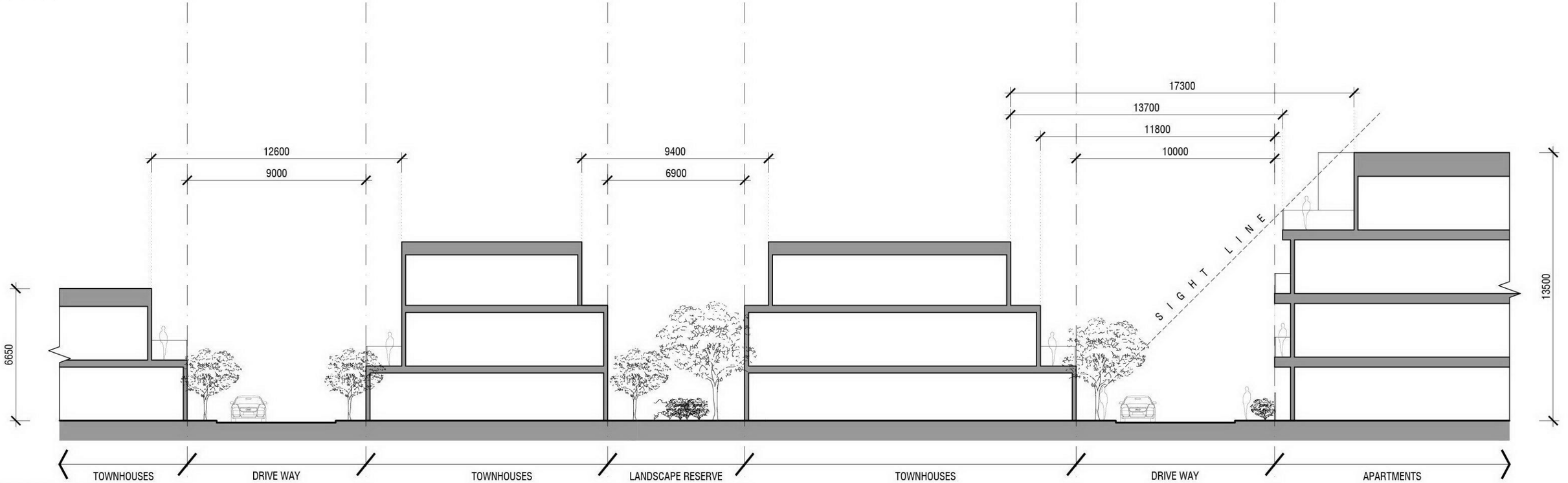
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
SITE SETBACK DIAGRAMS

DATE	SEPTEMBER 2015
SCALE	1:200 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP19

D19-334480



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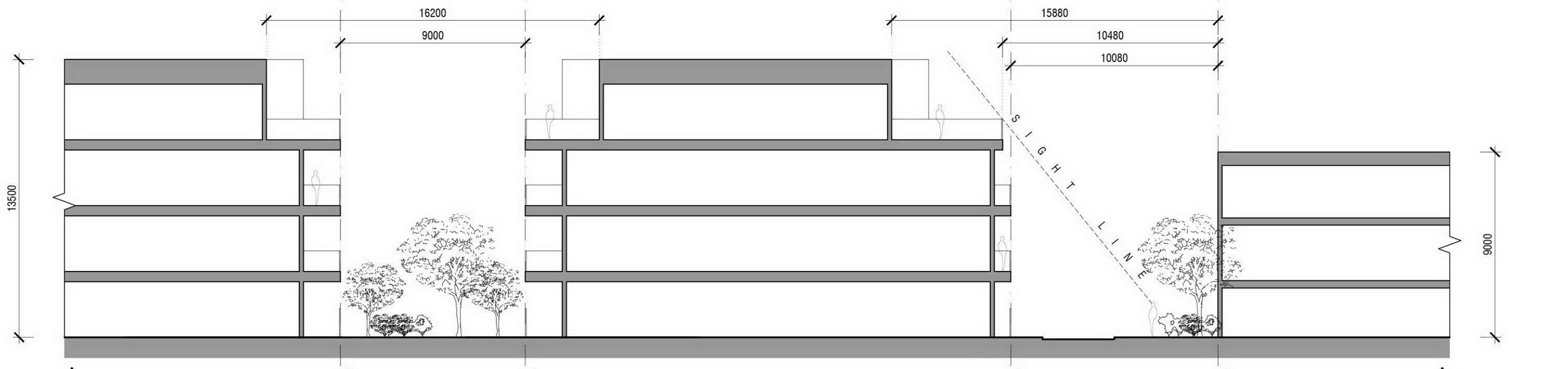

SECTION B

FINAL

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ABN: 44 162 772 714

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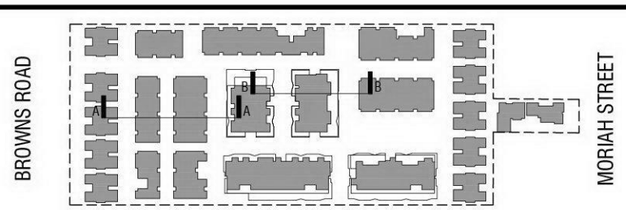
木山集團
MUSHAN



NORTH

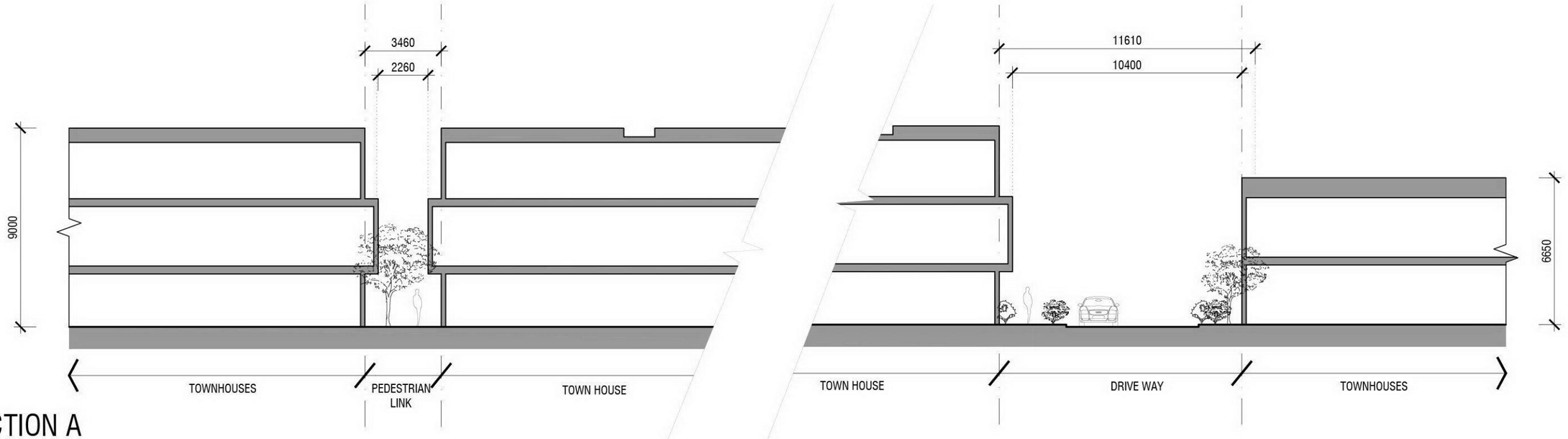
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
INTERNAL INTERFACE SECTIONS

DATE	SEPTEMBER 2015
SCALE	1:200 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP20

D19-334480



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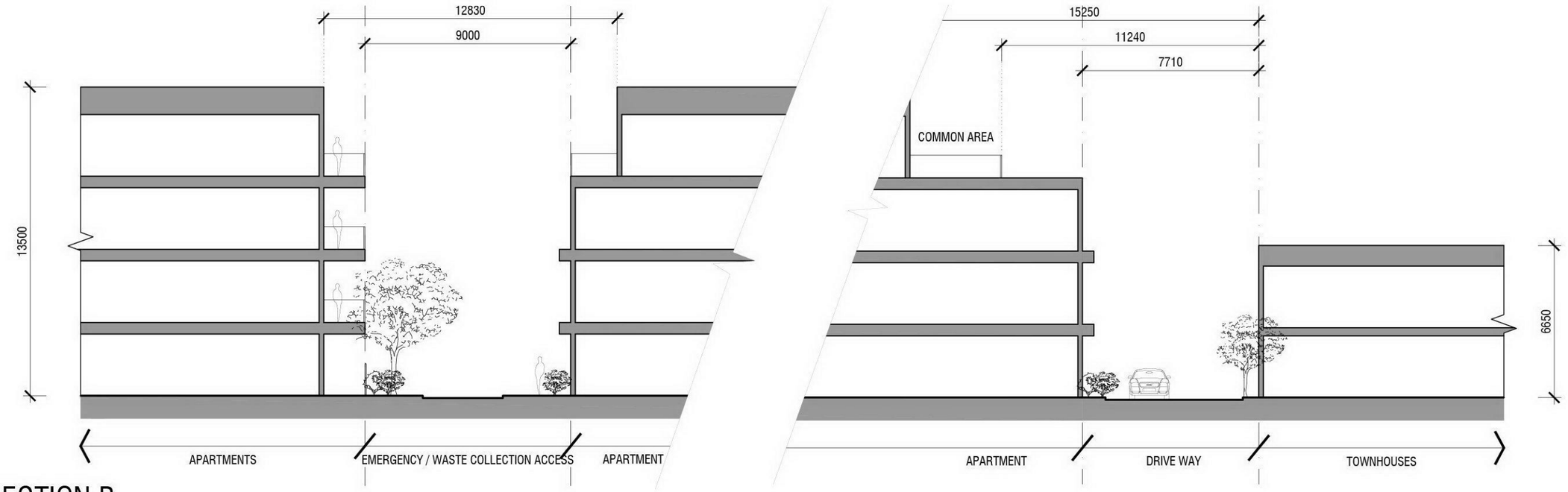

SECTION B

FINAL

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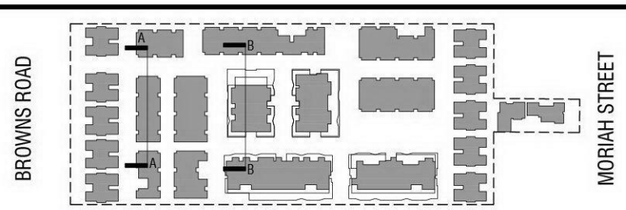


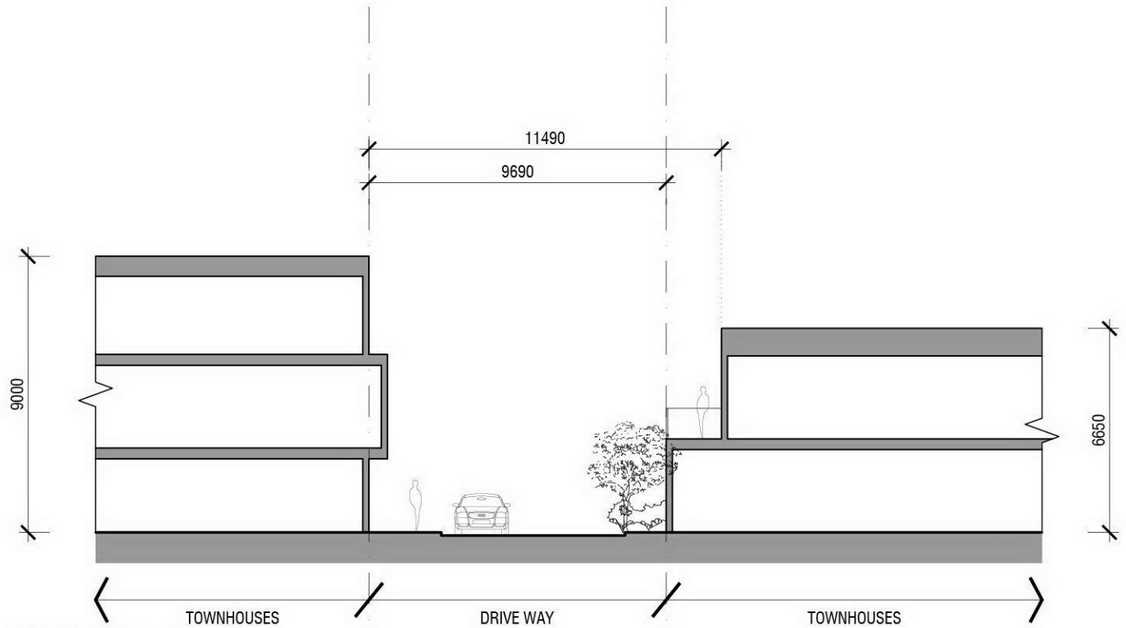
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
INTERNAL INTERFACE SECTIONS

DATE	APRIL 2016
SCALE	1:200 @ A3
PROJECT NO.	M023
DRAWING NO.	

B DP21

D19-334480



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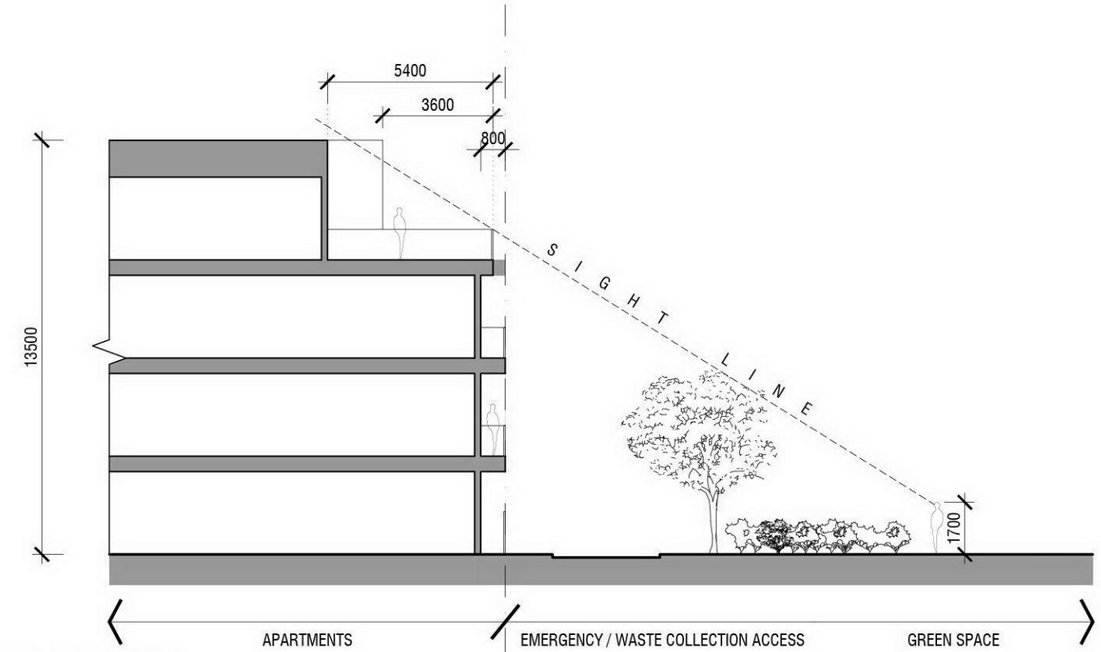

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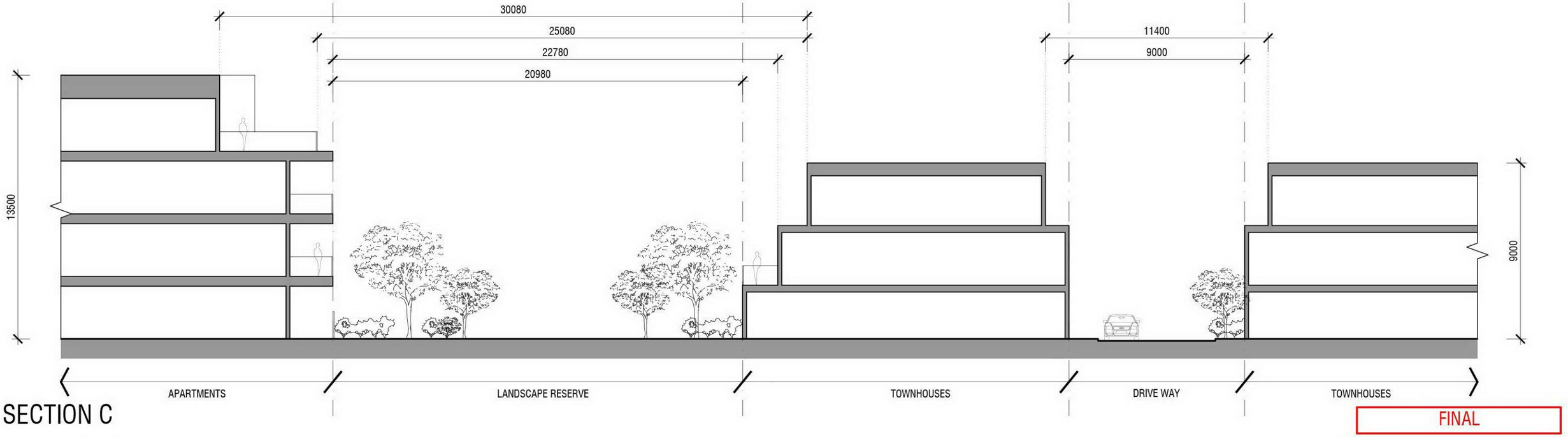

SECTION C

FINAL

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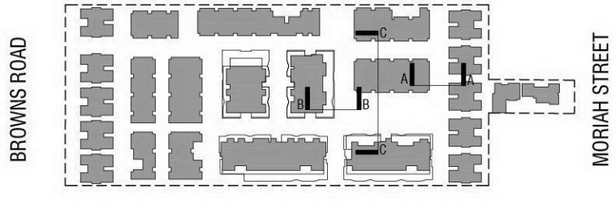


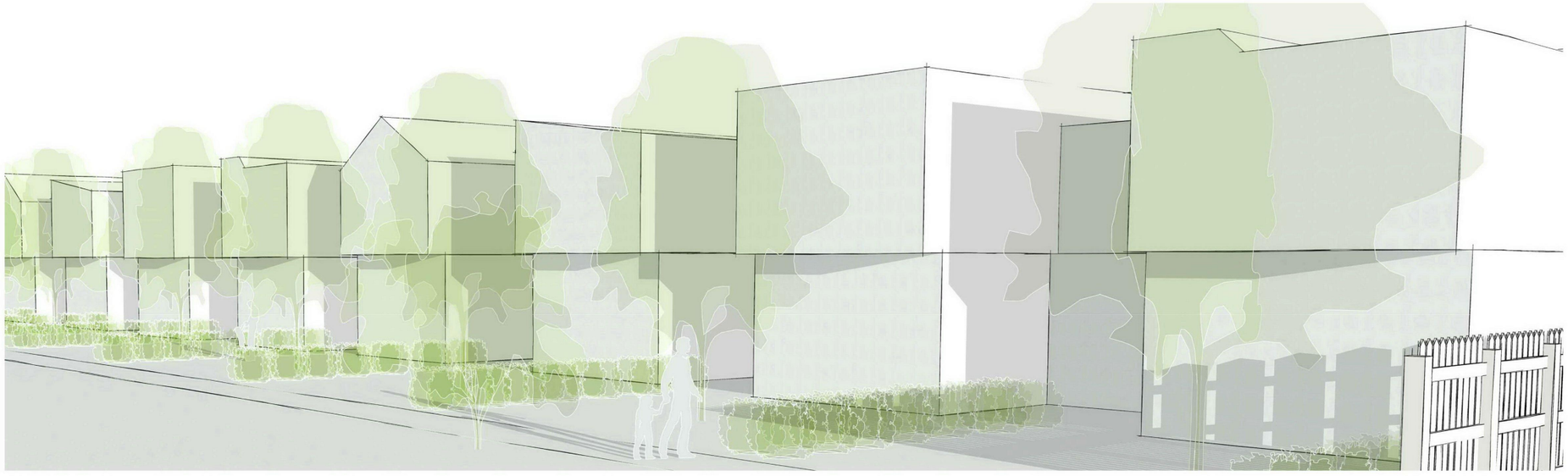
NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

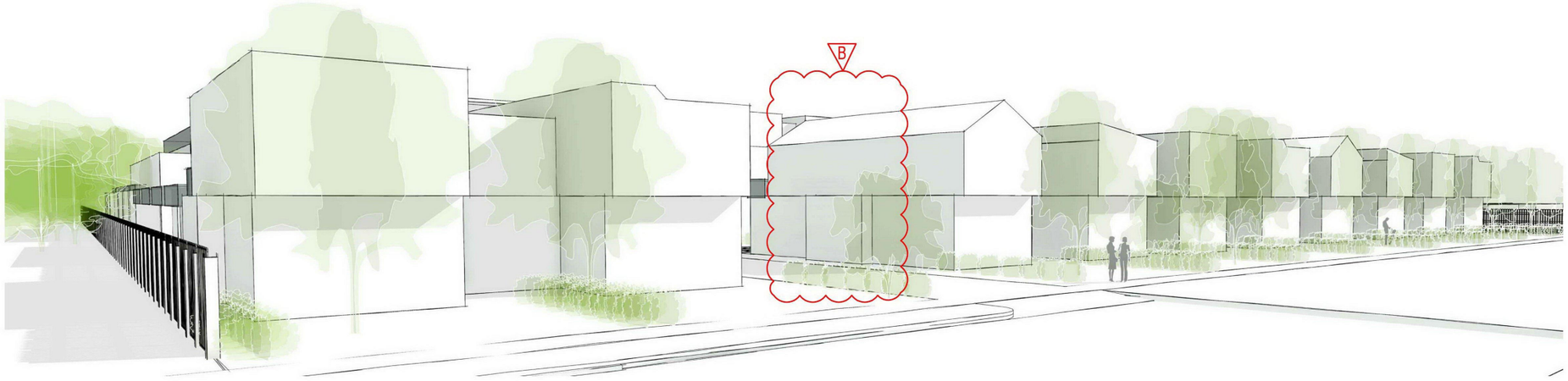
TITLE
INTERNAL INTERFACE SECTIONS

DATE	SEPTEMBER 2015
SCALE	1:200 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP22



(VIEW 01) LOOKING NORTH EAST
BROWNS ROAD



(VIEW 02) LOOKING SOUTH EAST
BROWNS ROAD

FINAL

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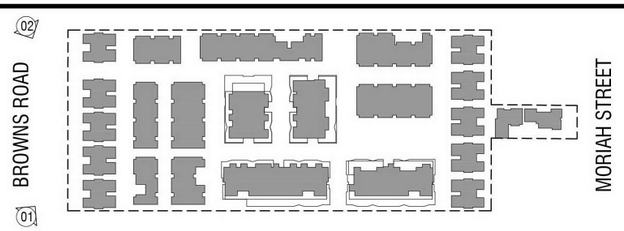

NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
3D MASSING VIEWS

DATE	FEBRUARY 2017
SCALE	NTS @ A3
PROJECT NO.	M023
DRAWING NO.	

B DP23

D19-334480

(VIEW 03) LOOKING SOUTH EAST
INTERNAL SITE

(VIEW 04) LOOKING SOUTH EAST
INTERNAL SITE

FINAL

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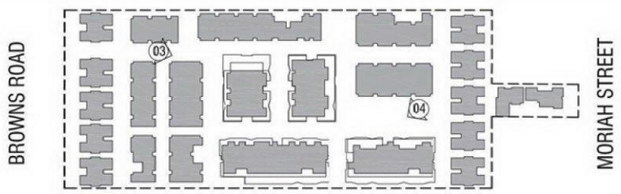

NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
3D MASSING VIEWS

DATE	SEPTEMBER 2015
SCALE	NTS @ A3
PROJECT NO.	M023
DRAWING NO.	A DP24

D19-334480

(VIEW 05) LOOKING SOUTH WEST
CENTRAL APRTMENTS

(VIEW 06) LOOKING NORTH WEST
INTERNAL PUBLIC PARK

FINAL

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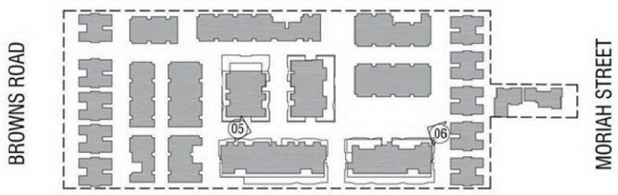

NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
3D MASSING VIEWS

DATE	SEPTEMBER 2015
SCALE	NTS @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP25

5.3 Design Philosophy and Architectural Themes

The design philosophy for the site has been carefully crafted from detailed analysis of both the strategic location and surrounding built form context of the site, as detailed by Mushan Design Studio:

The architectural design for the Browns Road residential development takes a first principles approach that demonstrates how better quality housing can be developed in parallel with better neighbourhood amenity. The integration and urban re- regeneration of such a large site is taken as the starting point for the architecture and urban design. The proposed building form and pedestrian circulation network aims to provide an improved hierarchy of public and private open spaces.

A sense of street address is provided by having a traditional low scale (two storey) residential typology facing the Browns Road street frontage. This arrangement provides the opportunity for clearly defined frontages and entries facing and activating a new street address for the site. These clear delineated access points reinforce the sense of street address and pedestrian permeability to the site. This theme is maintained further within the site by placing lower scale townhouses around the perimeter boundary. This addresses the more sensitive western boundary interface where abutting existing Moriah street residential houses.

The shared pedestrian and driveway zones will have its vehicular entry from the North West corner of Browns Road. The internal road ways act as veins through the site to provide convenient and easy vehicular access. Townhouse buildings are clustered together and oriented directly north to maximise winter sun to north facing windows. Other townhouses orientated east west also have opportunity for good solar access with breaks provided

between townhouses located on the northern boundary. Common landscape strips of open space running north south are provided between the apartments and townhouses, with good connections to site circulation networks.

An articulated built form to the apartments, with clear vistas through the site along walkways all ensure appropriate levels of passive surveillance and private amenity. The elevation treatment of the apartments articulates the facade by using a combination of sunken and expressed angled cantilevered balconies which allows for both private and intimate external space as well as expressed balconies to gain northern light. This contributes to apartments with better amenity, and also increases passive surveillance in the area, contributing to a better built environment. The ground floor apartment courtyards provide a connection to the public landscape areas and are articulated by recessed alcoves. Townhouse entries are treated in the same manner which helps identify these entries from both the shared drive way and the open public garden areas. Upper apartment levels have been set back slightly to reduce the overall mass and scale of buildings as well to enable better solar exposure throughout the site.

External materials proposed are of low maintenance and predominately of natural appearance consisting of natural textured concrete, profiled metal/timber cladding, roofing, and face brick work prevalent to the area.

Sustainable design solutions have been integrated into the building and landscape design. These range from passive design fundamentals such as maximising winter sun and cross ventilation to grey water use & solar hot water panels, a strong emphasis will has been placed on the social dimension of sustainability with the introduction of landscaped public open space, private courtyards and shared services and amenity.

-- Daniel Podlewski, Project Architect, Mushan Design Studio Pty Ltd

5.4 Development Schedule

The tables in Appendix H provide an indicative development schedule for the Development Plan area, including the minimum number and density of dwellings for apartment and townhouse dwellings types.

6 Shadow Analysis and Amenity

6.1 Shadow Analysis

Drawings DP26 – DP28 identify the existing shadows and shadow cast for the proposed building envelope conditions at 10am, 1pm and 3pm on 22 September.

The shadow analysis demonstrates that all overshadowing will satisfy the relevant overshadowing objectives of Clause 55 of the Monash Planning Scheme for adjoining sites.

The building envelope also incorporates generous spaces between building elements to ensure that buildings maximise solar access for townhouses and apartments within the development.

6.2 Amenity

The building envelope has been designed so that any development on the site will not generate adverse off-site amenity impacts, in that:

- The building envelope reduces scale towards the residential interfaces by locating town houses along the eastern and western boundaries of the site.
- The eastern row of town houses have been set back from the eastern property boundary in accordance with Standard B17 of Clause 55 for rear boundary setbacks to minimise visual bulk to the neighbouring dwellings. Overlooking is prevented through the use of screens to 1.7 metres above finished floor level where required.

The building envelope has been designed so that any development on the site will promote a high amenity living environment for future residents, in that:

- The building envelope provides for a number of landscaped common open space areas, providing outlook for dwellings onto a garden area.
- The building layout allows sufficient spacing between dwellings to provide sunlight to front and side gardens which will facilitate landscaping to soften built forms.
- Buildings have been spaced so as to avoid overlooking or need for screening and to allow sunlight to private open spaces and communal areas.

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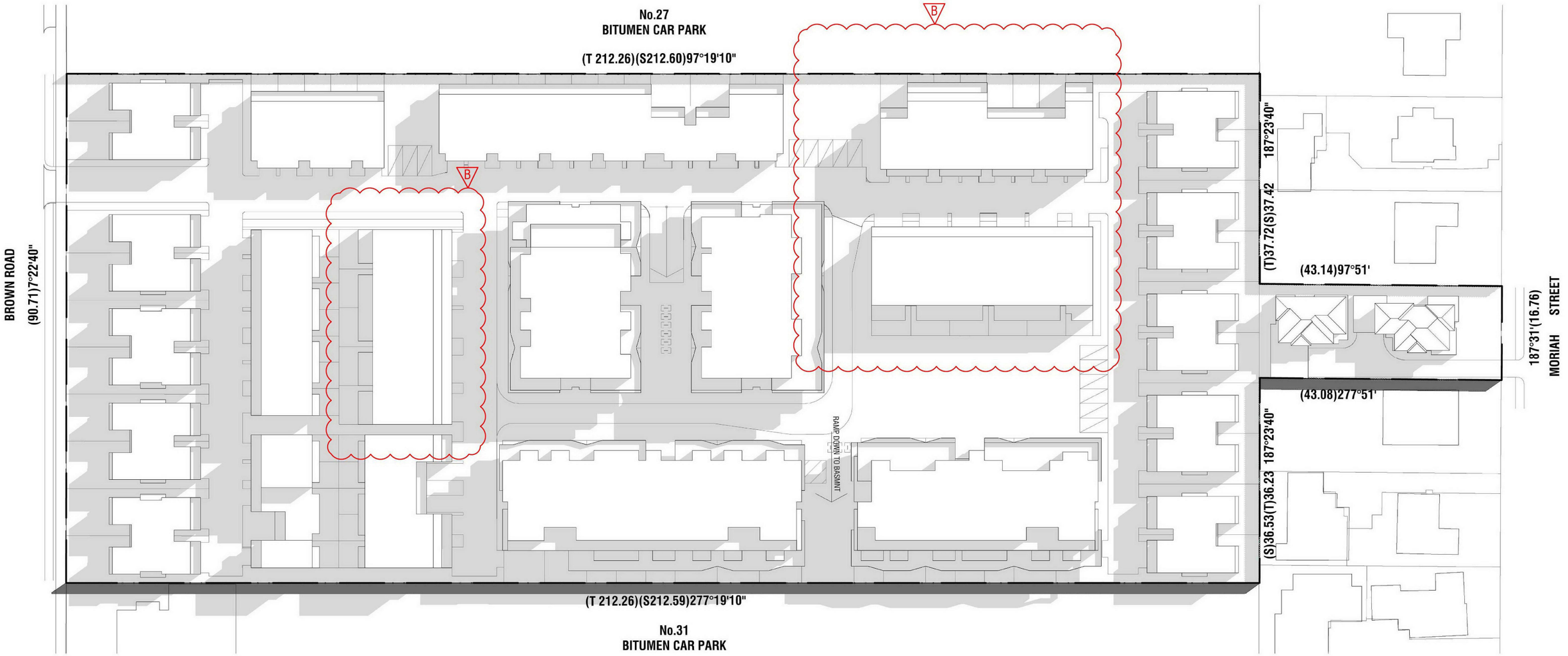

SHADOW FOR EXISTING FENCE

SHADOW FOR PROPOSED BUILDING

FINAL

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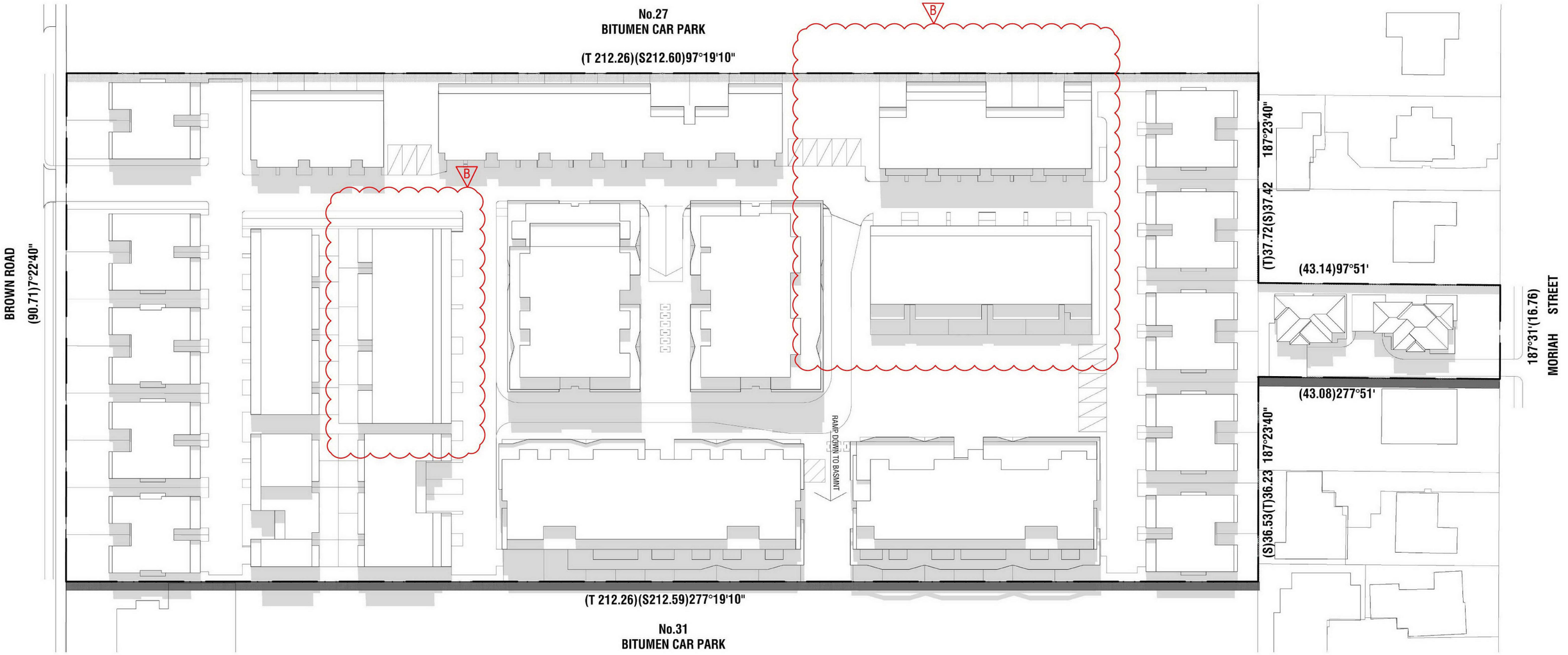
NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
SHADOW ANALYSIS - 10AM

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	B DP26

D19-334480



SHADOW FOR EXISTING FENCE

SHADOW FOR PROPOSED BUILDING

FINAL

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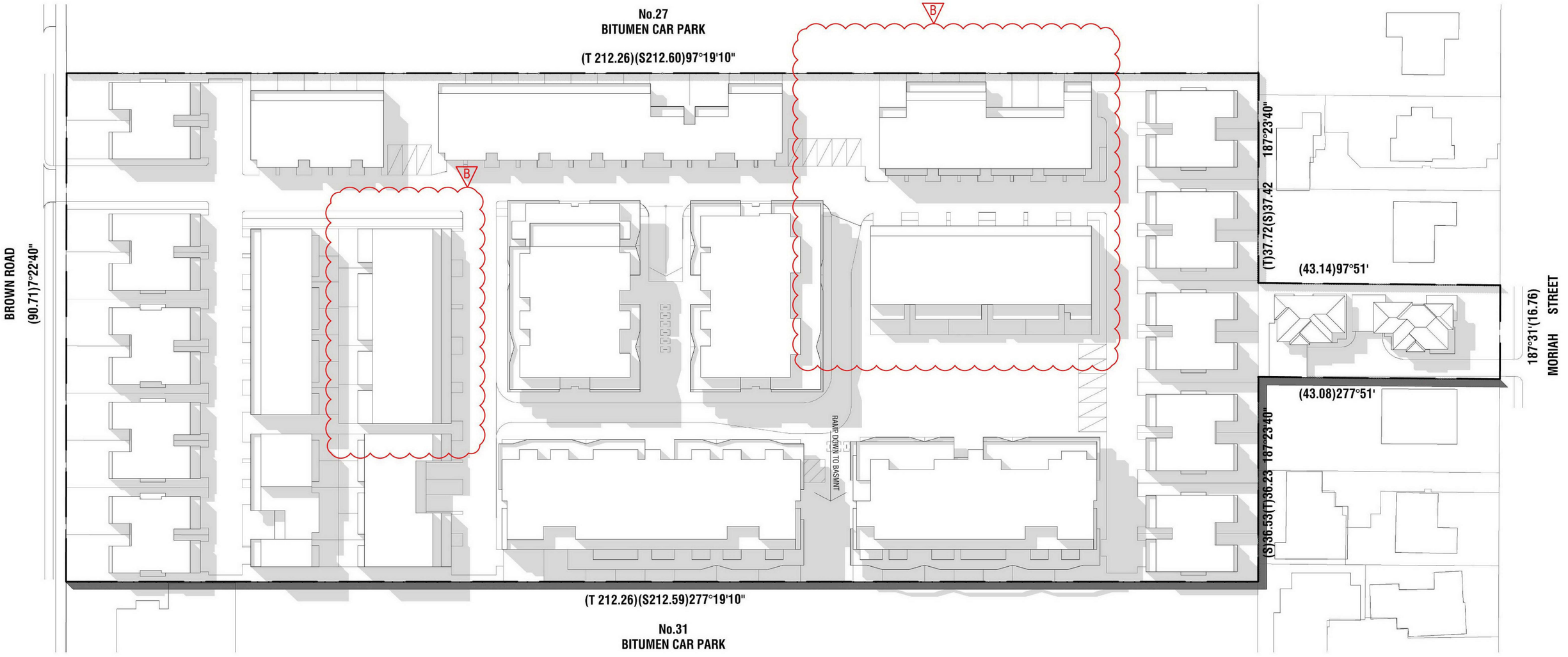
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
SHADOW ANALYSIS - 1PM

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	

B DP27

D19-334480



SHADOW FOR EXISTING FENCE

SHADOW FOR PROPOSED BUILDING

FINAL

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PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
SHADOW ANALYSIS - 3PM

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	

B DP28

7 Infrastructure and Environment

A sustainable Design Assessment (SDA), Waste Management Plan (WMP) and Stormwater Management Plan (SMP) have been prepared for the Development Plan Area at Appendices D, E and F. The key elements of these reports are outlined below.

7.1 Sustainable Design

A Sustainable Design Assessment prepared by Energy Lab demonstrates how development within the Development Plan area will meet sustainability targets, comply with best practice and where practicable exceed Council performance standards under Monash's Sustainable Design Assessment in Planning Process (SDAPP) having regard to the following key areas:

- Indoor environment quality
- Energy efficiency
- Water efficiency
- Stormwater management
- Transport
- Waste management
- Urban ecology
- Innovation
- Ongoing building and site management

Design initiatives include:

- Maximising cross-flow ventilation.
- Maximising access to natural light.
- Insulation for acoustic and thermal comfort.
- Zoning of rooms.
- Use of low emission materials.
- Energy efficient building design, heating, cooling and lighting.
- Water efficient taps, toilets and appliances.
- Water sensitive urban design initiatives including capture and re-use of stormwater, permeable paving and drought tolerant landscaping.
- Building materials that are durable with low embodied energy.

7.2 Waste Management

A Waste Management Plan prepared by Waste Tech Services at Appendix F outlines the waste management measure for the Development Plan area. Waste is to be sorted on site by future residents into the following streams and associated bins:

- Garbage
- Co-mingled recycling
- Garden waste (for townhouses only)

Bin collection for the townhouses is to be performed by a private contractor a weekly basis for garage and fortnightly for recycling.

Bin collection for the apartment building is to be performed by a private contractor and the building manager will be responsible for transferring bins from the bin room to the collection points. Garbage collection will occur up to four times a week and recycling collection will occur up to twice a week.

7.3 Stormwater Management

A Stormwater Management Plan prepared by Irwinconsult Pty Ltd at Appendix E outlines the overall drainage strategy for the Development Plan area. The proposed drainage strategy takes into account the City of Monash requirements for legal point of discharge and requirement for control of peak discharge from the site.

The legal point of discharge nominated by Council is the 900mm Council drain located in the south-eastern corner within the sewerage easement along the eastern boundary of the development area. The development will also provide on-site detention.

8 Access and Parking

The Development Plan is informed by a Traffic Impact Report prepared by Ratio Consultants (provided at Appendix C). The physical elements of the report are represented in Drawing DP07 – Precinct Circulation Plan.

The report describes the existing and proposed road networks, public transport connections, pedestrian links and car parking provision.

8.1 Sustainable Transport

The site has excellent access to existing public transport and is proximate to existing employment, shopping, educational and recreational facilities.

The public transport network in the vicinity of the Development Plan area includes the Clayton Train Station and bus interchange and provides access to Dandenong, Chadstone, Mulgrave, Oakleigh, Monash University (Caulfield), Elwood, Huntingdale, Southland, Waverley Gardens, Ormond, Middle Brighton, Moorabbin, Toorak and into the Melbourne Central Business District.

8.2 Vehicle Access

Vehicle access will be taken from one location on Browns Road via a double crossover. Vehicle access points have been minimised to reduce the impacts on the existing traffic network.

Pedestrian permeability throughout the site has been maximised through the provision of landscaped pedestrian areas. Where possible, primary pedestrian access to the town houses has been provided directly from the pedestrian areas with a secondary access from the vehicular accessway.

8.3 Car and Bicycle Parking

Car and Bicycle parking rates are outlined in the Traffic Impact Report provided at Appendix C. In summary, car parking is to be provided at the following rates:

- 1 resident space for each one or two bedroom dwelling.
- 2 resident spaces for each three bedroom dwelling
- 1 visitor space per 5 dwellings.

Bicycle parking is to be provided at the following rates:

- 1 resident space per 5 apartments
- 1 visitor space per 10 apartments

The proposed parking provision meets these requirements, pursuant to Clause 52.06 of the Monash Planning Scheme.

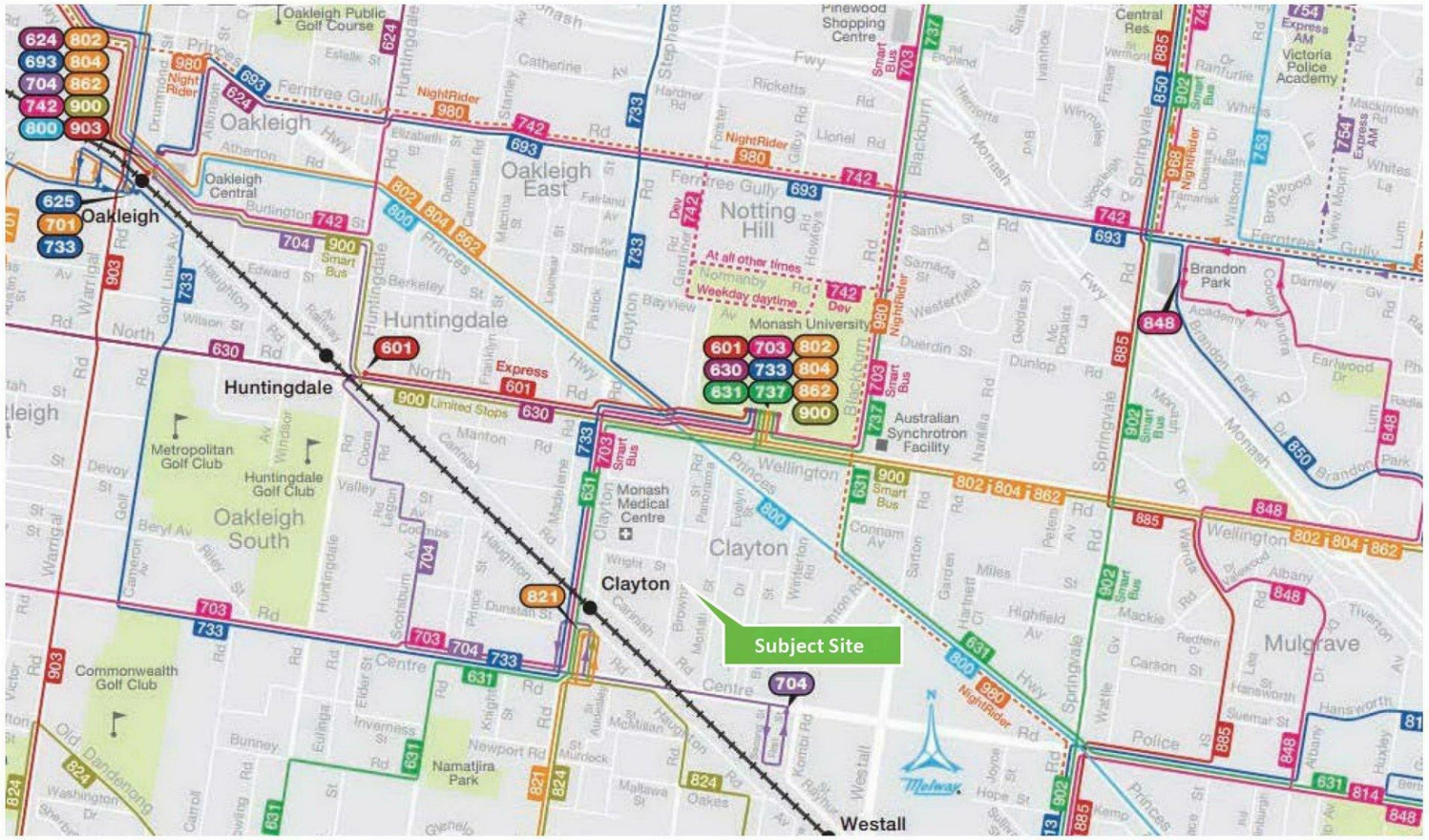

Figure 5 Public transport network around the site

D19-334480

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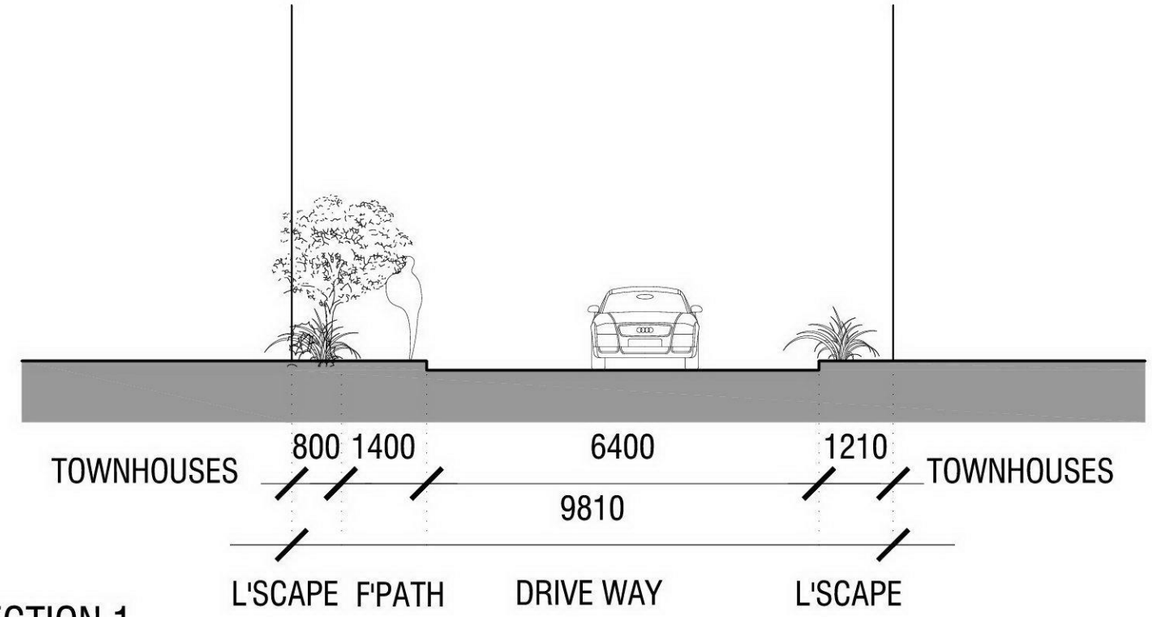
NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
PRECINCT CIRCULATION PLAN

DATE	SEPTEMBER 2015
SCALE	1:2000 @ A3
PROJECT NO.	M023
DRAWING NO.	- DP07

D19-334480



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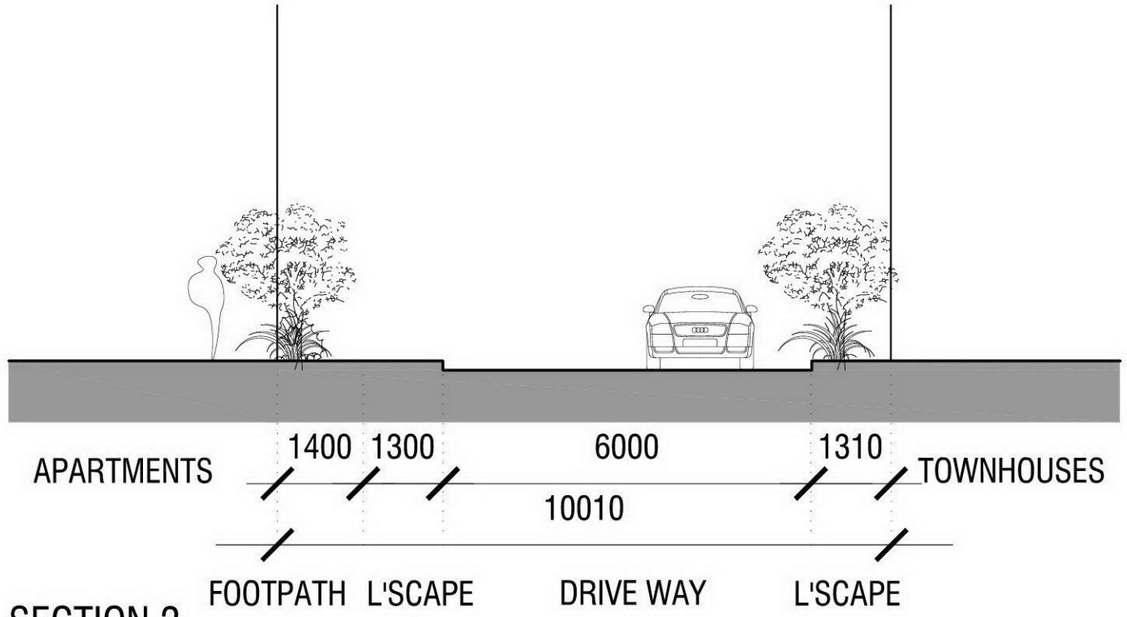

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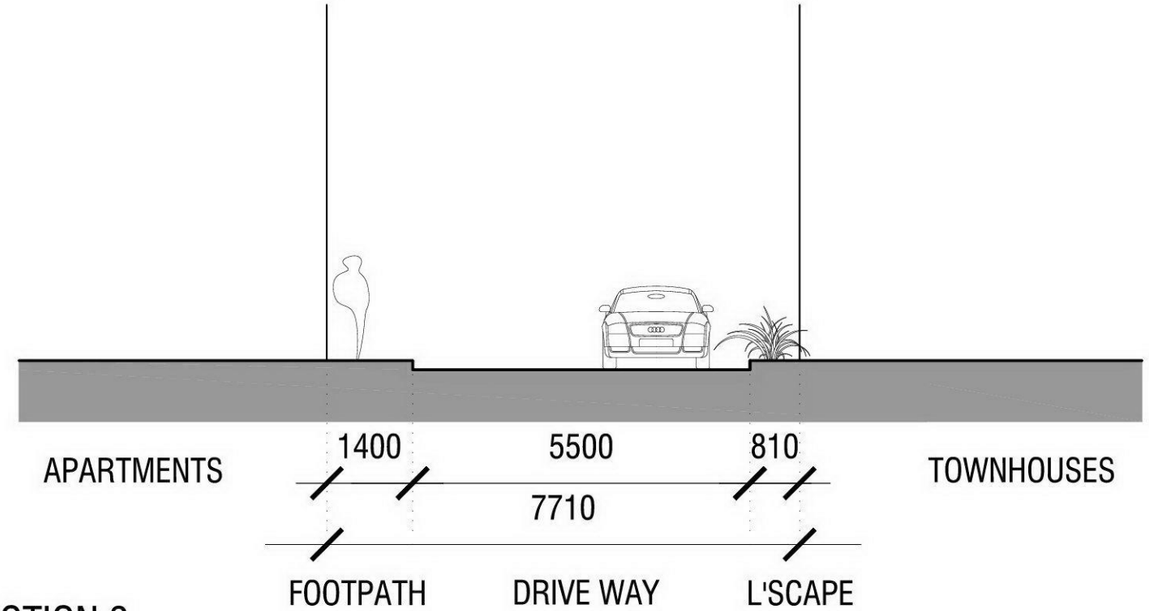

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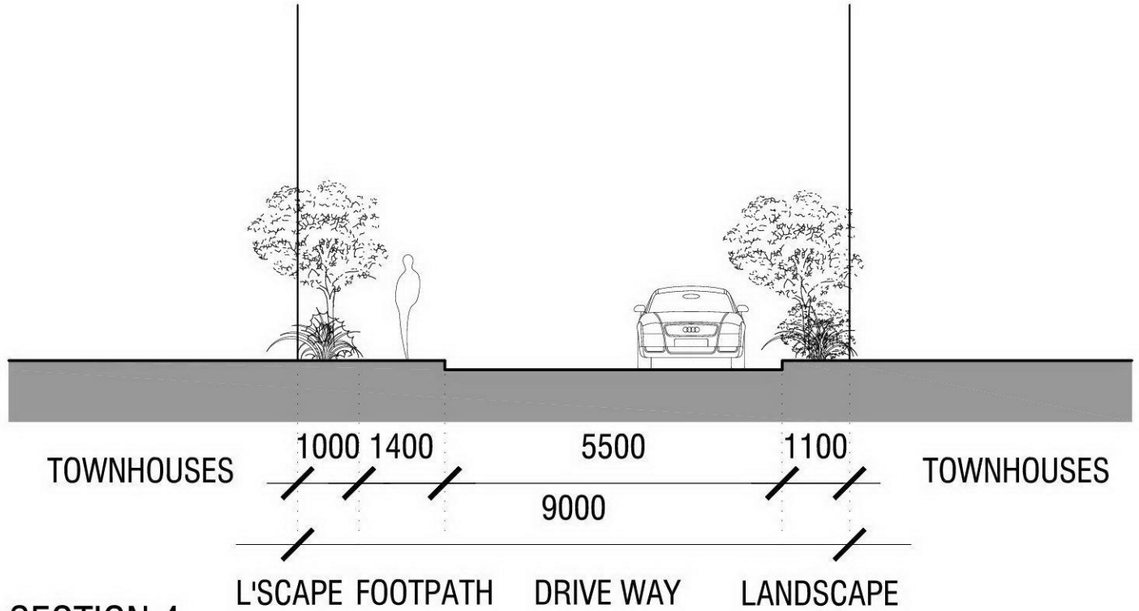

SECTION 4

FINAL

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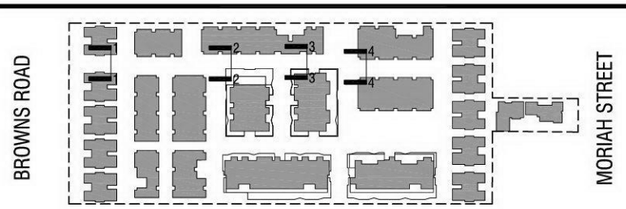


NORTH

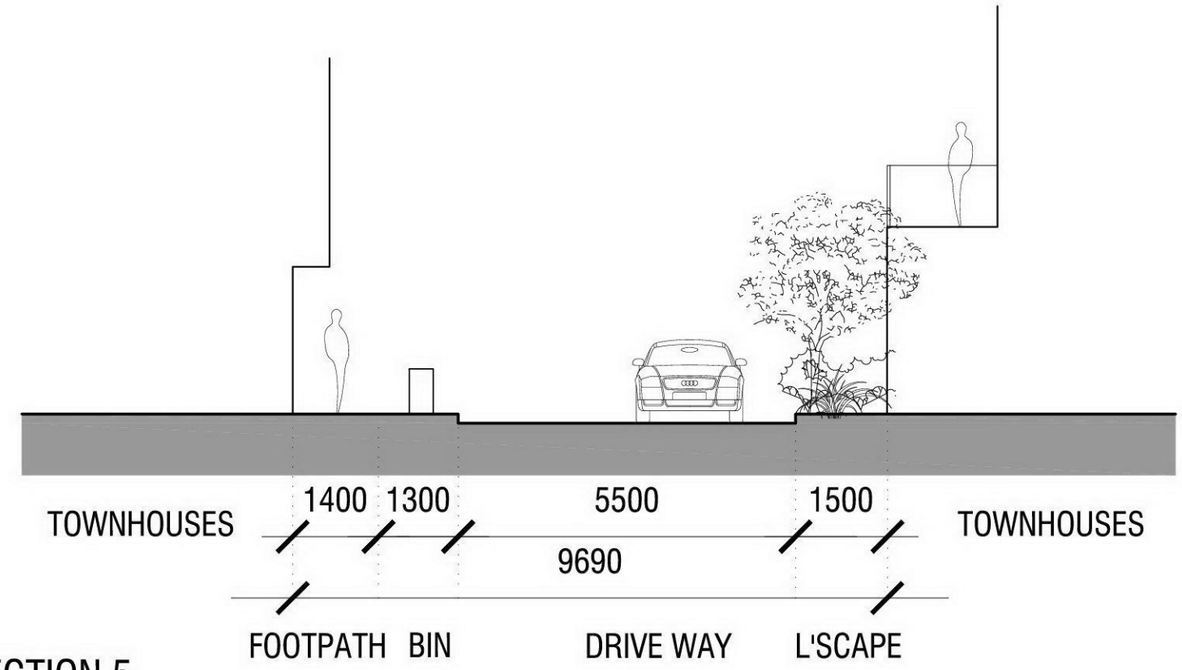
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
FOOTPATH & DRIVEWAY DIAGRAM

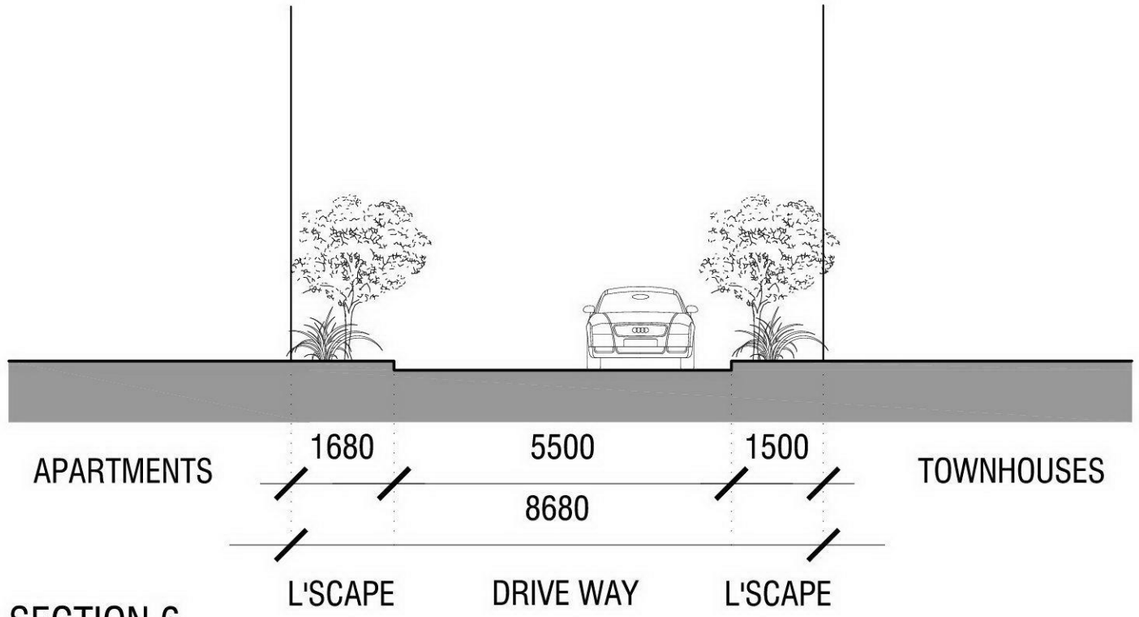
DATE	APRIL 2016
SCALE	1:100 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP29

D19-334480



SECTION 5



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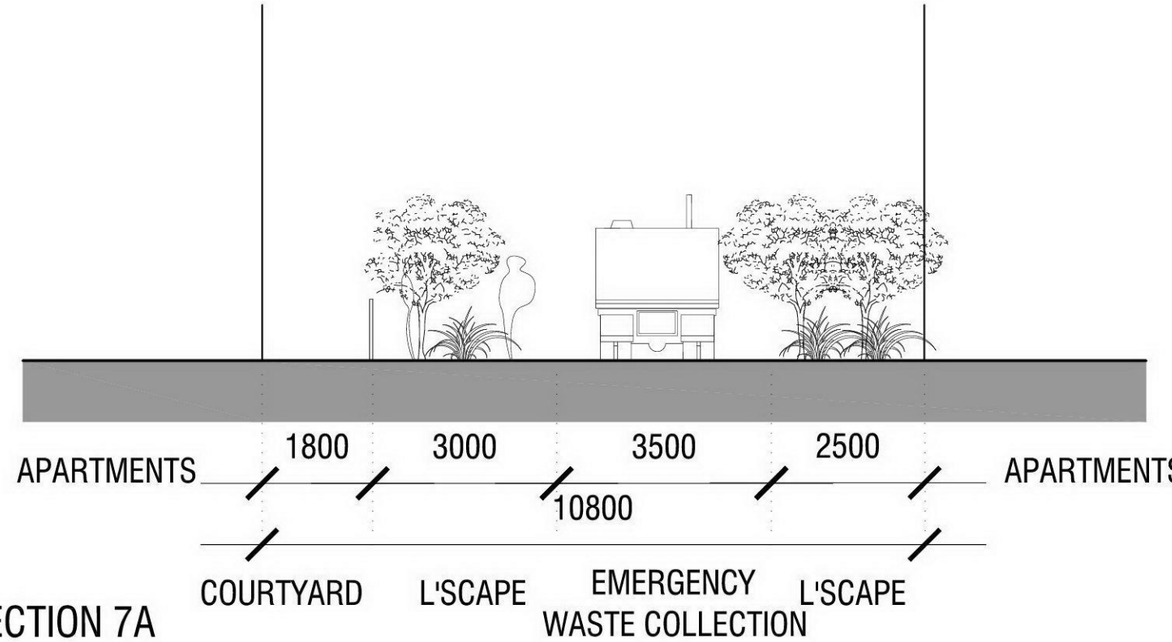

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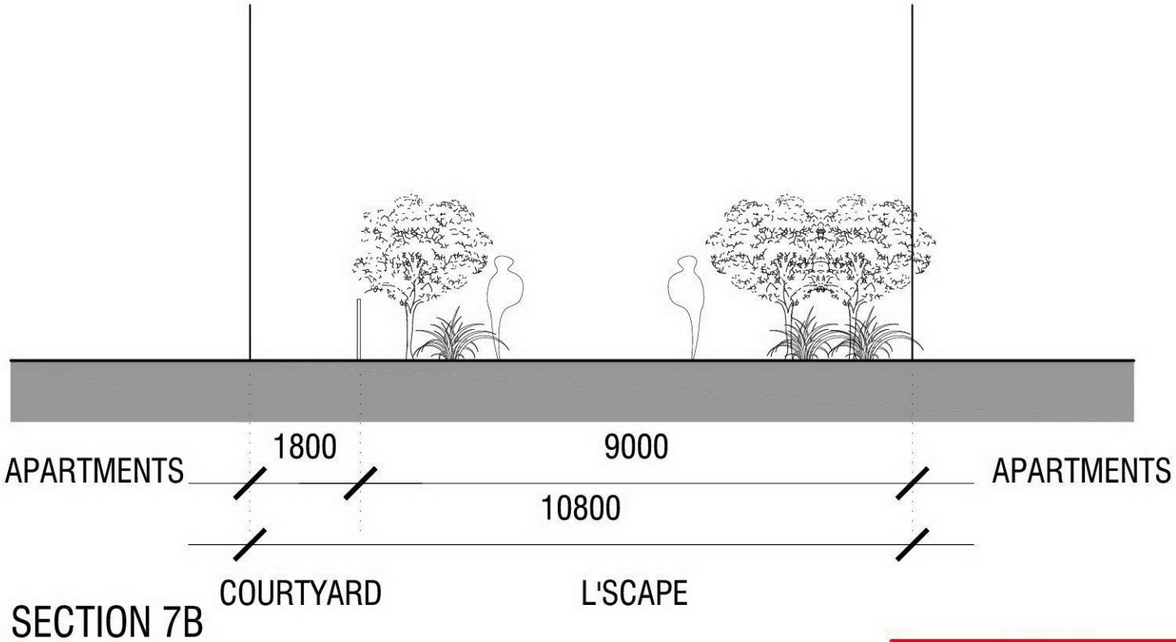


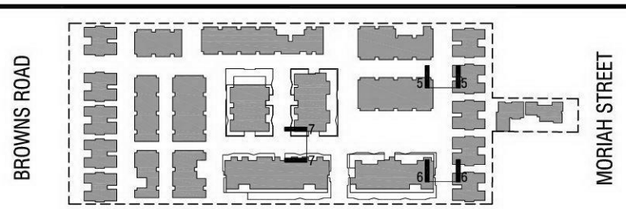
SECTION 7B

FINAL

MUSHAN DESIGN STUDIO PTY LTD
LEVEL 15, 333 COLLINS STREET
MELBOURNE VIC 3000
ABN: 44 162 772 714

PH: 03 8611 7605
EMAIL: INFO@MUSHAN.COM.AU

木山集團
MUSHAN



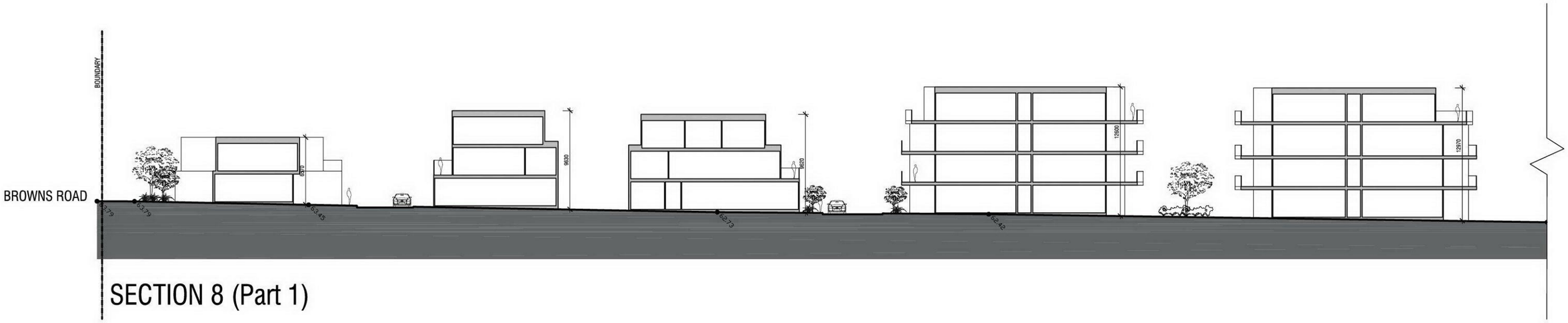
PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
FOOTPATH & DRIVEWAY DIAGRAM

DATE	APRIL 2016
SCALE	1:100 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP30

D19-334480



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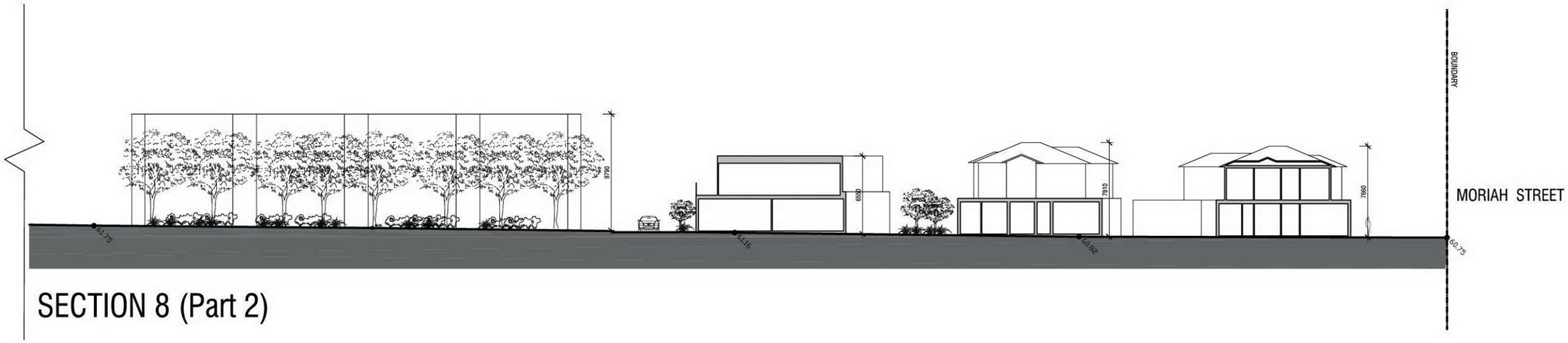

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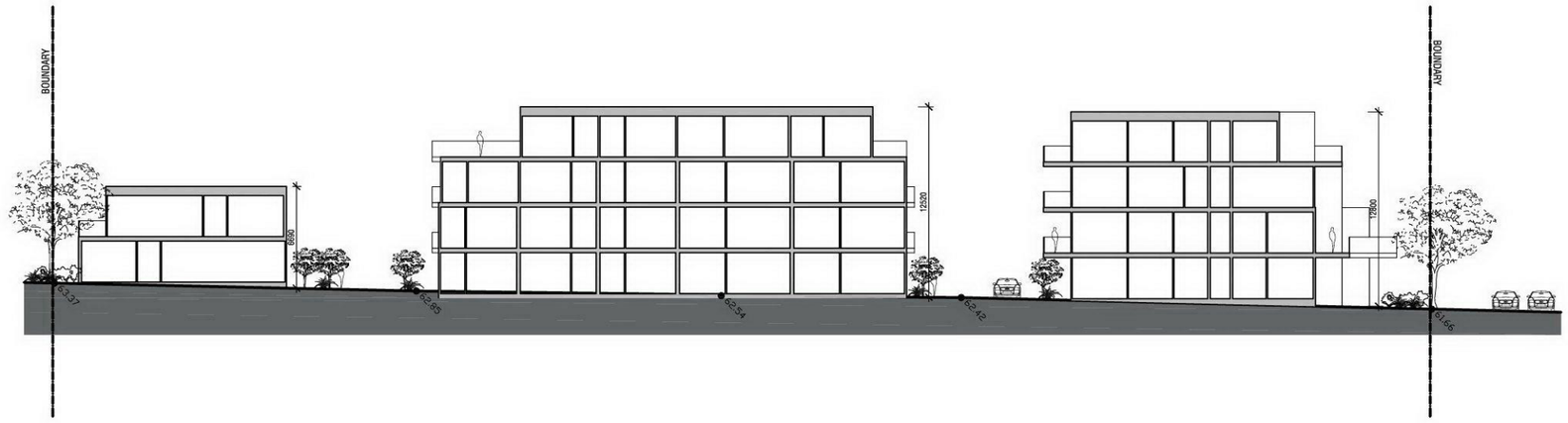

SECTION 9

FINAL

MUSHAN DESIGN STUDIO PTY LTD
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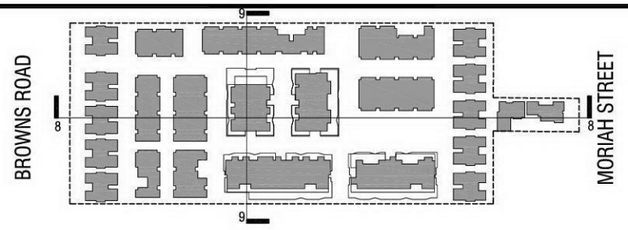
MUSHAN



NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
PROPOSED SECTIONS

DATE	MAY 2016
SCALE	1:400 @ A3
PROJECT NO.	M023
DRAWING NO.	

A DP31

9 Landscaping Concept

The Landscape Concept for the Development Plan is provided at Appendix A prepared by John Patrick. The plan identifies all existing trees on the site, including those identified for removal, and all proposed landscaping and paving.

The key elements of the concept include:

- Planting of 152 trees on the site within the front and side building setbacks.
- Retention of all moderate retention value trees as identified in the Treelogic Report (2013). It is noted that a review of these trees undertaken in 2015 has downgraded the value of one tree (tree 14) to low.
- Protection of all trees adjoining the site.
- Perimeter planting and retention of existing trees along all boundaries to assist in softening and screening proposed built form.
- A communal open space area with substantial landscaping towards the rear half of the site.
- Drought tolerant native tree and plant sections to promote biodiversity and minimise water use.

The arborist report prepared by Tree Logic (Appendix G) dated April 2013 assessed thirty-four (34) trees within the study area. No trees within the subject site were identified as being of high arboricultural rating. Seventeen (17) trees were attributed an arboricultural rating of moderate, and seventeen (17) were attributed low or no retention value.

The landscape plan allows for retention of all moderate retention value trees and the proposed planting of 152 trees to establish a substantial tree canopy across the site. This approach will provide a unified garden scheme that responds to the building layout whilst retaining trees of particular amenity value.

All tree species on the site were determined to be planted for garden and amenity purposes with no naturally occurring

indigenous trees (refer page 7 of the Tree Logic Report Appendix G). Accordingly, a permit is not required to remove the existing native trees from the site pursuant to Clause 52.17 of the Monash Planning Scheme.

10 Conclusion

This Development Plan provides the land use and built form parameters relevant to the future planning of **29 Browns Road, Clayton – Clayton Primary School.**

It has been prepared having regard to the provisions of Schedule 5 to the Development Plan Overlay and has considered the existing and proposed future development context for adjoin and nearby land.

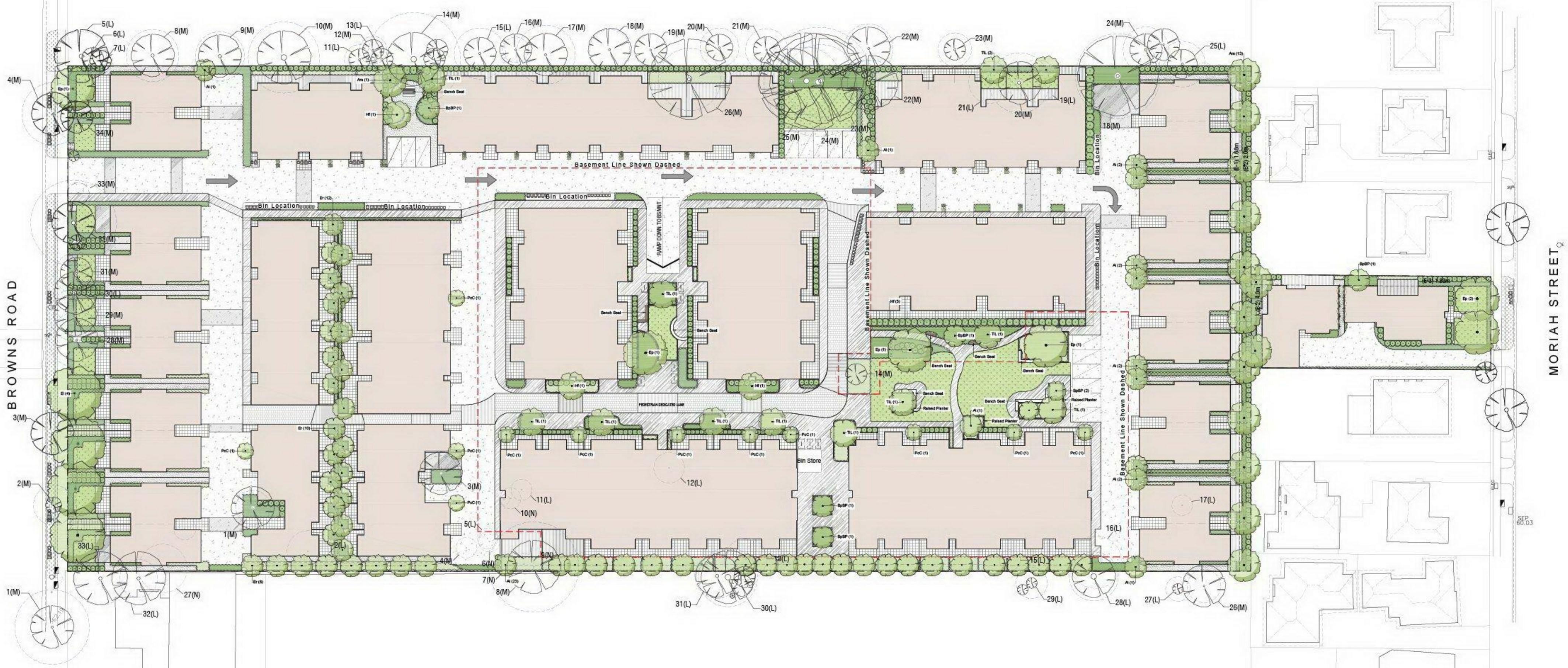
The development plan is derived from and supported by a detailed analysis of the environmental, landscape, built form, infrastructure, access and strategic features of the site and surrounding area.

The Development Plan satisfies the relevant requirements for preparation of a Development Plan at Clause 43.041-3 of the Development Plan Overlay (DPO) and Clause 3.0 at Schedule 5 to the DPO.

Appendix A: Landscape Report

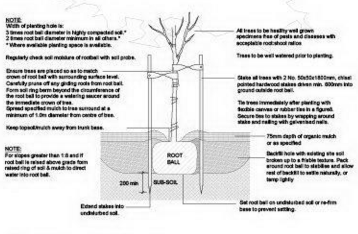
mecone

D19-334480

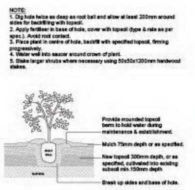


NOTE: ALL PLANTING PROPOSED OVER BASEMENT TO BE IN RAISED PLANTERS AS DRAWN.
THE TWO LAWN AREAS SHOWN OVER BASEMENT TO BE PLANTED IN SHALLOW PLANTERS AT GROUND LEVEL

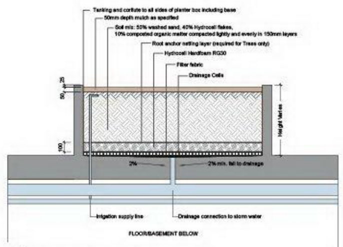
TYPICAL PLANTING DETAILS



D1 TP1 TYPICAL TREE PLANTING DETAIL
Scale N.T.S.



D2 TP1 TYPICAL SHRUB PLANTING DETAIL
Scale N.T.S.



D3 TP1 TYPICAL LIGHTWEIGHT PLANTER BOX DETAIL
Scale 1:20

PLANT SCHEDULE

SYM	BOTANICAL NAME	COMMON NAME	DE/N/Ex	HEIGHT X WIDTH AT MATURITY	SUPPLY SIZE	QTY
TREES						
Ai	Acacia implexa	Lightwood	E/N	10 x 4m	2m	[illegible]
Am	Acacia melanoxylon	Blackwood	E/N	12 x 6m	2m	14
El	Eucalyptus leucoxylon	Yellow Gum	E/N	20 x 10m	2m	4
BpBP	Brachychiton populneus x acerifolius 'Bella Pink'	Bella Pink Brachychiton	E/N	8 x 4m	2m	7
Ep	Eucalyptus polyanthemos	Red Box	E/N	12 x 8m	2m	6
Er	Elaeocarpus reticulatus	Blueberry Ash	E/N	8 x 4m	2m	[illegible]
Hf	Hymenosporum flavum	Native Frangipani	E/N	10 x 5m	2m	8
PcC	Pyrus calleryana 'Capital'	Capital Pear	D/Ex	11 x 3m	3m	12
TL	Tristaniopsis laurina 'Luscious'	Water Gum	E/N	8 x 5m	2m	12
					TOTAL	128
SHRUBS						
AcMC	Acacia cognata 'Mini Cog'	Dwarf River Wattle 'Mini Cog'	E/N	0.8 x 1.8m	200mm pots	
Ca	Correa alba	White Correa	E/N	1 x 1m	200mm pots	
Cg	Correa glabra	Rock Correa	E/N	1.2 x 1.2m	200mm pots	
Go	Goodenia ovata	Hop Goodenia	E/N	1 x 1.5m	200mm pots	
Mp	Murraya paniculata	Orange Jessamine	E/Ex	3 x 1m	200mm pots	
SaBC	Syzygium australe 'Bush Christmas'	Bush Christmas Lilly pilly	E/N	2-3 x 1-2m	200mm pots	
SaP	Syzygium australe 'Pinnacle'	Pinnacle Lilly pilly	E/N	8-10 x 1-1.5m	200mm pots	
Wf	Westringia fruticosa	Coastal Rosemary	E/N	1.2 x 1.2m	200mm pots	
					TOTAL	[illegible]
GROUNDCOVERS						
DcB	Dianella caerulea 'Breeze'	Breeze Flax Lily	E/N	0.7 x 0.7m	140mm pots	
DtT	Dianella tasmanica 'Tasred'	Tasred Flax Lily	E/N	0.4 x 0.4m	140mm pots	
LlT	Lomandra longifolia 'Tanika'	Tanika Mat-rush	E/N	0.6 x 0.8m	140mm pots	
Mpa	Myoporum parvifolium	Creeping Boobialla	E/N	0.2 x 1m	140mm pots	
Pl	Poa labillardieri	Tussock Grass	E/N	0.8 x 0.8m	140mm pots	
Rh	Ruscus hypoglossum	Butcher's Broom	E/Ex	0.5 x 1m	140mm pots	
Vh	Viola hederacea	Native Violet	E/N	0.15 x Spreading	140mm pots	
					TOTAL	[illegible]
CLIMBERS						
Fp	Ficus pumila	Climbing Fig	E/Ex	Climber	140mm pots	
Ph	Parthenocissus henryana	Silver Vein Creeper	D/Ex	Climber	140mm pots	
					TOTAL	[illegible]

D/E = Deciduous/Evergreen N/Ex = Native/Exotic

LEGEND

- Existing Trees to be Retained With TPZ
- Existing Tree To Be Removed
- Proposed New Trees Refer to Plant Schedule
- Proposed New Shrubs Refer to Plant Schedule
- Proposed New Groundcovers Refer to Plant Schedule
- Proposed New Climbers Refer to Plant Schedule
- Proposed New Lawn Area Refer to Specification
- Proposed New Paving To Later Detail
- Proposed Paving Type 2 To Later Detail
- Proposed Paving Type 3 To Later Detail
- Proposed Permeable Paving To Later Detail
- Proposed New Gravel Surface Refer to Specification
- Proposed New Deck To Later Detail
- Proposed New Driveway Surface To Later Detail
- Reinstated/Repaired Naturestrip Refer to Specification

SPECIFICATION NOTES

Soil Preparation

Mulch

Weed Removal

Gravel Path

Planting

Timber Edges

Irrigation

Raised Planter Boxes

Repair/Restoration of damaged Nature-strips

Turf

Plant Establishment Period

JOHN PATRICK
JOHN PATRICK LANDSCAPE ARCHITECTS PTY LTD
www.johnpatrick.com.au

CLIENT
NANXIN INVESTMENT BROWNS ROAD PTY LTD

PROJECT
PROPOSED DEVELOPMENT

29 BROWNS ROAD, CLAYTON

DRAWING
DEVELOPMENT LANDSCAPE PLAN

REVISION		DATE	BY
A	To Council Request	18-11-2015	BB
B	Architecture Changes	15-03-2016	BB
C	Architecture Changes	10-05-2016	BB
D	Architecture Changes	02-06-2016	BB
E	Architecture Changes	23-02-2017	BB

SCALE	1:250 @ A0
DATE	FEB 2017
DRAWN	BB
CHECKED	JP
JOB NO	15-108
DWG NO	TP01-Rev E
CAD FILE	15-108-TP01-Rev E

PLEASE NOTE
The contractor must verify all dimensions on site before commencing any work or preparing any shop drawings.

Do not scale off drawings.

Appendix B: Site Survey Report

mecone

D19-334480

3rd February 2015

Attention: Daniel Podlewski

Mushan Design Studio Pty Ltd
Level 15, 333 Collins Street,
Melbourne, VIC, 3000.

Dear Daniel,

BOUNDARY RE-ESTABLISHMENT, FEATURE & LEVEL SURVEY AND SITE ANALYSIS.
29 BROWNS ROAD, CLAYTON.
OUR REF: 30515

The Re-establishment, Feature and Level Survey and Site Analysis at 29 Browns Road, Clayton is now complete.

Accordingly, please find attached the following documents relating to the survey:

- Re-establishment, Feature and Level Plan Ref.30515100BA.
- Site Analysis Plan Ref.3051500AA.
- Site Photograph Plan Ref.3051500CA.
- Certificate of Title Vol. 8476 Fol. 789.
- Instrument B265305.
- Underground service information (MOCS).

Boundary Re-establishment

The attached Re-establishment, Feature and Level Plan Ref. 3051500BA shows the relationship between existing occupation relative to the Title boundaries. The site is an old primary school and in general the occupation agrees well with the Adopted boundaries.

Along the western boundary (Browns Road frontage) a low chain wire fence has good agreement with Adopted Boundaries. An old peg found at the south western corner and galvanised iron post at the north western corner accord with the Adopted boundary.

A high chain wire fence along the Northern boundary agrees with Adopted Bounadary. At the north east corner adjacent to No.79 Moriah Street a 0.34m gap exists between the chain wire fence and brick wall.

Along the eastern boundary (neighbouring No81 Moriah Street) the brick wall is virtually on Title. At the change in occupation from brick to paling the paling fence is inside the adopted boundary by 0.29m at the northern end and is practically on Title at the Southern end.

The southern boundary of No.83 Moriah Street is occupied by a paling fence that is encroaches into the Adopted Boundary by up to 0.27m. A peg was found at the south western corner of No.83.

The Moriah Street Frontage (eastern boundary) is defined by a spike found on Title in the north east corner and a peg found on Title in the south east corner. The low chain wire fencing give reasonable agreement with Title.

The Paling Fence along the southern boundary (abutting No.87 Moriah Street) encroaches into our Title by 0.38m at the eastern end and 0.33 at the northern end. An old peg was found at the bend in Adopted Boundary.

The southern boundary is defined by chain wire fencing, a high brick wall and a brick factory wall. The chain wire fencing at the eastern end gives reasonable agreement with Title. There is a paling fence well inside Title along the southern boundary. The high brick wall also generally agrees with Title dimensions. The abutting brick factory practically agrees with title while the chain wire fencing at the western end of the southern boundary is outside Title by up to 0.4m.

Bosco Jonson Pty Ltd
ACN 169 138 827
ABN 15 169 138 827

16 Eastern Road
South Melbourne
Vic 3205 Australia

PO Box 5075
South Melbourne

Tel 03) 9699 1400
Fax 03) 9699 5992

Due to the age of the Title, Title dimensions differ from boundary dimensions and Land Registry approval must be sort prior to any detailed Design on the new adopted boundaries.

In general where the occupation is inside the Title boundary, we recommend limiting any future development to the location of the existing occupation. This is under the assumption that the adjoining owners may have accrued possessory rights over that portion of land they occupy. Alternatively where the occupation is outside the Title boundary, any future development should be limited to the Title Boundary. Should you wish to relocate the encroaching fence/structure on to the Title boundary we recommend seeking written agreement with the adjoin owner before doing so.

Encumbrances and Appurtenances

Certificate of Title is encumbered by drainage, sewerage and water supply easements shown as E-1, E-2 and E-3 on Plan Ref. 3051500BA.

Feature and Level Survey

The Boundary Re-establishment Feature and Level Plan Ref. 3051500BA shows levels and contours to Australian Height Datum. The location and levels of the existing building, significant visible features and services in and abutting the site, abutting buildings including eave and ridge heights and window locations within 9 metres of the site boundaries and floor level of the existing buildings are also shown on the Plan for your reference.

The Site Context Plan includes the property boundaries for the surrounding area, and along with the Digital Photo Plan can form the base for a Town Planning submission.

Plans were prepared using AutoCAD. Digital data has been emailed to you.

A copy of Title is also enclosed for your reference.

Please call me if you have any queries regarding the survey.

Yours faithfully,

Ross Nicholson
Senior Licensed Surveyor
Bosco Jonson Pty Ltd
rnicho@bosjon.com.au

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D19-334480


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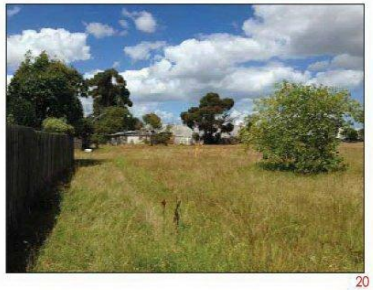
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Site Photographs

29 Browns Road
Clayton

3051500CA.dwg
January 2015
Sheet 1 of 2

Bosco Jonson Pty Ltd
A.B.N 15 169 138 827
P.O. Box 5075, South Melbourne, Vic 3205
16 Eastern Road South Melbourne
Vic 3205 Australia
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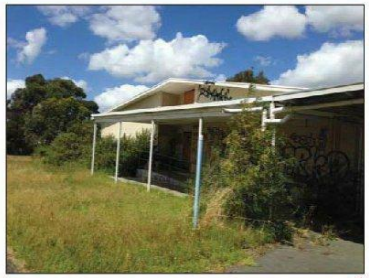
D19-334480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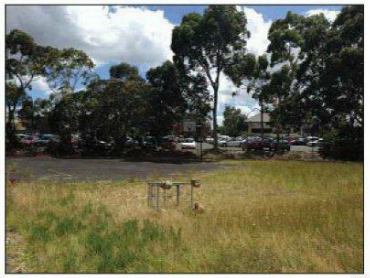
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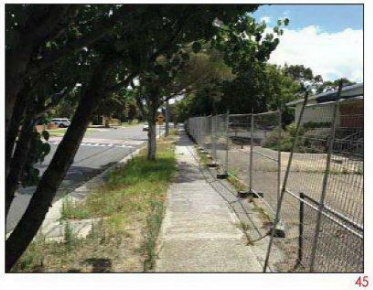
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Site Photographs

29 Browns Road
Clayton

3051500CA.dwg
January 2015
Sheet 2 of 2

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D19-334480

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Appendix C: Traffic Impact Report

mecone

ratio:

Report
Prepared for
Nan Xin Investments Pty Ltd

23 February 2017

Proposed Residential Development

Development Plan Traffic Impact Assessment

29 Browns Road
CLAYTON

traffic:report

r:

ratio:consultants

9 Clifton Street
Richmond VIC 3121
ABN 93 983 380 225

Prepared for: Nan Xin Investments Pty Ltd

Our reference 12555Rep07.docx

Version	Date	Reason for Issue	Prepared By	Checked By
01	31/08/15	Issued for approval	B Chan	R Symons
02	18/09/15	Issued for approval	B Chan	R Symons
03	18/09/15	Issued for approval	B Chan	R Symons
04	18/09/15	Issued for approval	B Chan	R Symons
05	06/06/16	Revised Scheme	B Chan	R Symons
06	20/02/17	Revised Scheme	B Chan	R Symons
07	23/02/17	Updated based on comments received on 23/02/17	B Chan	R Symons

Directory Path	Y:\12501 - 13000\12555 - 29 Browns Road, Clayton (Residential Development)\Reports\12555Rep07.docx

r:

Table of contents:

Appendices:

1 Introduction:

Ratio Consultants has been engaged by Nan Xin Investment Pty Ltd to assess the traffic and parking implications of a Development Plan for a residential development at 29 Browns Road, Clayton.

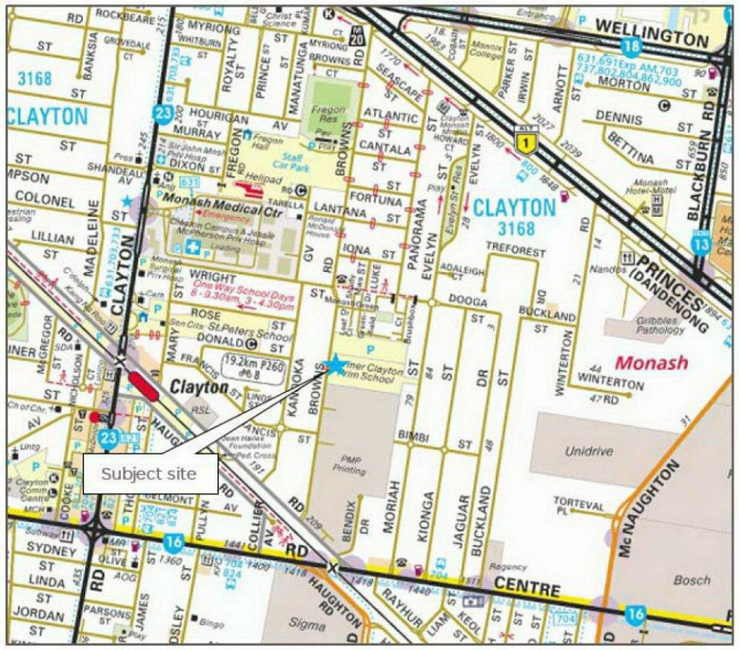
This report has been prepared to address the parking and traffic matters to form part of the Development Plan and will be submitted to the Monash City Council.

The report is based on recent surveys and observations in the vicinity of the site, and of previous studies of similar developments elsewhere in Melbourne.

2.1 Location and Environment

The subject site is located at 29 Browns Road and is located south of Princes Highway, between Browns Road and Moriah Street in Clayton. The site and surrounding road network is shown below in Figure 2.1.

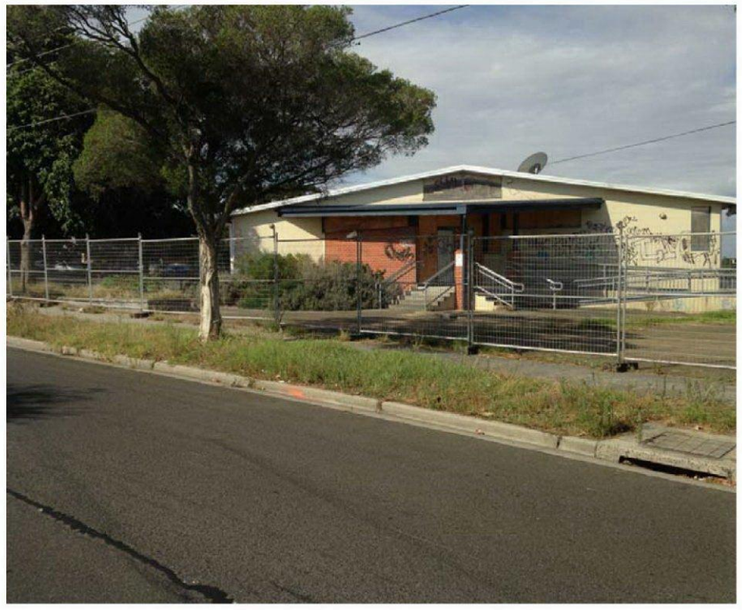
Figure 2.1: Site Location and the surrounding road network



Source: http://www.melway.com.au/

The site is rectangular in shape with a frontage to Browns Road of approximately 90.86 metres, a frontage to Moriah Street of 16.36 metres and an approximate depth of 212.9 metres for an overall site area of approximately 2 hectares. There is currently an unoccupied single storey school (Clayton Primary School) and car park on-site. There is one existing vehicular crossover to/from Browns Road located along the northern boundary and one existing crossover to/from Moriah Street. There is also a pedestrian wombat crossing provided across Browns Road at the frontage of the site.

Photo 2-1: Subject Site



The subject site is located within a General Residential Zone – Schedule 1 (GRZ1), subject to a Development Plan Overlay – Schedule 5 (DPO5). The subject site is surrounded by a General Residential Zone – Schedule 2, to the east and west, and Industry 1 Zone (INZ1) to the north and south. Accordingly, the land use in the immediate vicinity of the site comprises a mixture of residential and industry uses.

Notable non-residential land uses in the vicinity of the site include:

- Secured car parking to the north of the site.
- PMP Limited print and distribution warehouse to the south of the site.
- Various warehouse developments along the east side of Browns Road between the site and Carinish Road.
- Sir John Monash Private Hospital approximately 750 metres north-west of the site.
- Monash Institute of Medical Research located approximately 350 metres north-west of the site.
- Clayton Railway Station approximately 700 metres south-west of the site.
- Clayton Activity Centre approximately 700 metres south-west of the site.
- Monash University located approximately 1.2 kilometres north of the site.
- Springvale Homemaker Centre located approximately 1.4 kilometres east of the site.

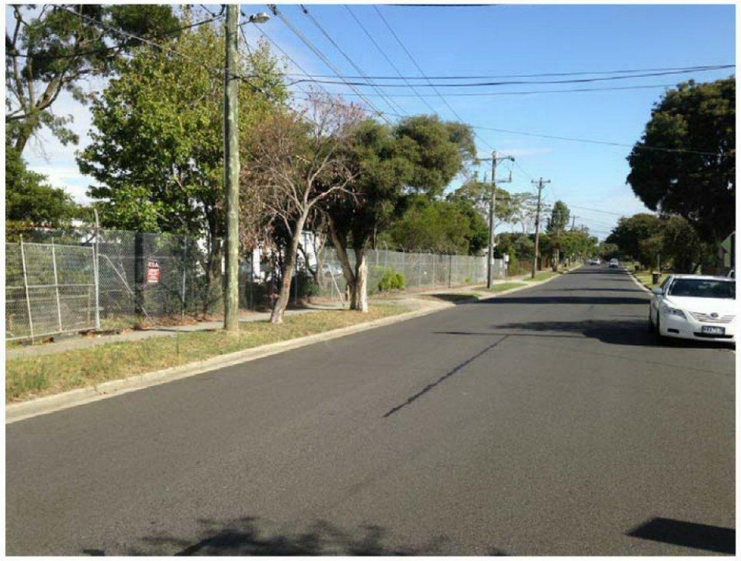
2.2 Road Network

Browns Road is a municipal Local Road that runs in a north-south alignment between Princes Highway (Dandenong Road) and Carinish Road, in Clayton. In the immediate vicinity of the site, Browns Road has an approximate carriageway width of 9.0 metres accommodating one traffic lane in each direction and kerbside parking on both sides of the road.

Footpaths are provided on both sides of the road. Browns Road has a default speed limit of 50km/hr.

Photo 2-2: Browns Road looking north

Photo 2-3: Browns Road looking south



Moriah Street is a Local Road that runs in a north-south alignment between Centre Road and Dooga Street, in Clayton. In the immediate vicinity of the site, Moriah Street has an approximate carriageway width of 7.0 metres accommodating one trafficable lane in each direction and kerbside parking on both sides of the road. Footpaths are provided on both sides of the road. Moriah Street has a posted speed limit of 50km/hr.

Photo 2-4: Moriah Street looking south

2.3 Traffic Conditions

Ratio Consultants Pty Ltd commissioned a 7-day traffic volume and speed count on Browns Road from Tuesday 18 August 2015 to Monday 24 August 2015. The detailed survey results are presented in Figure 2.2 and Table 2.1 of Appendix A.

In summary, the survey results showed:

- A 7-day average of 3,249 vehicles per day, of which 2.8% were classified as Heavy Vehicles. Of this, 1418 vehicles were recorded travelling northbound and 1831 vehicles travelling southbound.
- The morning peak occurred between 8:00am and 9:00am when an average total of 245 vehicles movements were recorded over this section of Browns Road. This consisted of an average of 129 vehicles travelling northbound and an average of 116 vehicles travelling southbound.
- The evening peak occurred between 5:00pm and 6:00pm when an average total of 317 vehicles movements were recorded over this section of Browns Road. This consisted of an average of 95 vehicles travelling northbound and an average of 222 vehicles travelling southbound.
- The 85th percentile speed over the 7 days was 37.9km/h.

2.4 Parking Conditions

Ratio Consultants conducted surveys of parking supply and demand on Thursday 5 March 2015 between 12:00pm to 8:00pm. The extent of the survey area and detailed survey results are presented in Figure 2.3 and Table 2.1, attached in Appendix A.

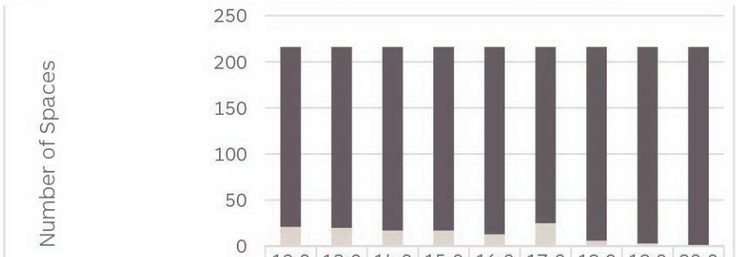
A summary of the results are as follows:

Thursday 5 March 2015

- There were a total of 216 publicly available car parking spaces available during the survey period, subject to a range of parking restrictions.
- The peak period occurred between 12:00pm and 1:00pm, when a total of 21 parking spaces were recorded occupied out of an available supply of 216 spaces, representing a parking occupancy of 10%.
- The demand for parking was low during the survey period, ranging between 0% and 10%.
- On Browns Road immediately in front of the site, there is a supply of 26 parking spaces on the eastern side of the road (Zone I) and 15 spaces on the western side of the road (Zone B), with a mixture of 2P and 1/2P parking restrictions. These were observed to be very minimally used during the survey period.
- On Browns Road to the south of the site, there is a supply of 25 spaces on the eastern side of the road (Zone J) and 10 spaces on the western side of the road (Zone C), with 2P parking restrictions. Similarly, these were observed to be very little used.

Graph 2.1 provides a graphical representation of the Thursday parking demands.

Graph 2.1: Thursday 5 March 2015 Temporal Profile of Parking Demand



	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
PUBLIC VACANCIES	195	196	199	199	203	191	210	213	215
PUBLIC OCCUPANCIES	21	20	17	17	13	25	6	3	1

The survey results indicate that the overall parking demand is low during the survey period, indicating that there is ample parking capacity within close vicinity of the subject site to accommodate any additional visitor parking demand generated by the site.

2.5 Sustainable Transport

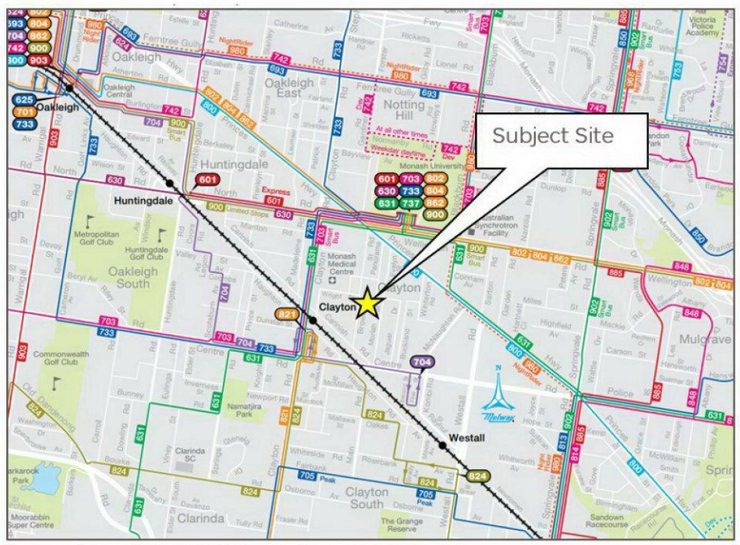
The site has access to the following public transport facilities:

- Clayton Railway Station located 700 metres south-west of the site.
- Bus Route 703 SMARTBUS (Middle Brighton – Blackburn via Bentleigh, Clayton, Monash University) operates along Clayton Road, with the closest stop located 620 metres west of the subject site.
- Bus Route 631 (Southland – Waverley Gardens via Clayton, Monash University) operates along Clayton Road, with the closest stop located 620 metres west of the subject site.
- Bus Route 733 (Oakleigh – Box Hill via Clayton, Monash University, Mt Waverley) operates along Clayton Road, with the closest stop located 620 metres west of the subject site.

- Bus Route 800 (Dandenong – Chadstone via Princes Highway, Oakleigh) operates along Princes Highway, with the closest stop located 950 metres north of the site.

Refer to Figure 2.3 for a graphical representation of the available public transport services in the vicinity of the site.

Figure 2.3: Monash Public Transport Map



Source: Public Transport Victoria http://ptv.vic.gov.au/

2.6 Crash Analysis

A review has been conducted of VicRoads 'Crashstats' data base for the most recent five year period of available data from 1 July 2008 to 30 June 2013 for any reported casualty crashes along Browns Road (between Francis Street and Wright Street inclusive of the intersections), and along Moriah Street (between Dooga Street and Bimbi Street inclusive of the intersections).

The analysis revealed one casualty crash at the intersection of Browns Road and Wright Street, involving a vehicle running off the road into a parked vehicle, resulting in a serious injury. Given the low number of crashes in the area, it is considered that the road network surrounding the subject site is operating in a relatively safe manner.

3 The Development Plan:

The Development Plan envisages 4 four-storey apartment buildings and 74 townhouses, plus associated on-site basement car parking on land at 29 Browns Road, Clayton.

Initial plans indicate:

- 172 apartments across 4x four-story apartment buildings, accessed from Browns Road, comprising:
  - 78 x one-bedroom apartments; and
  - 94 x two-bedroom apartments.
- 72 townhouses accessed from Browns Road, comprising:
  - 34 x two-bedroom townhouses;
  - 20 x three-bedroom + study townhouses[1];
  - 18 x four-bedroom townhouses.
- 2 x three-bedroom + study townhouses accessed from Moriah Street
- A total of 340 car parking spaces is proposed to be provided on-site, comprising:
  - 212 at-grade car parking spaces provided within a basement car park for residents and visitors of the apartments, accessed via a ramp to/from the internal road;
  - 14 visitor spaces provided on ground level within the internal streets; and
  - 114 car parking spaces provided for the 74 townhouses, with each of the two-bedroom townhouses provided with a single garage, and each of the three and four-bedroom townhouses provided with either a double garage or a single garage plus a tandem space.

Access to the site will be via Browns Road. Access to the townhouses within the site will be via a network of internal roads.

Vehicular access to the basement car park for the apartments will be via an access ramp located centrally on the site, accessed from the northern internal street.

In addition to the above, there are 2 three-bedroom + study townhouses proposed at the eastern end of the site, accessed from Moriah Street. Each of these two townhouses will be provided with a double garage (ie. four spaces). No through vehicular access is proposed between Moriah Street and Browns Road.

A network of 1.4 metre wide footpaths throughout the site have been provided to accommodate access to each of the townhouses and the apartment buildings.

Refer to Appendix B for the Development Plans prepared by Mushan Architects.

[1] The dimensions of the studies are not considered to be of sufficient size to allow them to function as a bedroom. Therefore, for the purpose of this assessment, these apartments have been considered as three-bed apartments.

4 Parking Assessment:

4.1 Clause 52.06 Assessment

Parking requirements for a range of uses are set out under Clause 52.06 of the Victoria Planning Provisions. The purpose of the Clause, amongst other things, is:

- To ensure that car parking is provided in accordance with the State Planning Policy Framework and Local Planning Policy Framework.
- To ensure the provision of an appropriate number of car parking spaces having regard to the demand likely to be generated, the activities on the land and the nature of the locality.
- To support sustainable transport alternatives to the motor car.
- To promote the efficient use of car parking spaces through the consolidation of car parking facilities.
- To ensure that car parking does not affect the amenity of the locality.
- To ensure that the design and location of car parking is of a high standard, creates a safe environment for users and enables easy and efficient use.

In accordance with the Car Parking Table to Clause 52.06-5, Table 4.1 below sets out the statutory parking requirements for the initial development plans.

Table 4.1: Clause 52.06 Planning Scheme Assessment

Use	Type	Number	Statutory Parking Rate	Statutory Requirement
Residential (apartments)	One Bedroom	78 x 1-bed apartment	1 space per dwelling	78 spaces
	Two Bedrooms	94 x 2-bed apartments	1 space per dwelling	94 spaces
Residential (townhouses)	Two bedrooms	34 x 2-bed townhouses	1 space per dwelling	34 spaces
	Three Bedrooms	20 x 3-bed townhouses	2 spaces per dwelling	40 spaces
	Four Bedrooms	18 x 4-bed townhouses	2 spaces per dwelling	36 spaces
Residential (townhouses accessed from Moriah Street)	Three Bedrooms	2 x 3-bed townhouses	2 spaces per dwelling	4 spaces
Visitor		244 dwellings total (172 apartments + 72 townhouses – excluding 2 units on Moriah Street)	1 visitor space per 5 dwellings	49 spaces
TOTAL				335 spaces

On the basis of the above, the initial plans would have a statutory requirement to provide 335 spaces (286 resident and 49 visitor spaces). Given that 340 on-site spaces are proposed, including 50 visitor spaces, the development exceeds the requirements of the Planning Scheme.

5.1 Access Arrangements

Access to the development will be to/from Browns Road via a 6.4 metre wide driveway crossing. The location of the access is considered satisfactory and appropriate as it provides good sightlines to both directions of traffic on Browns Road, and at a good distance away from any existing intersections to avoid any potential conflict with turning vehicles.

Internal Streets

The site access road will have a road reserve width of 9.81 metres, between Browns Road and the first intersecting street to provide for landscaping and footpath on the south side of the road.

The proposed internal private street network is configured to provide a main circulating road between the site entry point on the north-western corner of the site and the basement car park entry. This section is anticipated to carry the largest volume of traffic. Lower order access streets extending from the main road are also provided, providing access to the remaining townhouses.

The main access road between the site access and the basement entry has been provided with a minimum kerb to kerb road width of 6.0 metres. The lower order side access streets extending out from the main section has been provided with a kerb to kerb road width of 5.5 metres.

Vehicle priority will be established for the main access road through the use of give way signage and linemarking. Refer to Appendix C for a linemarking plan showing details of the vehicle priorities which will be established for the main circulating road.

Footpaths are proposed to be provided at a width of 1.4 metres.

A one-way road is proposed through the apartment buildings, which is envisaged to be bollarded on both ends and closed to vehicular traffic, and only to be used for emergency vehicles and waste removal vehicles. The road is proposed to be 3.5 metres wide, and has been designed to accommodate the movements of an 8.8 metre long truck.

Provision has been made at the ends of the side streets to allow for a turnaround area for cars. The ends of the side streets will be designed to enable vehicles to perform three-point turn manoeuvres and exit in a forwards direction. 'No Stopping' restrictions will be installed at the dead end sections to ensure vehicles are not parked in the area.

Basement Car Park Access

- The initial plans show a 6.0 metre wide basement car park access ramp to the north of the site, accessed from the internal street and leading down into the basement car park. This provides sufficient width to accommodate two-way traffic and a central intercom island, if required.
- Ramp gradients will be determined during the conceptual design stage, and designed within the gradient transition requirements set out in Clause 52.06-8 of the Planning Scheme.
- It is recommended that an exit sight splay measuring 2.0 metres by 2.5 metres is provided at the top of the basement car park ramp, to provide adequate sight distance to pedestrians on the footpath

5.2 Car Park Layout

The development accommodates a total of 341 parking spaces, comprising of:

— 212 parking spaces within a basement level car park, comprising:
  - 176 resident parking; and
  - 36 visitor parking spaces;
— 114 parking spaces for the townhouses; and
— 14 visitor parking spaces on the ground level, accessed from the internal streets.

Each car space will be designed consistent with the dimensions and standards outlined in Clause 52.06-8 of the Monash Planning Scheme and/or AN/NZS 2890.1:2004.

Basement Parking Spaces

The basement car parking spaces will comply with the dimensional requirements of Clause 52.06 of the Planning Scheme and/or AS/NZS 2890.1:2004, with the following minimum requirements:

— Minimum width of 2.6 metres and a length of 4.9 metres, accessed via a minimum 6.4 metre wide access aisle
— In accordance with Design Standard 2: Diagram 1 of Clause 52.06, a minimum of 300mm clearance will be provided to parking spaces located adjacent to structures or objects that impact upon the parking envelope;
— No columns are currently shown in the basement level, and will be detailed at a later stage. All columns adjacent to parking bays will need to be set back 250mm and extending no further than 1.25m back from the front of the parking space, in compliance with Diagram 1 of Clause 52.06-8 Design Standard 2;
— End bay islands to be provided to protect cars that are parked in the end bays;
— Parking aisles to be extended by 1 metre beyond the last parking spaces at blind aisles to allow for vehicles to turn around at the end and drive out forwards in accordance to Section 2.4.2 of AS/NZS 2890.1:2004.

Townhouse Garage Spaces

Parking for the townhouses are provided within a combination of single garages, double garages and single garages plus a tandem space. More specifically:

— 32 townhouses will be provided with a double garage (including the two townhouses accessed from Moriah Street)
— 34 townhouses will be provided with a single garage
— 8 townhouses will be provided with a single garage with a tandem space

The townhouse parking arrangement will be designed in accordance with Clause 52.06 of the Planning Scheme and/or AS/NZS 2890.1:2004, with the following minimum requirements:

— The single garages to have an internal width of 3.5 metres by 6.0 metres, in accordance to Design Standard 2 of Clause 52.06-8 of the Monash Planning Scheme.
— The double garages to have a minimum internal width of 5.5 metres by 6.0 metres, accessed by a minimum aisle width of 6.4 metres.
— The tandem garages to have a minimum internal length of 11.4 metres and an internal width of 3.5 metres.

Townhouse Visitor Parking Spaces

14 visitor parking spaces have been proposed on the ground level for the townhouses. The townhouse visitor parking spaces will be in a 90 degree format and will be designed in accordance with the dimensional requirements of Clause 52.06 of the Planning Scheme, with the following minimum requirements:

— Minimum width of 2.6 metres and a length of 4.9 metres, accessed via a minimum 6.4 metre wide access aisle, in accordance with AS/NZS 2890.1:2004.

Swept Path Assessment

A swept path assessment (Refer to Appendix D) has been conducted using the "Autodesk Vehicle Tracking' software. The assessment demonstrates that:

— Cars are able to enter and exit the basement car park simultaneously (the B99 vehicle has been used for this assessment).
— Cars are able to adequately turn around at the end of each of the side streets (the B99 vehicle has been used for this assessment)

6 Bicycle Parking:

6.1 Bicycle Parking

The provisions set out under Clause 52.34-3 of the Monash Planning Scheme require that bicycle parking be provided at the following rates, as shown in Table 4.3:

Table 6.1: Bicycle Parking Statutory Requirements

Use	Type	Number of Apartments	Statutory Parking Rate	Statutory Requirement
Residential (apartments)	Resident	172 apartments	1.0 space per five residential apartments	35 spaces
	Visitor	172 apartments	1.0 space per 10 residential apartments	18 spaces
Total				53 spaces

Accordingly, the proposal has a statutory requirement to provide 53 bicycle spaces. It is recommended that a minimum of 53 on-site bicycle spaces are provided for apartment residents and visitors. It is noted that there is ample space to provide the required level of bicycle parking.

Bicycle storage for the townhouses may be within the garage.

7 Waste Management:

7.1 Waste Management

Waste storage areas for the apartments could be provided on the ground level between the two apartment buildings.

For the townhouses, bins may be accommodated within the garages.

Waste collection will be collected kerbside via private contractor within the internal streets. Townhouse residents will transfer bins to bin collection points located at various points around the site, and a building manager/caretaker will be responsible for transferring apartment garbage and recycling bins for collection from the bin storage areas to the kerbside collection points.

Prior to collection, residents within the eastern row of townhouses will shift their bins to western side of the street, adjacent to the apartment block, with waste collection to be undertaken at the intersection. A 1.3 metre wide nature strip has been provided at this location to accommodate the placement of bins in a single line without obstructing the footpath. Waste collection vehicles will utilise the intersection as a turning area, and prop within the street to undertake the waste collection.

It is recommended that a Waste Management Plan be prepared at a later stage by a qualified consultant detailing the waste collection arrangements.

Swept Path Assessment

A swept path assessment (Refer to Appendix D) has been conducted using the “Autodesk Vehicle Tracking’ software. The assessment demonstrates that:

- Waste collection vehicles are able to circulate through the one-way street (8.8m long Medium Rigid Vehicle has been used for this assessment)
- Waste collection vehicles are able to utilise the intersection on the north-eastern corner of the site to turn around and exit in a forward direction (8.8m long Medium Rigid Vehicle has been used for this assessment).

8.1 Traffic Generation

Residential apartments of the type and location proposed generate approximately four vehicle trips per day for one and two bedroom dwellings with one car space, and up to eight trips a day for three or four bedroom dwellings with two car spaces. Therefore, the 172 apartments and 72 townhouses that will be accessed via Browns Road (consisting of 38 three or four-bedroom dwellings and 206 one and two bedroom dwellings) would be expected to generate in the order of 1,128 vehicle trips per day. Generally, 10 percent of the trips, which equates to about 112 peak hour trips, will occur in each of the morning and evening peak hours.

The majority of the traffic generated by the residential development during the morning peak period will be residents departing the site (80 percent out and 20 percent in) and the majority of the traffic during the evening peak period will be residents returning to the site (30 percent out and 70 percent in).

Accordingly the expected trip generation for a typical weekday AM and PM peak hours is estimated as shown in Table 8.1

Table 8.1: Traffic Generation for the Development

	AM Peak	PM Peak
Arriving trips:	19	81
Departing trips:	93	31
Total trips:	112	112

8.2 SIDRA Analysis

The Australian Research Board (ARRB) developed a computer program called SIDRA, as an aid in the design and analysis of both signalised and unsignalised intersections. The relevant major performance measures calculated by SIDRA are the 95th percentile queue length, the average delay, and the Level of Service (LOS).

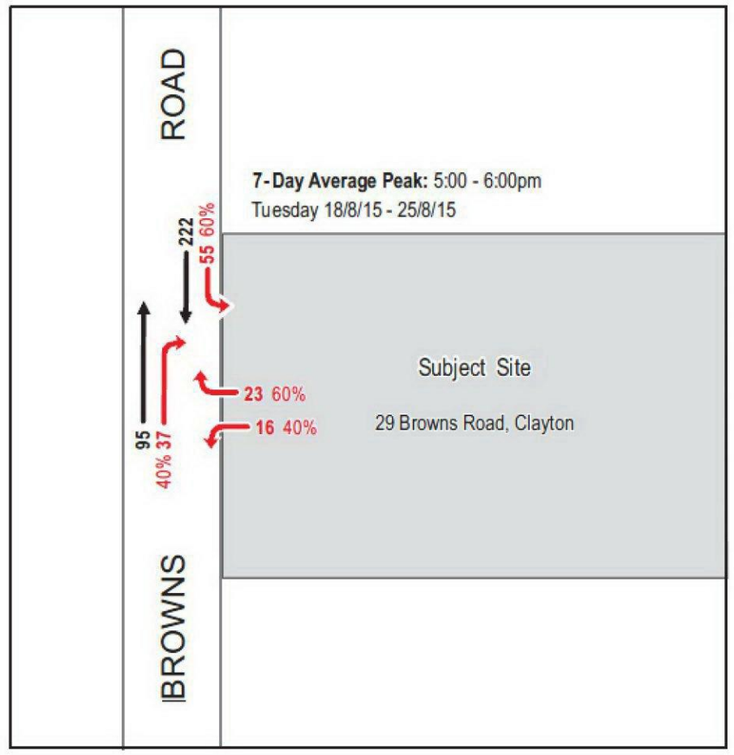
The location of the site access for the proposed development is on Browns Road, midblock between Francis Street and Monash Green Drive.

Traffic volume data was obtained as described previously in Section 2.3 of this report, and a SIDRA analysis was undertaken, including both the existing AM and PM peak periods.

A model with the current road geometry and the existing peak hour volumes along Browns Road was conducted for the afternoon / evening critical period, based on the 7-day average volumes obtained from the tube counts. A 5% heavy vehicle percentage was applied to both the eastbound and westbound traffic volumes. A further model of the proposed intersection was then conducted, incorporating the estimated additional volumes.

For the purposes of the study, the distribution of traffic is assumed to be 60% arrival/departure from the north, and 40% arrival/departure from the south. Using the traffic generation estimates outlined in Table 5.1 above, the expected generated traffic volumes are shown graphically in Figure 8.1 below:

Figure 8.1: Post-Development Traffic Generation



The results of the SIDRA analysis for the proposed conditions are summarised in Table 8.2 below, and the full set of results have been included for reference in Appendix E.

Table 8.2: SIDRA Analysis – Browns Road Future Conditions

Approach	Movement	PM Peak Hour (5:00pm-6:00pm)		
		Average Delay (sec)	Level of Service	95% Back of Queue (metres)
Browns Road (South Approach)	Through	0.5	A	1.9
	Right	5.6	A	1.9
Site	Left	2.7	A	0.9
	Right	3.8	A	0.9
Browns Road (North Approach)	Through	0	A	0
	Left	4.6	A	0

The results indicate that in the critical PM peak hour (5:00pm-6:00pm),

the traffic generated by the site would have a very minor impact on the existing operation of Browns Road. The through traffic would be largely unaffected by the additional 114 vehicles during the PM peak hour, and there would be a negligible queue in both directions of Browns Road as well as within the site.

8.3 Traffic Distribution and Impact

The majority of the additional traffic generated by the proposed development will flow onto Browns Road and the surrounding road network, with a low level of traffic generated onto Moriah Street. It is considered that the traffic generated by the proposed development (in the order of 114 vehicle movements in the morning and afternoon peak hours) can be managed in a safe and effective manner without creating adverse safety or capacity impacts to the wider road network.

9 Conclusion:

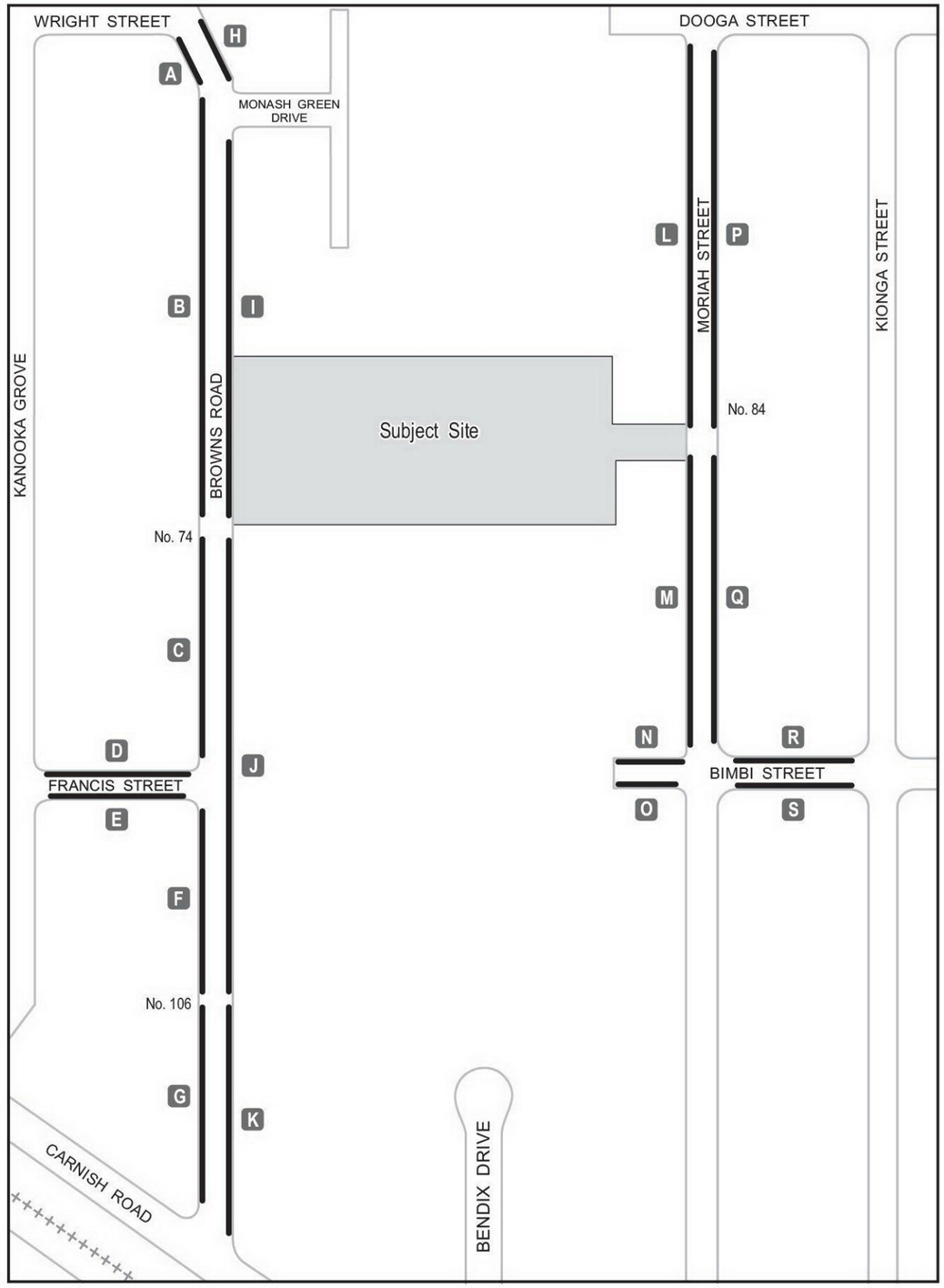
The initial development plans for residential development at 29 Browns Road, Clayton, comprises 172 apartments within 4x four-storey buildings, 34 two-bedroom townhouses, 22 three-bedroom townhouses and 18 four-bedroom townhouses. The proposed development would also include the provision of 340 on-site car parking spaces.

Based on the above considerations, it is considered that:

- The proposed on-site parking provision fully meets the requirements of Clause 52.06 of the Monash Planning Scheme and is expected to accommodate the resident and visitor parking demand. Parking surveys indicate that there is ample parking along Browns Road in the immediate vicinity of the site to accommodate for additional visitor parking if and when required.
- The proposed car park and access arrangements are suitably designed and will be designed in accordance with the requirements of the Monash Planning Scheme and/or AS/NZS2890.1:2004.
- Up to 112 vehicular trips will be generated during the morning and afternoon peak hours by the proposed development. Traffic generated by the proposed development will be dispersed onto the surrounding road network, which has the capacity to accommodate the additional traffic volumes in a safe and satisfactory manner.
- Bicycle parking is currently not shown in the plans. However, it is noted that there is ample space to provide for the required number of bicycle parking under Clause 52.34 of the Monash Planning Scheme.
- Waste collection will be undertaken within the site on ground level, with waste collected kerbside at certain locations throughout the site. A Waste Management Plan is recommended to be prepared.

Overall, the proposed development is not expected to create adverse traffic or parking impacts in the precinct. Accordingly, it would be appropriate to approve a Development Plan incorporating a proposal of the indicated type and scale.

Appendix A **Survey Results**



Project : 12555 March 2015

FIGURE 2.3
PARKING SURVEY AREAS

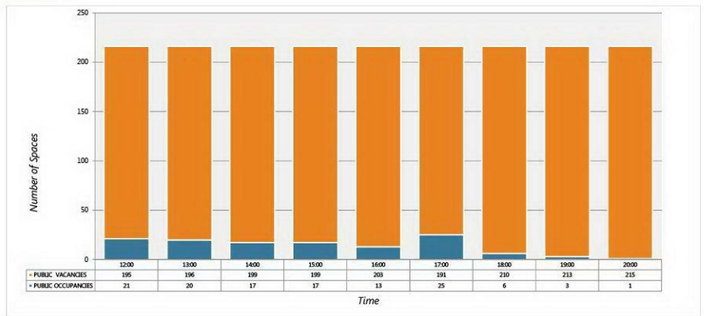
Browns Road Clayton

Parking Occupancy Survey

Location 29 Browns Road, Clayton
Date Thursday, 5 March 2015
Weather Mild And Overcast

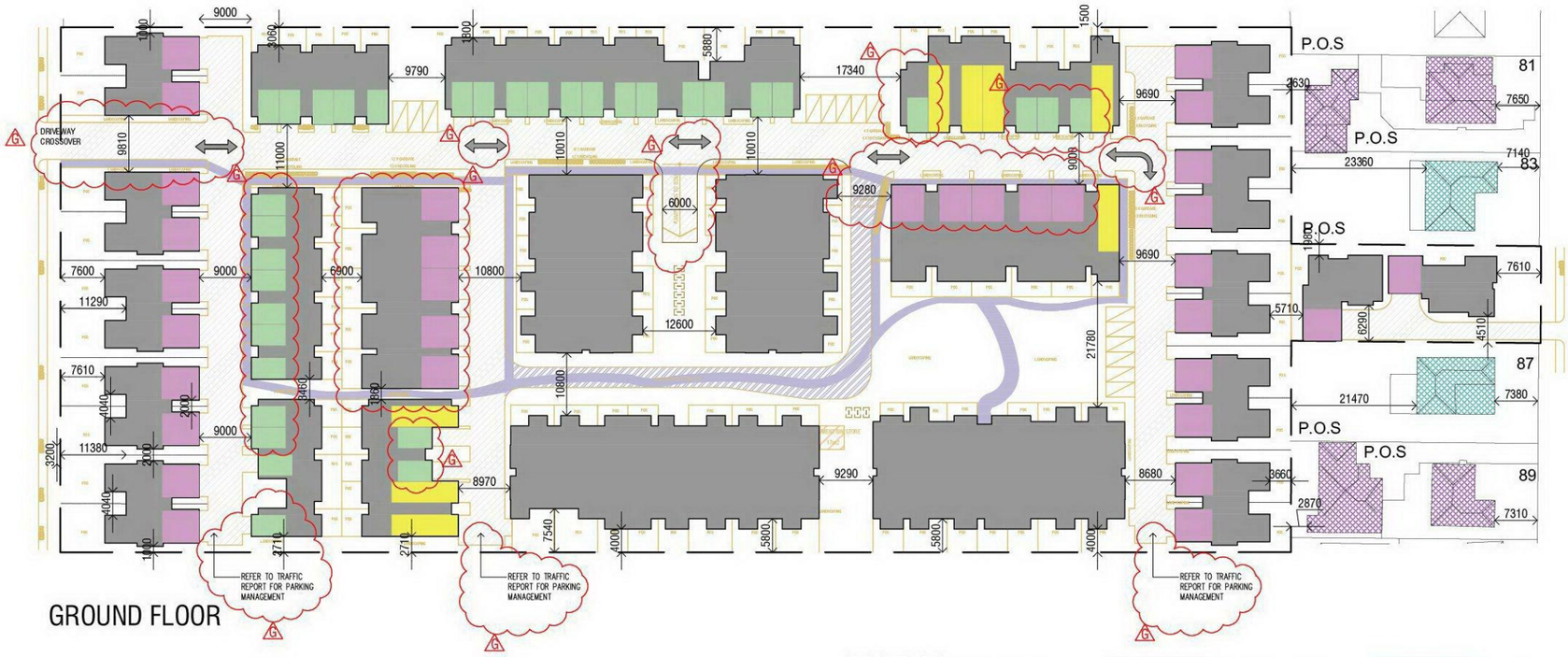
Public Parking (1/0)	Ratio Map Ref	Street	Section	Side	Restriction	Capacity	Parking Occupancy								
							12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
0	A	Browns Rd	From Monash Green Drive To Wright St	W	No Standing	0	0	0	0	0	0	0	0	0	0
1	B		From No.74 To Monash Green Drive	W	2P 7:30a-5:30p Mon-Fri	1	0	0	0	0	0	0	0	0	0
1					1/2P 8a-6p Mon-Fri	14	1	0	0	0	0	1	0	0	0
1	C		From Francis St To No.74	W	2P 7:30a-5:30p Mon-Fri	10	0	0	0	0	0	1	0	0	0
1	D	Francis St	From Browns Rd To Kanooka Grove	N	1/2P 8a-6p Mon-Fri	7	0	0	0	0	0	0	0	0	0
1	E		From Browns Rd To Kanooka Grove	S	1/2P 8a-6p Mon-Fri	8	0	0	0	0	0	0	0	0	0
1	F	Browns Rd	From No.106 To Francis St	W	2P 7:30a-5:30p Mon-Fri	10	0	0	0	0	1	1	0	0	0
1	G		From Carnish Rd To No.106	W	2P 7:30a-5:30p Mon-Fri	12	0	1	0	0	0	1	0	0	0
0	H		From Monash Green Drive To Wright St	E	No Standing	0	0	0	0	0	0	0	0	0	0
1	I		From No.74 To Monash Green Drive	E	2P 7:30a-5:30p Mon-Fri	4	0	0	0	0	0	0	0	0	0
1					1/2P 8a-6p Mon-Fri	22	0	0	0	0	1	1	0	0	0
1	J		From No.106 To Francis St	E	2P 7:30a-5:30p Mon-Fri	11	3	2	2	2	1	1	0	0	0
1			From Francis St To No.74	E	2P 7:30a-5:30p Mon-Fri	14	0	0	0	0	0	1	0	0	0
1	K		From Carnish Rd To No.106	E	2P 7:30a-5:30p Mon-Fri	14	1	0	0	1	0	0	0	0	0
1	L	Moriah Street	From No.84 To Dooga St	W	Unrestricted	2	2	2	2	2	1	1	0	0	0
1					1P 8a-6p Mon-Fri	17	4	4	3	3	2	4	3	2	1
1	M		From Bimbi St To No.84	W	Unrestricted	15	2	2	2	2	2	3	1	0	0
1	N	Bimbi St	From Moriah Street To End (W)	N	Unrestricted	3	0	0	0	0	0	1	0	0	0
1	O		From Moriah Street To End (W)	S	Unrestricted	4	2	2	2	1	1	1	0	0	0
1	P	Moriah Street	From No.84 To Dooga St	E	Unrestricted	2	1	1	1	1	1	1	0	0	0
1					1P 8a-6p Mon-Fri	18	1	2	2	2	1	3	0	0	0
1	Q		From Bimbi St To No.84	E	Unrestricted	15	3	3	2	2	2	3	2	1	0
1	R	Bimbi St	From Moriah Street To Kionga St	N	Unrestricted	6	0	0	0	0	0	1	0	0	0
1	S		From Moriah Street To Kionga St	S	Unrestricted	7	1	1	1	1	0	0	0	0	0
	PUBLIC CAPACITY						216	216	216	216	216	216	216	216	216
	PUBLIC OCCUPANCIES						21	20	17	17	13	25	6	3	1
	PUBLIC VACANCIES						195	196	199	199	203	191	210	213	215
	PUBLIC % OCCUPANCIES						10%	9%	8%	8%	6%	12%	3%	1%	0%

not available for public parking



Appendix B **Development Plans**

D19-334480



GROUND FLOOR

TANDEM GARAGES
SINGLE GARAGES
DOUBLE GARAGES

NOTE
ALL ROADS TO BE PRIVATE INTERAL ROADS

SITE BOUNDARY
DRIVE WAY
FOOTPATH MIN 1.4m WIDE
WASTE COLLECTION / EMERGENCY ONLY
2-STOREY NEIGHBOR
1-STOREY NEIGHBOR
GROUND LEVEL
2 STOREY
3 STOREY
4 STOREY
REFER TO TRAFFIC REPORT FOR DETAIL OF VEHICLE PRIORITY ESTABLISHMENT

FINAL

MUSHAN DESIGN STUDIO PTY LTD
LEVEL 15, 333 COLLINS STREET
MELBOURNE VIC 3000
ABN: 44 162 772 714

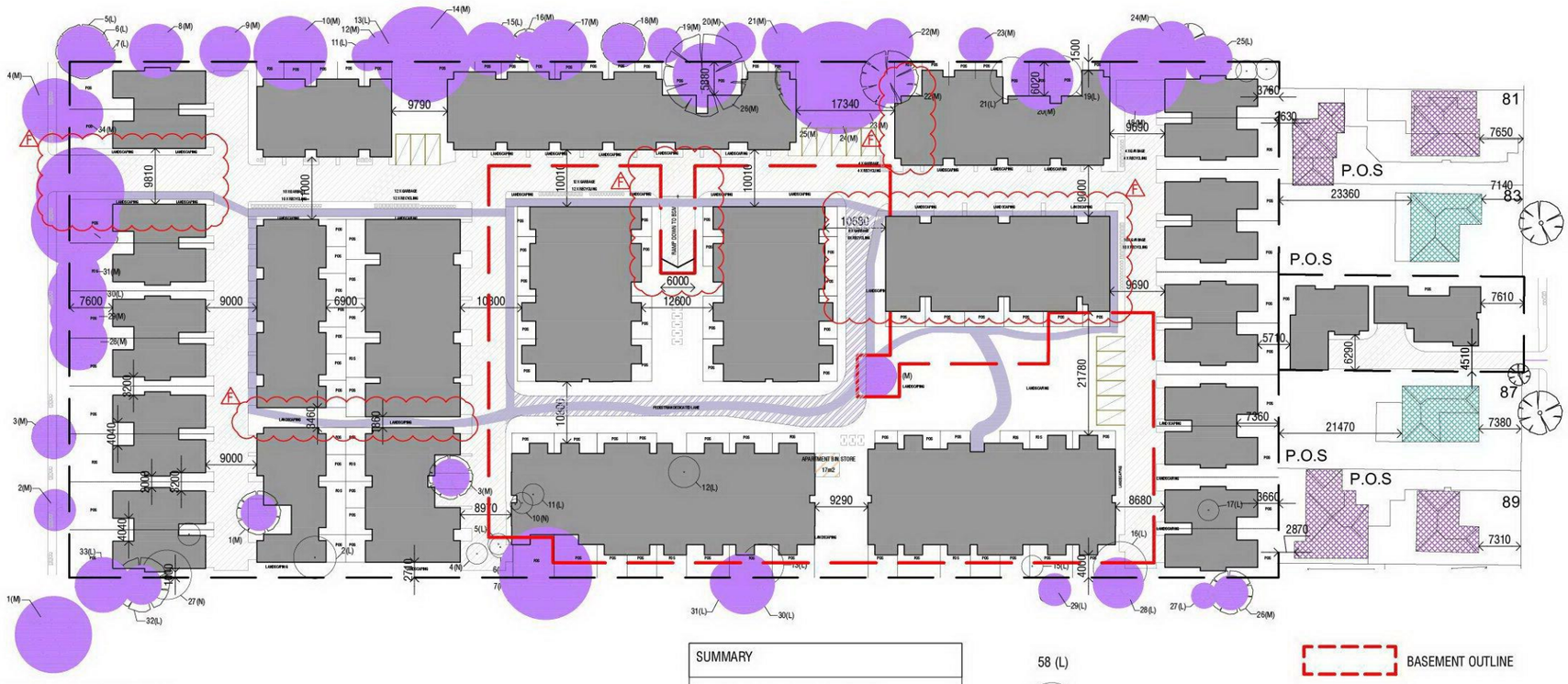
PH: 03 8611 7605
EMAIL: INFO@MUSHAN.COM.AU

NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
PROPOSED BUILT FORM AND CIRCULATION

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	G DP08



GROUND FLOOR

SUMMARY	
TOTAL EXIST STREET TREES 04	
TREES TO BE REMOVED	04
TOTAL EXIST SITE TREES 66	
TREES TO BE REMOVED	18
TREES TO BE RETAINED	34
HIGH RETENTION TOTAL	00
HIGH RETENTION TO BE REMOVED	00
MODERATE RETENTION TOTAL	16
MODERATE RETENTION TO BE REMOVED	00
LOW RETENTION TOTAL	08
LOW RETENTION TO BE REMOVED	08

58 (L)
TREES TO BE REMOVED
TREE PROTECTION ZONE
TREES TO BE RETAINED

BASEMENT OUTLINE
SITE BOUNDARY
CIRCULATION
WASTE / EMERGENCY VEHICLES ONLY
FOOTPATH MIN 1.4m WIDE
GROUND LEVEL MASS

FINAL

MUSHAN DESIGN STUDIO PTY LTD
LEVEL 15, 333 COLLINS STREET
MELBOURNE VIC 3000
ABN: 44 162 772 714

PH: 03 8611 7605
EMAIL: INFO@MUSHAN.COM.AU

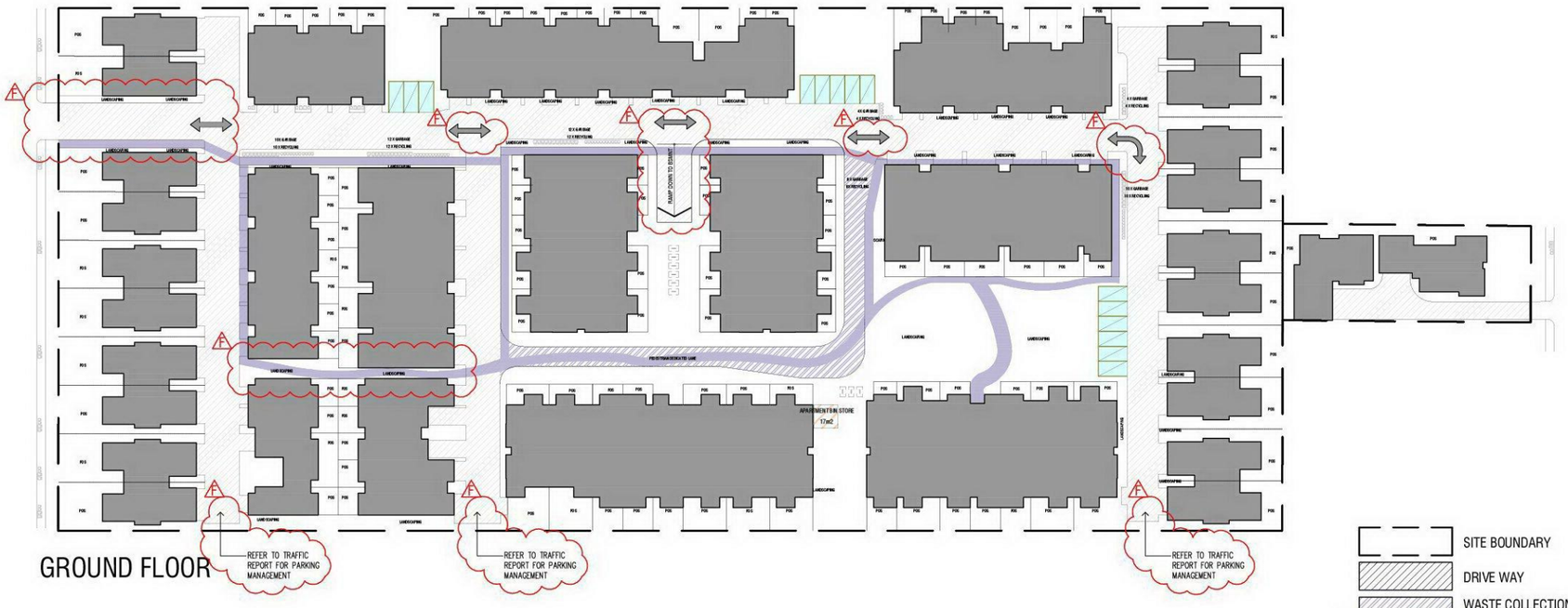
NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
TREE RETENSION DIAGRAM

DATE	FEBRUARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	F DP08A

D19-334480



GROUND FLOOR

SITE BOUNDARY
DRIVE WAY
WASTE COLLECTION / EMERGENCY ONLY
FOOTPATH MIN 1.4m WIDE
GF BUILDING FORM
VISITOR PARKING

REFER TO TRAFFIC REPORT FOR DETAIL OF VEHICLE PRIORITY ESTABLISHMENT

FINAL

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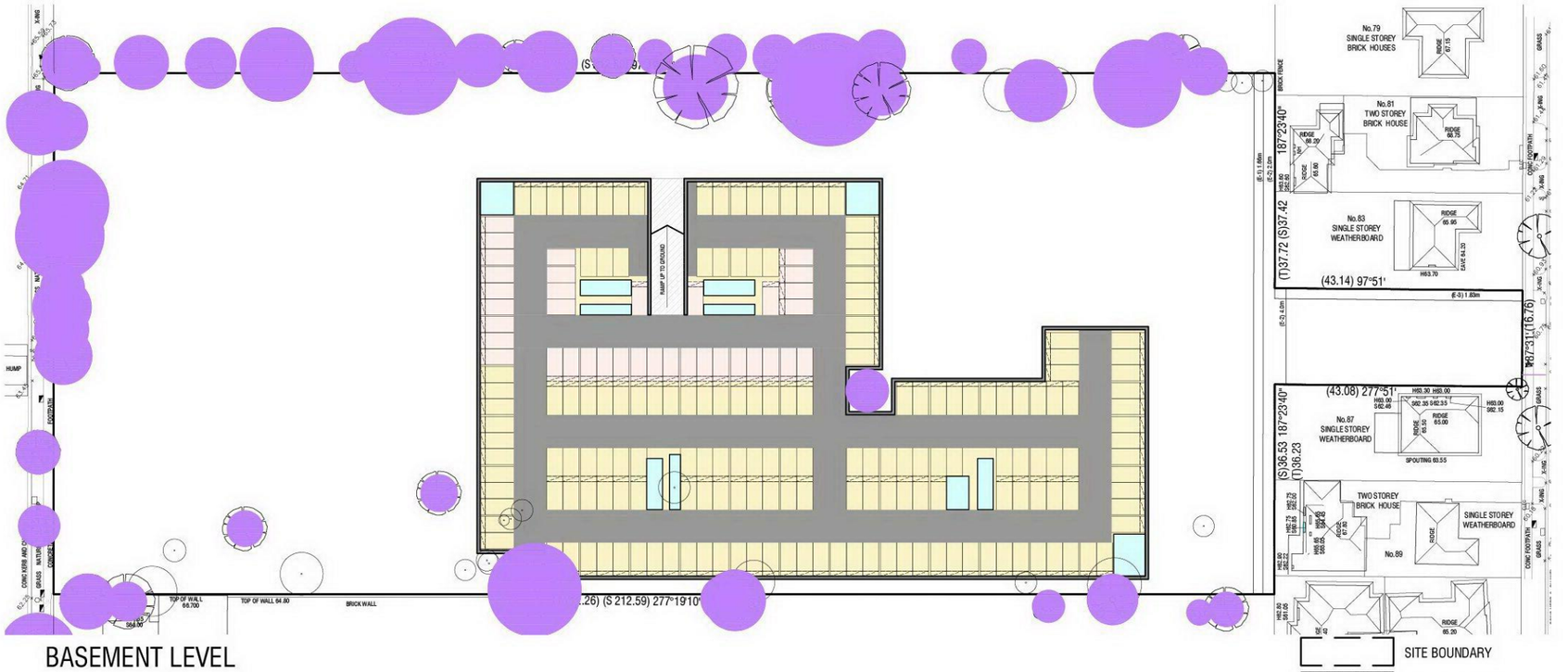
EMAIL: INFO@MUSHAN.COM.AU

NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
VEHICLE CIRCULATION & PARKING (GL)

DATE	FEBURARY 2017
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	F DP12



BASEMENT LEVEL

SITE BOUNDARY
VEHICLE ACCESS
BASEMENT DRIVE WAY
PLANT/BINS/SERVICE CORE
RESIDENT PARKING
VISITOR PARKING

FINAL

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LEVEL 15, 333 COLLINS STREET
MELBOURNE VIC 3000
ABN: 44 162 772 714

PH: 03 8611 7605
EMAIL: INFO@MUSHAN.COM.AU

NORTH

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
VEHICLE CIRCULATION & PARKING (BL)

DATE	APRIL 2016
SCALE	1:700 @ A3
PROJECT NO.	M023
DRAWING NO.	B DP13

Appendix C **Signs and Linemarking Plan**

SIGN SCHEDULE

#1 GIVE WAY R1–2

INSTALL GIVEWAY SIGNAGE AND LINEMARKING TO ESTABLISH PRIORITY TO MAIN CIRCULATION ROAD

PRELIMINARY PLAN
FOR DISCUSSION PURPOSES ONLY
SUBJECT TO CHANGE WITHOUT NOTIFICATION
DATE OF ISSUE: .....

ISSUE	APP'D	DATE	AMENDMENT
A			

GENERAL NOTES
1. BASE INFORMATION OBTAINED FROM MUSHAN ARCHITECTS ON 17/02/17
2. DIMENSIONS IN MILLIMETRES
3. PRELIMINARY PLAN FOR DISCUSSION ONLY

DESIGNED	B CHAN
CHECKED	R SYMONS
AUTHORISED	R SYMONS
SCALE	0 5 10

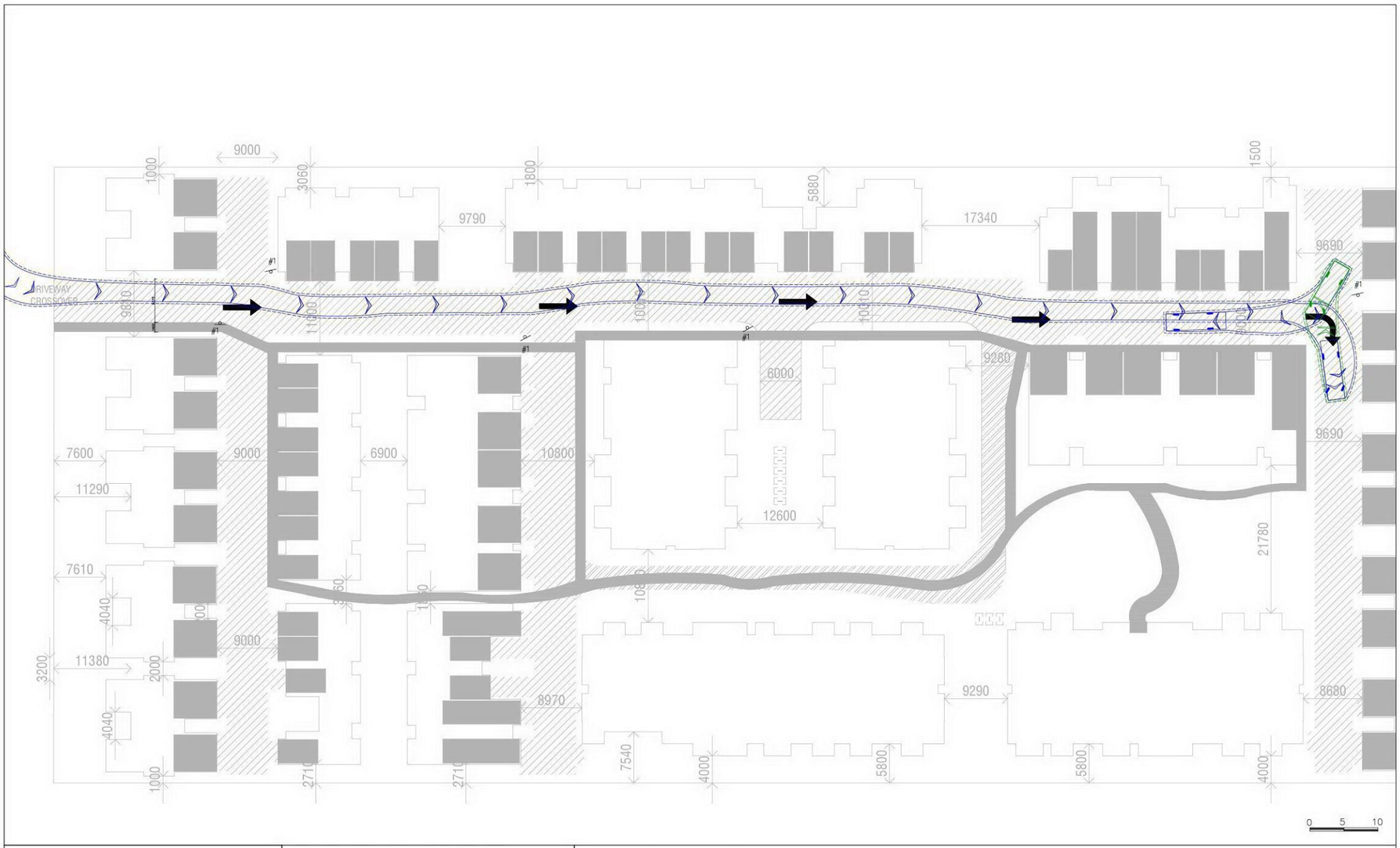
ratio:
RATIO CONSULTANTS PTY LTD
ACN 005 422 104
8 CLIFTON STREET
RICHMOND VICTORIA 3121
TELEPHONE (03) 9429 3111
FACSIMILE (03) 9429 3011

PROPOSED RESIDENTIAL DEVELOPMENT
CITY OF MONASH
29 BROWNS ROAD, CLAYTON
SIGNS AND LINEMARKING PLAN

DATE	SHEET NO.	DRAWING NO.	ISSUE
18/02/2017	1 OF 1	12555–1	A

CAD FILE: J:\12501 - 12600\12555 - 29 browns road, clayton - (residential development)_layout\paths\2017.02.18\12555-sk06.dwg

Appendix D **Swept Path Assessment**



ratio:

RATIO CONSULTANTS PTY LTD
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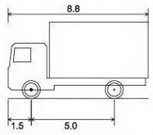
TELEPHONE (03) 9429 3111
FACSIMILE (03) 9429 3011

MRV - Medium Rigid Vehicle (AS/NZS2890.2:2002)



VEHICLE ENVELOPE (FORWARD)
500mm CLEARANCE (FORWARD)
VEHICLE ENVELOPE (REVERSE)
500mm CLEARANCE (REVERSE)

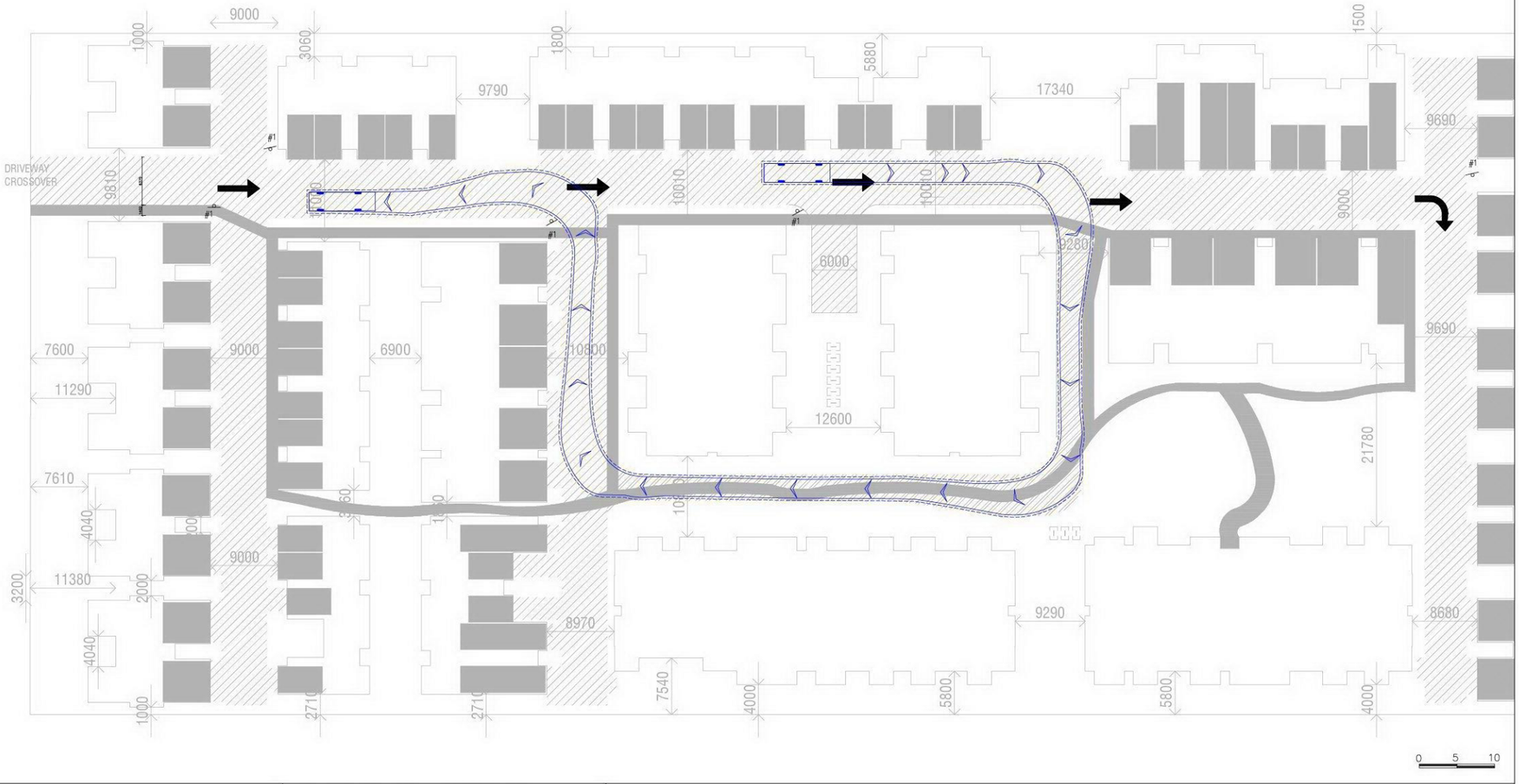
Overall Length	8.800m
Overall Width	2.500m
Track Width	2.500m
Lock to Lock Time	4.00 sec
Curb to Curb Turning Radius	10.000m

Proposed Residential Development
29 Browns Road, Clayton
Swept Path Assessment

NOTE:
1) Base Plan Supplied by Mushan Architects on 17/02/17
2) Maximum Design Speed 10km/h

RATIO REFERENCE	SHEET No.	SCALE	DATE
12555-AT06/BC	A3 AT(1)	1:500@A3	18/02/2017

D19-334480

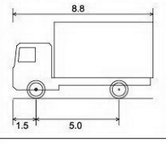


0 5 10

ratio:

RATIO CONSULTANTS PTY LTD
ABN 005 422 104
9 CLIFTON STREET
RICHMOND, VICTORIA 3121
TELEPHONE (03) 9429 3111
FACSIMILE (03) 9429 3011

MRV - Medium Rigid Vehicle (AS/NZS2890.2:2002)

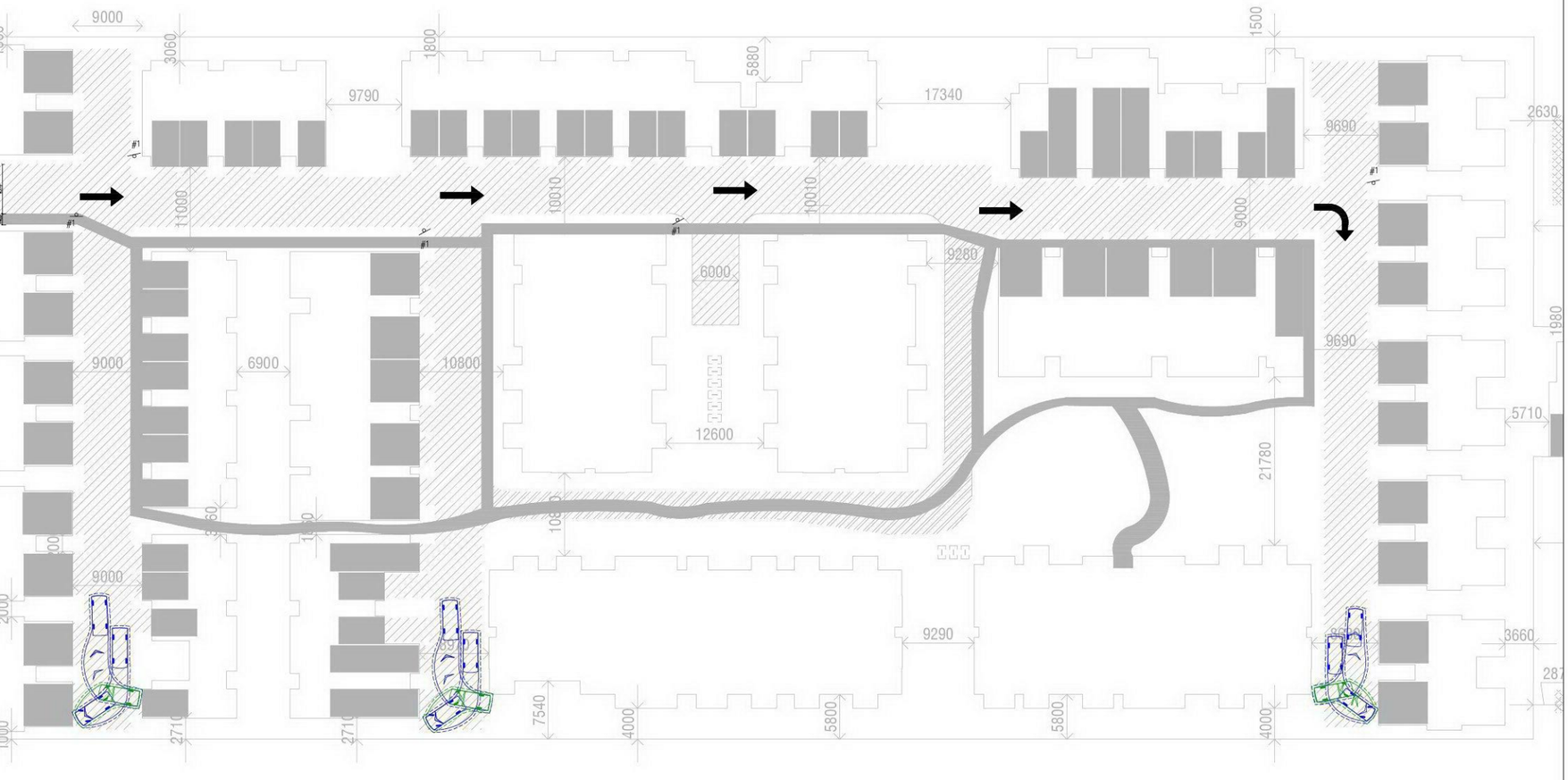


VEHICLE ENVELOPE (FORWARD)	
500mm CLEARANCE (FORWARD)	
VEHICLE ENVELOPE (REVERSE)	
500mm CLEARANCE (REVERSE)	
Overall Length	8.800m
Overall Width	2.500m
Track Width	2.500m
Lock to Lock Time	4.00 sec
Curb to Curb Turning Radius	10.000m

Proposed Residential Development
29 Browns Road, Clayton
Swept Path Assessment

NOTE:
1) Base Plan Supplied by Mushan Architects on 17/02/17
2) Maximum Design Speed 10km/h

RATIO REFERENCE	SHEET No.	SCALE	DATE
12555-AT06/BC	A3 AT(2)	1:500@A3	18/02/2017



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ratio:

RATIO CONSULTANTS PTY LTD
ABN 005 422 104
9 CLIFTON STREET
RICHMOND, VICTORIA 3121
TELEPHONE (03) 9429 3111
FACSIMILE (03) 9429 3011

B99 Vehicle (AS/NZS2890.1:2004)

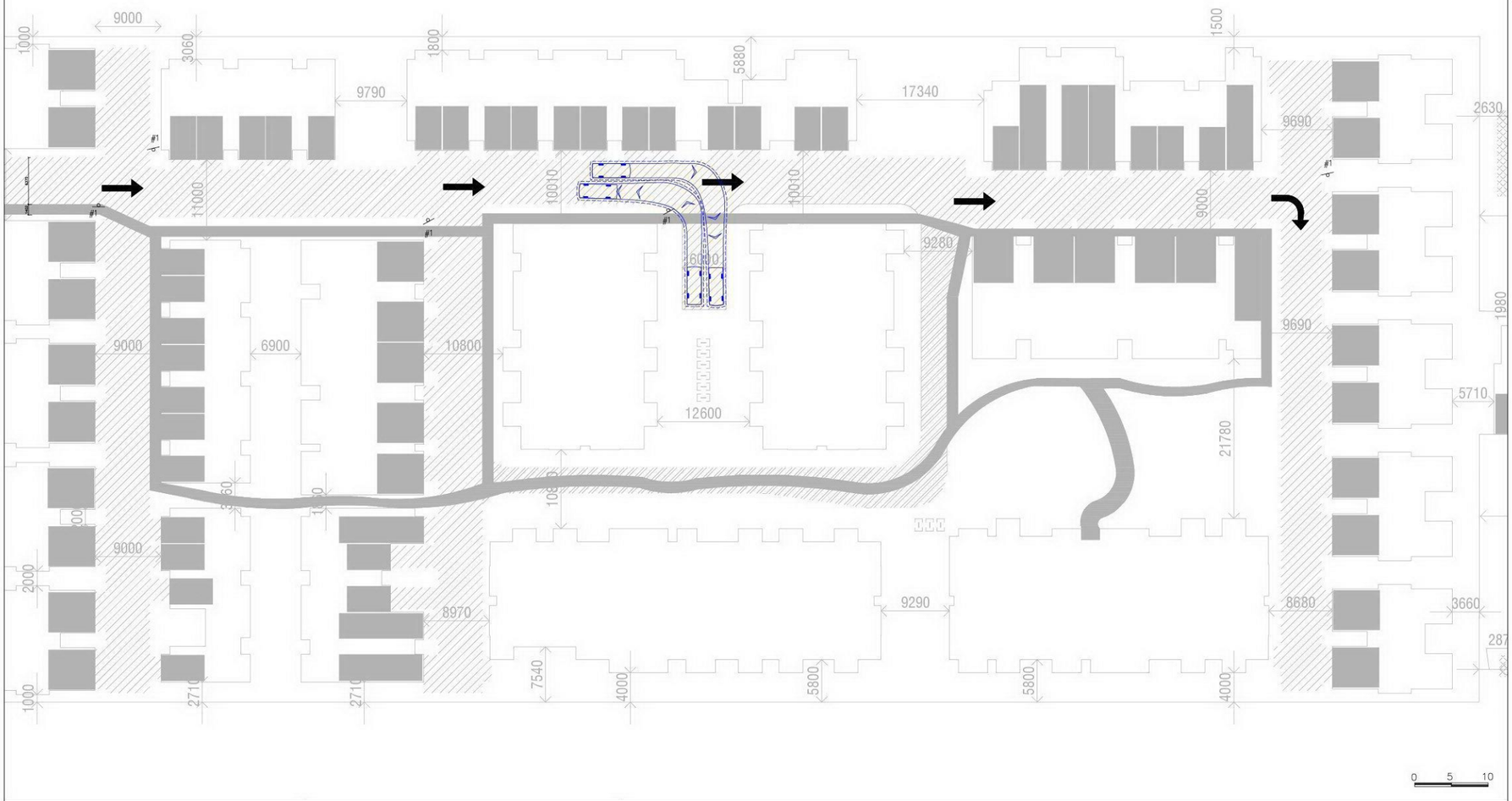
VEHICLE ENVELOPE (FORWARD)	
300mm CLEARANCE (FORWARD)	
VEHICLE ENVELOPE (REVERSE)	
300mm CLEARANCE (REVERSE)	
Overall Length	5.200m
Overall Width	1.940m
Overall Body Height	2.200m
Min Body Ground Clearance	0.312m
Track Width	1.840m
Lock to Lock Time	4.00 sec
Curb to Curb Turning Radius	6.30m

Proposed Residential Development
29 Browns Road, Clayton
Swept Path Assessment

NOTE:
1) Base Plan Supplied by Mushan Architects on 17/02/17
2) Maximum Design Speed 10km/h

RATIO REFERENCE	SHEET No.	SCALE	DATE
12555-AT06/BC	A3 AT(3)	1:500@A3	18/02/2017

D19-334480



ratio:

RATIO CONSULTANTS PTY LTD
ABN 005 422 104
9 CLIFTON STREET
RICHMOND, VICTORIA 3121
TELEPHONE (03) 9429 3111
FACSIMILE (03) 9429 3011

B99 Vehicle (AS/NZS2890.1:2004)

Overall Length	5.200m
Overall Width	1.940m
Overall Body Height	2.200m
Min Body Ground Clearance	0.312m
Track Width	1.840m
Lock to Lock Time	4.00 sec
Curb to Curb Turning Radius	6.30m

Proposed Residential Development
29 Browns Road, Clayton
Swept Path Assessment

NOTE:
1) Base Plan Supplied by Mushan Architects on 17/02/17
2) Maximum Design Speed 10km/h

RATIO REFERENCE	SHEET No.	SCALE	DATE
12555-AT06/BC	A3 AT(4)	1:500@A3	18/02/2017

MOVEMENT SUMMARY

Site: Browns Road Site Access

New Site
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Browns Road South Approach											
2	T1	100	0.0	0.077	0.5	LOS A	0.3	1.9	0.24	0.16	48.5
3	R2	39	0.0	0.077	5.6	LOS A	0.3	1.9	0.24	0.16	47.7
Approach		139	0.0	0.077	1.9	NA	0.3	1.9	0.24	0.16	48.3
East: Site Access											
4	L2	24	0.0	0.037	2.7	LOS A	0.1	0.9	0.33	0.43	29.6
6	R2	17	0.0	0.037	3.8	LOS A	0.1	0.9	0.33	0.43	29.4
Approach		41	0.0	0.037	3.1	LOS A	0.1	0.9	0.33	0.43	29.5
North: Browns Road North Approach											
7	L2	58	0.0	0.142	4.6	LOS A	0.0	0.0	0.00	0.11	48.9
8	T1	234	0.0	0.142	0.0	LOS A	0.0	0.0	0.00	0.11	49.4
Approach		292	0.0	0.142	0.9	NA	0.0	0.0	0.00	0.11	49.3
All Vehicles		472	0.0	0.142	1.4	NA	0.3	1.9	0.10	0.15	46.3

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Organisation: RATIO CONSULTANTS PTY LTD | Processed: Friday, 28 August 2015 1:49:47 PM
Project: Y:\12501 - 13000\12555 - 29 Browns Road, Clayton (Residential Development)\SIDRA\12555.sip6

Appendix D: Environmentally Sustainable Design Report

mecone

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Environmentally Sustainable *Development* *V2*

ESD Principles and Initiatives for Sustainable Futures

29 BROWNS ROAD, CLAYTON

October 2015

Key Sustainable Building Contents

Introduction

The Australian Government is dedicated to the development of our sustainable future, and thus has set Ecologically Sustainable Development targets for residential / commercial buildings. These targets not only encourage reduced environmental impact during construction, but equally promote sustainable use for the entire life cycle of the development. To facilitate this goal, the commitment of the client is paramount.

The impact of buildings within the environment is very complex. The life cycle of the building from design phase through to use and eventual refurbishment/demolition can produce a variety of impacts. At the initial phase, we must be very mindful of planning for sustainability. Materials, land ecology and waste management are vital to protecting the environment. The design stage must also examine passive design principles and plan for optimum occupant comfort and use. Finally, consideration must be given future refurbishment / demolition to ensure the opportunities for recycling / reuse are maximised.

Life Cycle of a Building

The design stage is when most of these impacts are determined, therefore is the greatest opportunity to reduce the environmental impact of the project. This is achieved by creating strategies to meet and exceed targets set by the Government (described in this ESD report).

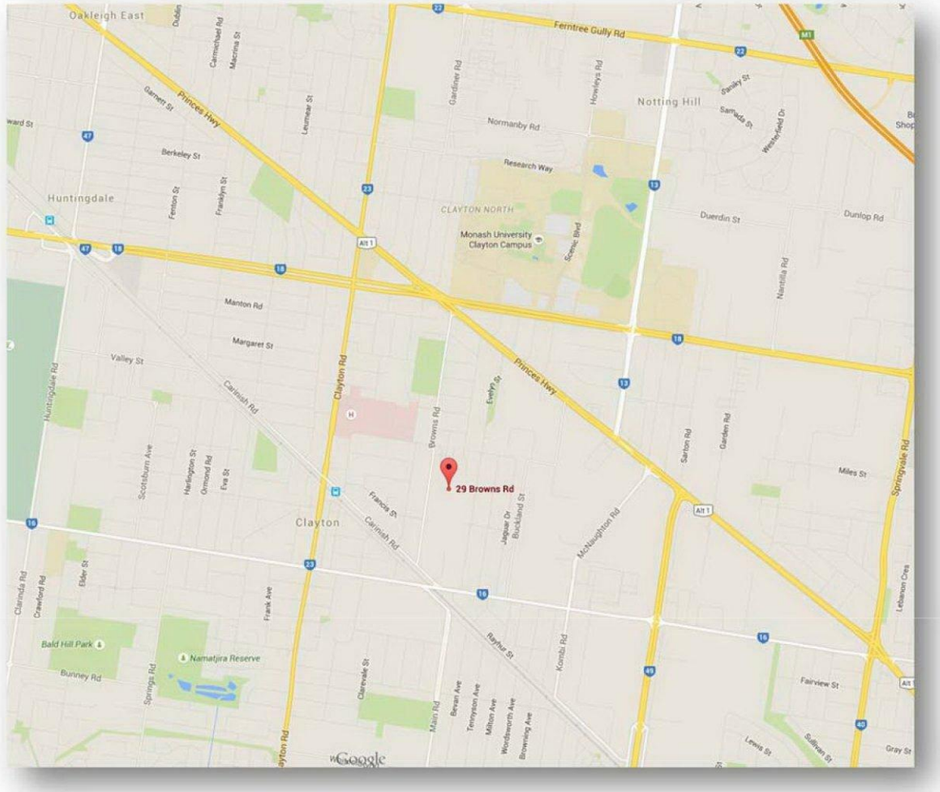
Project Description

The proposed development is designed to be respectful of the environment during both construction and its continued use. The proposal expects to integrate measures that support social, environmental and economic outcomes. This report presents a description of these ESD strategies and initiatives proposed for implementation within the project.

Located within the dynamic City of Monash, the project aims to promote the Council's leading policies on sustainability.

The project consists of the construction of approximately 80 townhouses and 175 apartments. Townhouses will be built on concrete slab with timber flooring all other levels. Wall materials vary from brick to feature lightweight cladding. Apartment buildings will be constructed of concrete slab to all floor and car parking provided in a basement garage.

This report is based on drawings prepared by Mushan Design Studio (dated 09.09/15 – REV P5).



Indicates location of development

Indoor Environment Quality

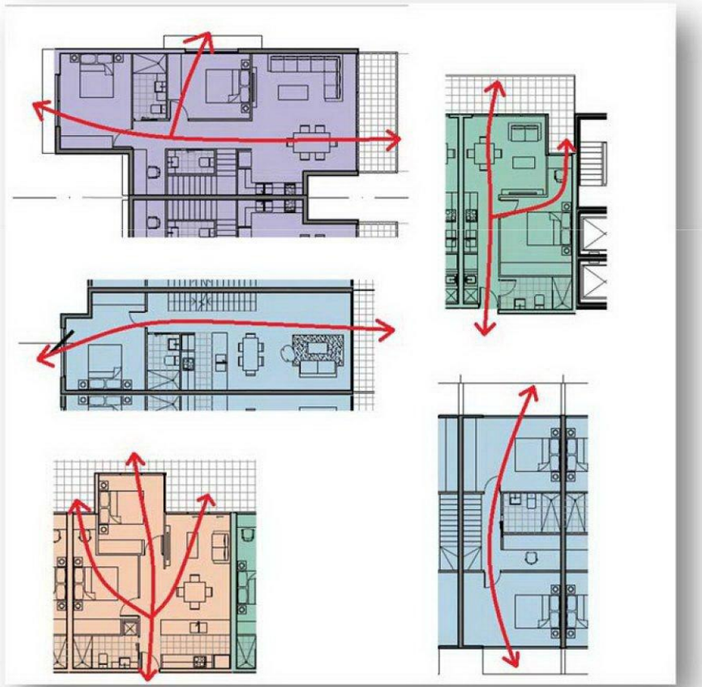
Indoor Environment Quality is measured by how the building is perceived by its occupants. This comprises of safety, accessibility, air quality, ventilation, thermal comfort, lighting, noise and visual appeal. It is important to analyse this because people spend around 90% of their time indoors. Ensuring human environments are as pleasant as possible in turn improves comfort.

Direct Application:

Light, ventilation and zoning

- The rectangular shape of each building has 4 useable edges which enhance access to daylight and natural ventilation throughout the townhouse levels, hallways and walkway areas. This supports a fresh air breeze path throughout which contributes to a healthy building. The buildings' shape increases air flow around the perimeter of the building which ultimately has a cooling effect.

- Each townhouse and apartment has been designed to maximise the natural ventilation throughout each dwelling. This has been achieved by providing ample openings to improve air flow throughout each townhouse. Good cross-flow ventilation improves occupant comfort by allowing fresh cool air to flow through the room, reducing the reliance on artificial cooling and circulating methods. It also assists in the removal of indoor pollutants which can be harmful to occupants.



- Each unit features the main living zone directed outward to allow for natural daylight to filter through the daytime occupied rooms.

- All townhouses and apartments feature a terrace or balcony and are shaded from above. This shading protects the glazed doors from high heat gain during summer and thus reduces the cooling load within the dwelling. The lower angled winter sun flows in helping the internal rooms to keep warm during the cold months.

- Artificial lighting will be installed with low-energy LED globes to living and bedroom areas. The lighting will be adequate for the tasks the occupants need to perform.

Comfort

- Each building is constructed of thermally efficient materials and has achieved a 6.0-star rating overall (refer to FirstRate reports). The townhouses will be very comfortable to live in and will need minimal artificial heating / cooling. The building features extensive thermal mass which will perform as a heat storage method over the cooler months.

- The project features good levels of insulation (at least R2.0 bulk + foil for walls – at least R.2.5 bulk insulation for ceilings) therefore will be acoustically and thermally comfortable. Occupants will be able to control their comfort by the use of highly efficient zoned heater/air conditioning systems.

Air quality

- Indoor environment quality has be addressed by committing to using low emission volatile organic compounds (VOC) paints, laminates, adhesives, varnishes, MDF, plywood, particleboard, floor coverings and extends to all other building products being used in the development. The commitments are as follows:
  - Carpets will be selected based on Low VOC labelling (fabric and bonding adhesive). Most VOC emissions dissipate within the first week after installation.
  - Traditional oil-based timber finishes have a high solvent level thus contributing to unpleasant internal air pollution. Timber will be finished with water-based products producing no more than 140 grams of VOC per litre.
  - Internal wall and ceiling paints will be selected with "Low VOC" noted on the product label. Commitment will be made to use products producing no more than 50 grams of VOC per litre.
  - Adhesives will be water-based with "Low VOC" noted on the product label. Commitment will be made to use products producing no more than 80 grams of VOC per litre.
  - Low formaldehyde emissions (LFE) will be addressed by committing to products producing no more than 0.05 parts per million (E0 standard)
  - During construction, doors and windows will be opened to increase ventilation when using products that emit (thus reducing exposure to VOC's).
  - While the townhouses are being built, the internal temperature and humidity will be kept low (as chemicals release more gas under warmer conditions and higher humidity).

Acoustics

- The site is situated between existing industrial buildings and residential districts. To minimise the impact of industrial noise intrusions, daytime zones are positioned away from these noise sources.

- The project includes high-performance glazing systems to selected orientations designed for acoustic protection and energy performance.

- Acoustic disturbances identified are:
  - Nearby light industry activity (immediate noise source)
  - Urban noise (surrounding light reverberation)
  - Neighbouring residences (immediate noise source)
  - Townhouse / apartment building plant equipment
  - Air conditioning condensers

- Selected external perimeter walls are constructed using heavy duty mass which offer significant protection from noise penetration.

- Party walls will be insulated using 2x R2.0 glasswool acoustic batts with minimum density 14kg/m2 (suitable to provide suitable protection between dwellings and projected sound transmittance).
- Rubber mounts will be applied to all air conditioning condenser units to isolate noise vibrations.
- Greenery and screening will been implemented to private courtyard areas for seclusion and acoustic protection.

Building Community and Safety

The success of a new development can be measured by evaluating safety, accessibility, community and unity between the residents and their built environment. The goal is to ensure each resident can navigate their building safely and are able to engage with other residents to develop a strong community.

Direct Application:

Safety

- The development complies with NCC Part 3.9 Safe Movement and Access.
- The development complies with Monash Planning Scheme and offers safe accessibility for all people including those with disabilities. To be included in Building Users Guide.
- The design delivers a comfortable, safe, walkable quality with open courtyards and elevators and stairwells for access to upper apartment levels.
- The main entry doors are a suitable weight for all capabilities.
- The site features separate pedestrian footpaths and road spaces reducing the risks for pedestrians from vehicular traffic within the development.
- Community safety is also boosted by the layout of the townhouses and apartment buildings by ensuring passive surveillance (being rectangular-shaped) thus 'hidden' corners, dark places and obstructions are greatly minimised.

Community

- The development features landscaped pedestrian spaces as well as practical courtyards for all townhouses which offer privacy, but also community and will enhance interaction between other residents.
- The development promotes equitable access so all residents can enjoy the building services and engage in community activities.

Energy Efficiency

Fossil fuels are non-renewable yet provide nearly all the energy needed by Australian residents, businesses and industry. Given that limited resources are available it is imperative that we look towards sustainability for the future. Addressing the efficiency of where we live will greatly improve our position and thus greatly reduce our reliance on these diminishing resources.

Direct Application:

Townhouses and apartments

- It can be demonstrated that the building will meet benchmark rating requirements and will achieve a minimum 6.0-star overall rating with the following energy efficiency initiatives (FirstRate5 energy rating supplement):

Indicative Energy Efficiency Items for all units: (refer to spreadsheet data for specific inclusions)

- Wall insulation to reach R2.0 – R2.5 + foil (no foil to party walls)
- Ceiling insulation to reach R2.5 – R6.0
- Intermediate floor insulation required to selected townhouses
- Suspended slab insulation required to all ground floor apartments
- Windows to be glazed in accordance with spreadsheet data for sample apartments
- Weatherseals to entry doors and windows
- Gaps and cracks to be sealed
- Exhaust fans to be sealed

- The energy rating results are:

Unit No.	Star Rating	Unit No.	Star Rating
TH1	6.0	A1	5.6
TH2	6.0	A2	6.8
TH3	6.0	A3	5.0
TH4	6.0	A4	6.1
TH5	6.0	A5	6.6
TH6	6.0	A6	6.6
TH7	6.0	A7	6.4
TH8	6.2	A8	5.5
TH9	6.0	THM2	6.1
TH10	6.1		
Average 6.0 stars estimated			

- Commitment to a heating and air-conditioning system of min. 5-stars (zoned gas ducted heating) – (room/space cooling only to main living/kitchen areas).
- The artificial lighting required is energy efficient LED downlights to living areas and bedrooms. Artificial lighting wattages have been nominated as 5w/m2 which meets current regulatory obligations.
- Each townhouse / apartment space features individually controlled heating/cooling systems, lighting systems and ventilation to allow for flexible control.
- Commitment to a 5-star gas-storage hot water system.
- Common area and carpark lighting will be installed using T5 lamps activated by motion sensors, designed to significantly reduce energy use. Selected areas will be permanently illuminated by approved energy-efficient lighting, however this will be limited.

Water Sensitive Design

Australia has suffered from a great water shortage in recent years; however being water-wise will greatly improve this position. Implementing the opportunities at design/construction stage will significantly reduce water consumption. The development greatly supports Monash's water initiative "Integrated water management plan" by the following commitments:

Direct Application:

Townhouses

- Each dwelling will feature its own separate water meter, ensuring each occupant is responsible for their own water usage, and thus water saving performance.
- Shower heads will be installed with a minimum 3-star WELS rating and will feature a flow rate of 4.5lpm to 6.0 lpm plus aeration device.
- Toilets will be installed with a minimum 4-star WELS rating and will feature a dual flush system.
- Basin taps will be installed with a minimum 5-star WELS rating and will feature flow restriction valves.
- Water heating will be achieved through individual 5-star gas-storage systems:
  - Minimal hot water piping lengths to minimise energy losses
  - Minimal hot water piping diameter to allow for maximum flow but minimal energy loss
  - Correctly sized water heater
  - Highly insulated piping
  - Heater positioned for easy access for installation and maintenance, resource supply and delivery of hot water to the townhouses.
- Dishwashers, washing machines and other builder-supplied appliances will be installed with minimum 4-star ratings.

- Residents will be educated (as part of their Building Users Guide) on the monitoring and fixing of leaking taps. The Building Users Guide will include details of a reputable and sustainable plumber to address any issues that may arise during occupancy. Additionally, water meters will be monitored to reveal any evidence of water leakage issues within the development – responsibility of Building Management Company.

Building and site

- Sub-metering will be installed to calculate water efficiency in areas of rainwater harvesting (collection and use) plus gas hot water systems. This allows for monitoring of these systems and subsequently addresses any areas that do not meet the targeted sustainable outcomes.
- Taps will be carefully monitored (daily) by all contractors on site to ensure taps are turned off properly after use. If a leak issue emerges, this will be instantly reported to the site manager and addressed immediately. Contractors will be required to engage in water-saving methods during their appointment and will form part of their signed agreement.
- Refer to "Urban Ecology" for commitments to water efficient landscaping.
- The development aims to be a great sustainable asset to the community particularly with regards to adding value to Water Management. The current site is an existing dwelling which features no water harvesting systems, thus improving the sustainability of the site.

Stormwater Management Clause 22.04 (Water Sensitive Urban Design)

Stormwater typically runs from an allotment, to collection and soon-after into rivers, lakes and the ocean. Making use of this water greatly reduces our impact on the environment, reduces reliance on potable water and protects Monash's waterways and creeks. Consideration should be given to catchment and storage, filtering the water to trap pollutants, and using this water for toilets and gardens.

Direct Application:

- The project features individual rainwater tanks of 2,500L capacity for all town house units and a single 25,000L capacity tank for each apartment building and will collect rainwater from 100% of the metal-deck roofing area. The rainwater tank storage will total 314,000L minimum and will service the following:
  - Every sanitary flushing system within the development
  - Watering gardens in planter boxes / gardens
  - Bin wash out (bin store area)
  - External washdown services
  - Emergency services storage

Pre-storage Filtration

- Downpipe / gutter leaf guards will be installed to all collection trains.
- Rainwater tank will feature an inlet filter in accordance with Australian Standards.
- The rainwater tank system will initially run through a first-flush filtration process to ensure the water collected is of optimal quality (see below for filtration details).
- To reduce sediment and particulate build-up within the tank, a triple action filtration system will be installed. Maintenance will be arranged by the building management company to ensure clean water is continually suppled to the toilets plus to minimise flow reductions due to sediment build up.

- Rainwater that runs from impervious surfaces to the rainwater tank is directed to the proposed re-use systems, with an On-Site Detention system to control peak flow. (Refer to plans and drainage engineering for location of rainwater harvesting tanks and detention storage).

- Monash's waterways will be protected by committing to site tidiness. The property will be regularly cleared / cleaned to ensure the footpath, gutter and drains are not contaminated with site rubbish;
  - Include pollutant traps / grates to prevent site waste from travelling to stormwater drains.
  - Divert / protect stormwater from disturbed or exposed areas (to avoid unfiltered water running to the stormwater system); including sweeping up excess sediment on bordering roads and other impervious surfaces.
  - Keep storage bins covered / well enclosed to ensure that rubbish is contained on site and disposed of properly.
  - Revise cleaning systems as the site changes during construction to ensure targets are being maintained.
  - Conduct weekly inspections of the site to ensure all measures are being adhered to.
  - Ensure that when washing equipment on site, the wastewater does not enter the stormwater system. This involves creating a barrier between washing areas and the stormwater drains.

- Prevent contaminants, spills or leaks from entering the stormwater system. This can be achieved by ensuring equipment is readily available to contain the pollutant (such as absorbents, barriers or brooms);
  - Ensure an emergency spill kit is available on site including shovel / brooms, safety gloves, sorbents, absorbent pads and rolls, drain seals and guards.
  - Ensure each contractor is familiar with procedures for emergency spillage.
  - Ensure spill kit is located in a position easily accessible for urgent use.

Building Materials

The materials chosen for a building project has a significant impact on the environment. Preference should always be given to products that have low embodied energy plus low toxicity in manufacture and use. It is also important to consider issues such as the impact of material consumption off-site (e.g. mining).

Direct Application:

- The use of local materials is paramount. The following will be sourced within the Melbourne area to minimise the embodied energy of the products; insulation, tiling, carpets, timber, concrete, plasterboard, cladding, garage doors, windows. Products will be sourced based on the following order of effect:
  1. Made locally (within 30km)
  2. Made within Victoria
  3. Made in Australia using Australian stock
  4. Made in Australia using imported stock
  5. Imported from China/Japan via sea freight
  6. Imported from Europe/USA via sea freight
  7. Imported by all other international air freight

- Recycled materials will be used in areas of insulation, concrete re-enforcing, specialised finishes;
  - Recycled concrete will be used in areas of general fill, pavement aggregate and road base. Minimum recycled commitment is :
    - 15% recycled content (for insitu concrete)
  - Glasswool type bulk insulation will be used which is made up largely from recycled glass. Rockwool is also a product which is highly recycled. Insulation will be sourced from suppliers who commit to the following minimums:
    - 70% recycled content
    - Packaged in a compressed state (more product can be shipped in each truck)

- Materials with low toxic emissions will be used (Refer to Quality of Public and Private Realm within this report).

- All materials selected for the project are suitable for their exact purpose, and will meet the installation and usage data as provided by the manufacturer.

- The appliances installed will not use chlorofluorocarbon (based) refrigerants.

- Materials will be selected that have very low embodied energy and water, from raw product to completion and disposal.

- Durable materials are also essential. Products and materials will be chosen that are long-lasting and require minimal maintenance. Commitment will also be given to the ongoing maintenance of materials which will include cleaning and preservation, ensuring continues to meet the intended usage.

- All timber used within the project will be FSC approved (meeting Moreland's Greenlist specifications) and will be sourced from suppliers who provide plantation timber product.

Transport

Alternative transport options encourage residents to rely on other ways of getting around instead of vehicular. Choosing a site close to public transport promotes this, along with providing space for bicycle storage.

Direct Application:

- Bicycle storage is available within each townhouse's private garage and in dedicated bicycle storage areas located on the basement level for apartment residents. Residents have convenient, safe access with sufficient room to access their bicycles and are able to exit directly at street level or the basement access ramp.

- The site is located within 10 minutes' walking distance to Clayton shopping precinct, with access to trains, buses and taxis.

- The M1 Freeway runs a short distance from the site, and thus access to the City is directly available.

- Significant nearby conveniences:
  - Citylink / Freeway access – 10 mins. drive
  - Clayton road shopping precinct including an extensive range of retail shops, services and dining/entertainment options, supermarkets, banking and other daily convenience stores – within 10 mins. walk
  - Chadstone Shopping Centre featuring an extensive range of retail shops, services and dining/entertainment options, as well as bus services and taxi ranks – 10 mins. drive
  - General Practitioner and specialist facilities –10 mins. walk
  - Primary and secondary schooling – various nearby
  - Monash University -15 mins. walk
  - Reserves, sporting fields and stadiums – various nearby
  - Sporting fields and stadiums – various nearby
- Green Travel:
  - Direct access to tram and bus services – Palermo Street tram within 5 mins. Walk
  - Clayton train station – within 5 mins. walk
  - Extensive dedicated bicycle routes, dedicated bicycle lanes and bicycle friendly roads within the City of Monash– all easily accessible from the development

Given the location of the development, it is estimated that occupants will not solely rely on car use for day-to-day activities. Public transport and living amenities are extensive and are within 5-10 minutes' walk.

Waste Management

In the early stages it is imperative to consider the environmental impact of waste on the greater environment. Design needs to be considerate of flexibility for future disassembly. As it is a major environmental issue, we must follow the following rules: avoid, reduce, reuse and recycle. If we do this, we can greatly reduce building-related waste (currently over 40% of landfill).

Direct Application:

- Product calculations (supply) will be precise to avoid over-supply and thus needless waste. Contractors will be consulted regarding how much waste they expect to be generated by the project, and scrutinise how to reduce levels.

- Construction recycled waste and general rubbish will be separated into two bins. Each contractor attending the site will be issued with instructions on sorting waste resourcefully.

- Each townhouse features a wastebin within the kitchen cabinetry, with separated general rubbish / recycling (for occupants). Residents will separate recyclable waste from garbage waste and place into the correct council bins. The area is signed adequately and access is easy.

70% Waste Recycling Strategy – Mass – to be applied to all waste activities encompassing demolition of existing dwellings and during construction phase:

- The Construction Waste Management Plan strategies are as follows:
  <u>Waste Reduction and Minimisation:</u>
  - Standard sized products will be used to avoid creating waste when materials are cut / adjusted to unusual lengths (this is the responsibility of the designer in collaboration with each contractor involved)
  - Packaging from site materials will be sorted and recycled. Each contractor will be responsible for choosing products with minimal packaging.
  - Pre-cut or pre-fabricated products will be given priority (contractor responsibility)
  - The design of the units are adaptable, thus when remodelling occurs the impact of waste will be greatly reduced
  - Care will be taken when the site is excavated to minimise unnecessary site disturbance, with the aim of reducing organic waste

  <u>Waste Organisation:</u>
  - Each major contractor will be informed of the waste management principles within this ESD, and it will form part of their contract. Each contractor is responsible for the daily cleaning of their respective work areas and for their own waste sorting.
  - Organic waste (vegetation clearance, land clearance, leaf litter and weeds) will be chipped / mulched and either a) salvaged and re-used on-site *or* b) sent to a compost facility (recommendation: SITA www.sita.com.au)
  - Off-cuts from timber will be re-used on site in landscaping. Alternatively, excess timber will be separated and collected from a local salvage company and recycled (recommendation: SITA www.sita.com.au) as a secondary option.
  - All waste areas will be clearly identified (re-cycling / general waste) during construction
  - Surplus bricks, tiles, plasterboard and concrete will be re-used onsite in areas of landscaping and architectural features, and further waste will be recycled off-site
  - No rubbish will be buried on site
  - Liquid waste (black & grey water) will be disposed of in accordance with regulations.

- The Operational Waste Management Plan strategies are as follows:
  - Each unit will feature general waste and recycling bins (minimum 10L capacity each) integrated into the kitchen cabinetry.
  - Each tenant is responsible for their own storing and sorting of general waste / recycling. General waste will be placed in the designated garbage chutes whereby it will be collected (by waste contractor) and transferred to the correct bins for disposal. Each level features clearly labelled recycle bins/chutes where tenants will dispose of their recyclable waste.
  - Bins are located centrally on each level with easy, safe access.
  - Each tenant will be provided with a clear guide to recycling as part of the Building User's Guide which will include:
    - What items are accepted
    - What items are excluded
    - Preparation of materials including flattening of cardboard, rinsing bottles and containers
    - Reusable shopping bags
    - No junk mail signage
    - Reduction of store-bought packaged items

- A post-occupancy waste management audit will be performed at 3 months and 12 months with any short-falls addressed within a suitable time period. Priority will be given to environmental performance and occupant welfare.

Urban Ecology

Selecting a site for development can involve many issues. Protecting the urban community can be encouraged by planning to support animals and plants that live in the area. Selecting a site that has been previously used is an advantage, or a site that is located within an urban area. Also implementing a landscaping plan that restores native plants helps us reach our target. Ultimately we aim to impact the environment in a positive way.

Direct Application:

- The project will significantly improve the sustainability and energy efficiency of the site in focus. The current site is a vacant primary school and will be redeveloped to provide for higher density occupancy in the area. The current site features no water harvesting systems which will be improved upon by the introduction of Water Sensitive Urban Design strategies for the new building.
- The development includes great opportunities for residents to be a part of their surrounding environment, particularly the private rear courtyards, balconies and landscaped pedestrian zones. These outdoor areas feature green screening to connect occupants to their surrounding community and the natural environment.
- Vegetation is positioned around the building connecting the occupants to their surrounding green environment. This vegetation is visible from the main living/kitchen area plus bedroom zones. The surrounding shrubs improve air quality and are situated near habitable windows which can greatly benefit from fresh air.
- The design is sensitive to providing a 'green' streetscape consistent with surrounding dwellings and gardens. The proposal will follow Council's instruction regarding protection of street trees including during construction and incorporating existing trees into landscaping design where possible.
- Drought tolerant plants will be planted in garden areas, reducing the amount of water required to maintain the landscaped gardens. Gardens are positioned throughout the site to connect occupants to their green environment.

Innovations

Each development site has its own and strengths and limitations. Understanding how to maximise the sustainability of a project often requires higher levels than basic Australian Standards.

Direct Application:

- Carparking is situated out of view so that they don't become a focus of everyday life. This should promote walking, cycling and the use of public transport.
- The WSUD approach includes rainwater tank and re-use strategies, permeable paving surfaces, and has retained as much permeability as possible (via landscaping). This will contribute to a sustainable development and will support council's stormwater strategies. The STORM rating meets the minimum 100% required.

- Exceeding STEPS minimum targets by the following:
  - Energy (Score = 37 – minimum score 25)
  - Peak Demand (Score = 73.2 – minimum score 10)
  - Water (Score = 49 – minimum score 25)
  - Building Materials (Score = 17% – minimum score 11%)

Name	Required Score	Project Score
Greenhouse Emissions from Energy Use	25%	37%
Peak Energy Use	10%	73.2%
Mains (Drinking) Water Use	25%	49%
Stormwater Quality Impacts	100%	100%
Building Material Impacts	11%	17%
Waste Management - recyclables	192.00 m^2	
Waste Management - rubbish	64.00 m^2	
Waste Management - green waste	0.25 m^2	
Waste Management - TOTAL	256.25 m^2	
Transport: Secure bicycle parks required	341	
Project sustainability score		**276.2 / 500**

Construction and Building Management

The project encourages environmental management during the design and construction phase by:

- Prioritising the use of local materials (as covered in **Building Materials**).
- Ensuring the stormwater system is protected during construction (refer to **Stormwater Management** within this report)
- Undertake post-occupancy commissioning and address issues that may not be performing as well as initially reported in particular:
  - Rainwater tank collection and quality, leak inspection
  - Performance of heating and cooling systems
  - Operational recycling maximised
  - Occupant well-being analysis
- Compile a Building Users Guide consistent with Green Star's targets and inclusions not limited to the following:
  - Targets and strategies for the reduction of energy usage including energy rating building performance, star ratings for appliances and lighting
  - WELS ratings of taps and fittings with additional guidance on water-wise activities
  - Waste reduction and recycling strategies adopted within the development
  - Description of the building services and operational requirements for efficient and safe use of these systems; in particular:

- HVAC systems and monitoring
- Electronic systems including intended operation and maintenance
- Lighting systems and efficient use
- Signs of system failures

- Monitoring indoor environment quality
- Information regarding green travel including Carparking provisions, location of bike storage and cycling networks and public transport services
- Emergency situations
  - Fire plans and escape routes
  - Lift evacuation procedures
  - Alarms and testing
  - Accessibility
- Responsibilities of building management company in support of BUG strategies and targets
- Responsibilities of residents in support of BUG strategies and targets

STEPS v5.0 Report

Revision Timestamp: 2015-10-01 16:29:18

Base Project ID: 30273

Revision: 6ff420c7791ada9bc66375ad45e1aae9

Project Details

Read the Guide to using STEPS before you begin an assessment

Project name	Proposed Development
Assessor	Sharelle Haines - VIC/BDAV/11/2078
Contact email address	admin@energylab.com.au
Street number and name	29 Browns
Street type	Road
Suburb	Clayton
Postcode	3168
Municipality	Monash City Council
Permit number	
Applicant	Mushan Group
Land size	19350 m^2
Type of residence	Apartment
Number of bedrooms	578
Total number of apartments (multi-unit developments only)	256

Disclaimer:

The Moreland City Council does not accept any liability for loss or damages incurred as a result of reliance placed upon STEPS. STEPS is provided on the basis that all persons using STEPS undertake responsibility for assessing the relevance and accuracy of its content. Council takes no responsibility for any

information or services on external websites linked to from this website.

STEPS predicts the environmental impacts of the development based on assumed usage patterns and long term climate. Actual environmental impacts will depend on actual building and appliance use patterns and efficiency as well as future climate. Information about environmental impacts should therefore be taken as indicative only and no guarantee is implied.

The Centre for Design at RMIT University makes no claim as to the accuracy or authenticity of the content of the materials element of STEPS, and does not accept liability to any person for the information or advice provided in it or incorporated into it by reference

Energy

For more information on products available for selection please see the Energy Appliances website.

Enter data and features of the average dwelling in the development.

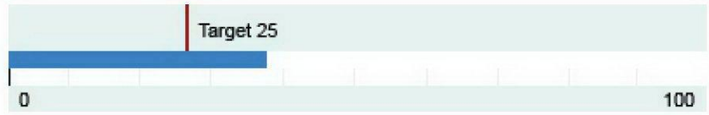
Building Envelope Energy Rating heating score	102.8	MJ per m^2
Building Envelope Energy Rating cooling score	18.0	MJ per m^2
Building Envelope Energy Rating conditioned area	127	m^2
Building Envelope Energy Rating energy star rating	6.0	stars
Heating system type	Gas Heating 5 stars	
Heating system options	Central Heating	
Cooling system type	Air-Conditioning, 4 stars	

Cooling system options	Room/Space Cooling Only
Water heater type	Gas storage 5 stars
Lighting in living areas	LED Downlights / Spotlights
Clothes-drying facility	No provision for drying space
Renewable Electricity Generation	
Renewable System Size	kW (kilowatt peak output)

Output

Energy

Score **37**



0 equals the estimated average performance of a conventional design

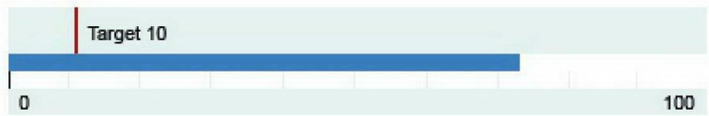
Required Score	**25**	**%**
Project Score	**37**	**%**
Benchmark Emissions	**8864**	**kg CO_2 / yr / dwelling**
Target Emissions	**6648**	**kg CO_2 / yr / dwelling**
Heating Greenhouse Gas Emissions	432	kg CO_2 / yr / dwelling
Cooling Greenhouse Gas Emissions	130	kg CO_2 / yr / dwelling
Water Heating Greenhouse Gas Emissions	680	kg CO_2 / yr / dwelling
Lighting Greenhouse Gas Emissions	230	kg CO_2 / yr / dwelling
Clothes Drying	217	kg CO_2 / yr / dwelling
Misc incl TV, cooking, refrigerator, computer	3910	kg CO_2 / yr / dwelling
Minus Renewable Electricity Generation	-0	kg CO_2 / yr / dwelling
Total Emissions	**5599**	**kg CO_2 / yr / dwelling**

Peak Demand

Output

Peakdemand

Score **73.2**



0 equals the estimated average performance of a conventional design

Required Score	**10**	**%**
Project Score	**73.2**	**%**
Benchmark Peak Demand	**3**	**kW**
Target Peak Demand	**2**	**kW**
Calculated Peak Demand	**0.7**	**kW**

Water

For more information on products available for selection please see the WELS website.

Fittings (for the average dwelling)

Shower type	3 (> 4.5 but <= 6.0 plus bonus water saving feature)
Toilet	4 Star WELS rating
Basin taps	5 Star WELS rating
Bath type	

Re-use (for the whole building)

Rainfall area	Melbourne (Eastern)	
Rainwater collection tank size	314000	L
Area of roof draining to rainwater tank	10194	m^2
Comments on rainwater tank	For Storm/WSUD Complianc	
Alternative water supply other than rainwater tanks used (e.g. greywater, third pipe connection or on-site wastewater treatment and reuse)	☐ Yes	
Type of alternative water supply		
Are toilets permanently connected to the rainwater tank/alternative water source?	☑ Yes	
... and also, number of toilets connected to rainwater tank	565	
Is the irrigation system permanently connected to the rainwater tank/alternative water source?	☑ Yes	
Is the washing machine(s) permanently connected to the rainwater tank?	☐ Yes	

Is the hotwater services(s) permanently connected to the rainwater tank?	☐ Yes	
Irrigated garden area	2000	m^2

Output

Water

Score **49**

0 equals the estimated average performance of a conventional design

Required Score	**25**	**%**
Project Score	**49**	**%**
Benchmark Mains Water Consumption	**187**	**kL / yr / dwelling**
Target Mains Water Consumption	**140**	**kL / yr / dwelling**
Shower	22.3	kL / yr / dwelling
Bath	0.0	kL / yr / dwelling
Misc hot water	44.5	kL / yr / dwelling
Toilet flushing	13.6	kL / yr / dwelling
Basins	5.6	kL / yr / dwelling
Evaporative cooler	0.0	kL / yr / dwelling
Irrigation	2.7	kL / yr / dwelling
Misc other water use	21.4	kL / yr / dwelling
Total water consumption	**110.1**	**kL / yr / dwelling**
Re-used toilet flushing	13.3	kL / yr / dwelling
Re-used Irrigation	0.8	kL / yr / dwelling
Re-used Laundry	0.0	kL / yr / dwelling
Re-used Hot Water Service	0.0	kL / yr / dwelling
Re-used Total	**14.1**	**kL / yr / dwelling**
Toilet usage from mains	0.3	kL / yr / dwelling
Irrigation usage from mains	1.9	kL / yr / dwelling
Misc other usage from mains	21.4	kL / yr / dwelling
Total hot water usage from mains	66.8	kL / yr / dwelling
Total usage from mains	**96**	**kL / yr / dwelling**

Stormwater

Read the Guide to STORM before you begin an assessment

Please visit the STORM website to obtain your STORM Score.

Enter STORM Score From Website: 100

Should MUSIC be used instead of STORM? ☐ Yes

Output

Stormwater

Score **100**

0 is equivalent to the typical urban pollutant loads

Required Score	**100**	%
Project Score	**100**	%
Best-Practice On-Site Stormwater Treatment	**100**	%

Materials

Read the Moreland Greenlist before you begin an assessment

Building Element	Material	Points
Ground Floor		
Material 1	Standard Concrete Slab	10.8
Material 2		
Material 3		
Ground Floor Material average		**10.8**

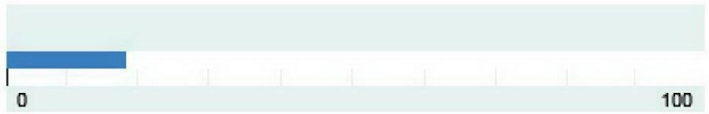
Upper Floors		
Material 1	Standard Concrete Slab	3.0
Material 2	Timber Frame	3.2
Material 3		
Upper Floors Average		**3.1**
Wall Framing		
Material 1	Greenlist Treated Frame	8.4
Material 2		
Material 3		
Wall Framing Average		**8.4**
Interior Wall Framing		
Material 1	Greenlist Treated Frame	8.4
Material 2		
Material 3		
Interior Wall Framing Average		**8.4**
Wall Cladding		
Material 1	Brick	12.6
Material 2	FC Sheet	11.7
Material 3		
Wall Cladding Average		**12.1**
Windows		
Material 1	Aluminium	3.0
Material 2		
Material 3		
Windows Average		**3.0**
Roof Framing		
Material 1	Timber frame	3.5
Material 2		

Material 3		
Roof Framing Average		**3.5**
Roof Cladding		
Material 1	Steel sheet	3.5
Material 2		
Material 3		
Roof Cladding Average		**3.5**
Outdoor Structures		
Material 1	Timber - Other	2.5
Material 2		
Material 3		
Outdoor Structures Average		**2.5**
TOTALS:		**55.3**

Output

Materials

Score **17**



0 equals the estimated average performance of a conventional design

Required Score	**11**	**%**
Project Score	**17**	**%**
Benchmark Materials Impact	**47.8**	**points**
Target Materials Impact	**52.65**	**points**
Project Materials Impact	**55.3**	**points**

Note:
Points are derived from materials' fate, embodied energy, biodiversity, human health and toxicity. Target is dependant on the specified building elements

Report

Project Details

Contact	admin@energylab.com.au
Project	29 Browns Road Clayton 3168
Municipality	Monash
Permit number	
Land size	19350 m^2
Type of residence	Apartment
Total number of bedrooms	578
Total number of apartments (multi-unit developments only)	256

Name	Required Score	Project Score
Greenhouse Emissions from Energy Use	25%	37%
Peak Energy Use	10%	73.2%
Mains (Drinking) Water Use	25%	49%
Stormwater Quality Impacts	100%	100%
Building Material Impacts	11%	17%
Waste Management - recyclables	192.00 m^2	
Waste Management - rubbish	64.00 m^2	
Waste Management - green waste	0.25 m^2	
Waste Management - TOTAL	256.25 m^2	
Transport: Secure bicycle parks required	341	
Project sustainability score		**276.2 / 500**

Upon completion of a STEPS assessment, prior to submission for a planning permit: print all pages of the assessment and ensure that the following are notated on the plans for endorsement (where applicable):

Energy

- fixed clothes drying racks; and
- the location of hot water systems (including marking solar panels on roof.)
- specifications used to achieve a 5-star FirstRate rating eg insulation and aluminium improved window framing;
- air-conditioning system and heating system types; and

- specified lighting types.

Water

- the rainwater tank, sized, and showing plumbing from the roof and to the toilets and/or garden.
- specified shower, toilet and basin types.

Stormwater

- the location, size and type of treatment systems;
- permeable paving areas;
- the proposed drainage to the treatment system; and
- section details, planting schedules and maintenance requirements of treatment types.

Materials

- material types.

Transport

- allocated bicycle parking spaces.

Waste

- allocated space for waste management.

Complete :

- an operational waste management plan for the site.

Innovation

Local Government encourages developers to consider inclusion of innovative environmental design solutions that may not be specified in STEPS. Should you wish to include additional environmentally sustainable design features in your proposed development, please notate them appropriately on the plans and include relevant design details in the planning application documentation.

Melbourne Water

STORM Rating Report

TransactionID:	274538
Municipality:	MONASH
Rainfall Station:	MONASH
Address:	29 Browns Road
	CLAYTON
	VIC 3168
Assessor:	Sharelle Haines - VIC/BDAV/11/2078
Development Type:	Residential - Multiunit
Allotment Site (m2):	19,930.00
STORM Rating %:	100

Description	Impervious Area (m2)	Treatment Type	Treatment Area/Volume (m2 or L)	Occupants / Number Of Bedrooms	Treatment %	Tank Water Supply Reliability (%)
Roofing area TH 4 to tanks	1,140.00	Rainwater Tank	40,000.00	60	158.90	82.00
Roofing area AB 4 to tanks	1,015.00	Rainwater Tank	25,000.00	70	144.80	78.00
Roofing area TH 3 to tanks	1,082.00	Rainwater Tank	40,000.00	60	161.20	82.00
Roofing area AB 3 to tanks	1,230.00	Rainwater Tank	40,000.00	100	156.60	81.00
Hard surface area to storn	5,250.00	None	0.00	0	0.00	0.00
Roofing area TH 2 to tanks	1,140.00	Rainwater Tank	40,000.00	60	158.90	82.00
Roofing area AB 2 to tanks	785.00	Rainwater Tank	25,000.00	60	155.80	81.00
Roofing area TH 1 to tanks	2,700.00	Rainwater Tank	75,000.00	100	146.40	84.60
Roofing area AB 1 to tanks	785.00	Rainwater Tank	25,000.00	60	155.80	81.00
Roofing area MOR1,2 to tanks	317.00	Rainwater Tank	4,000.00	8	89.50	79.70

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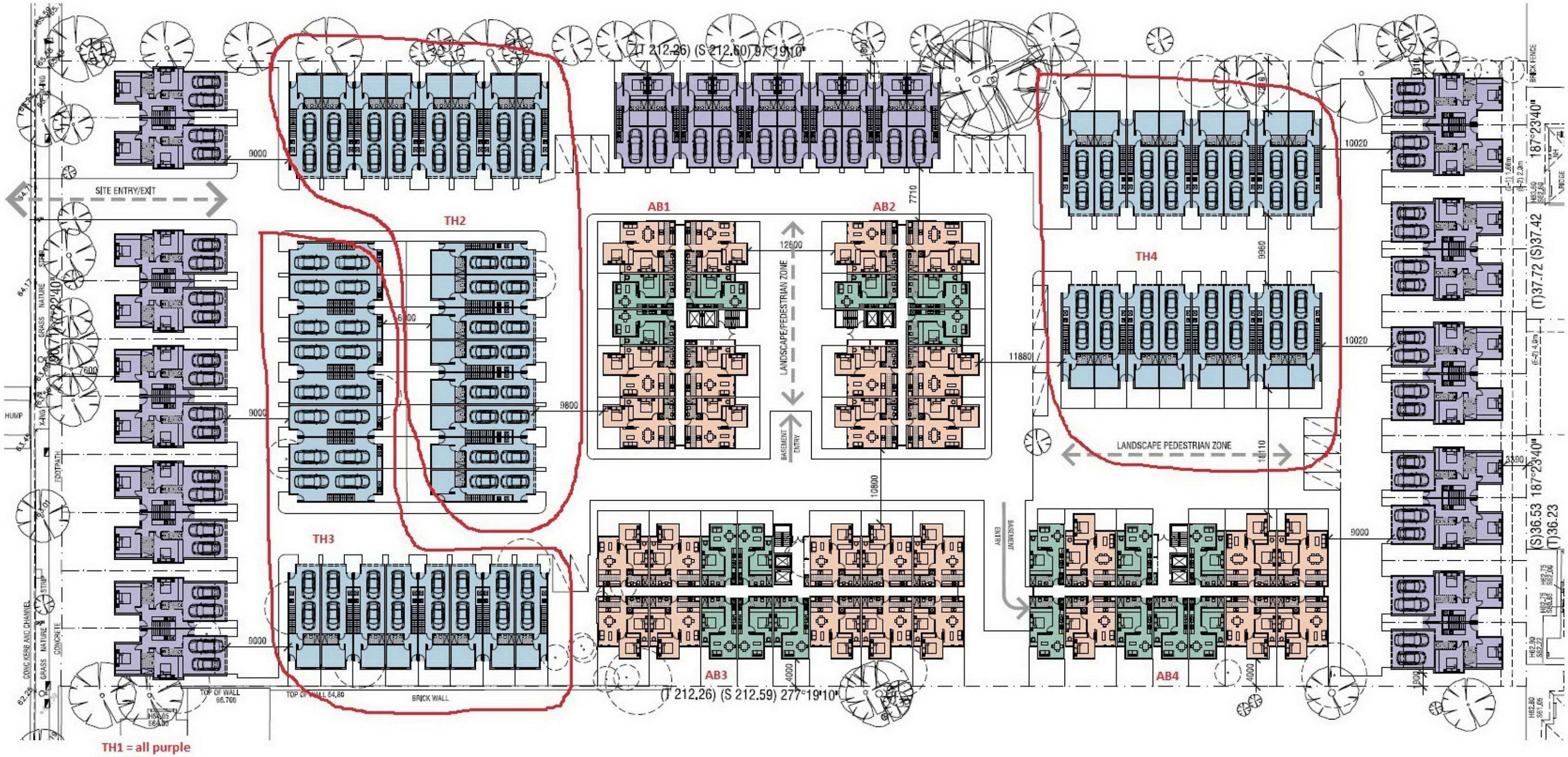
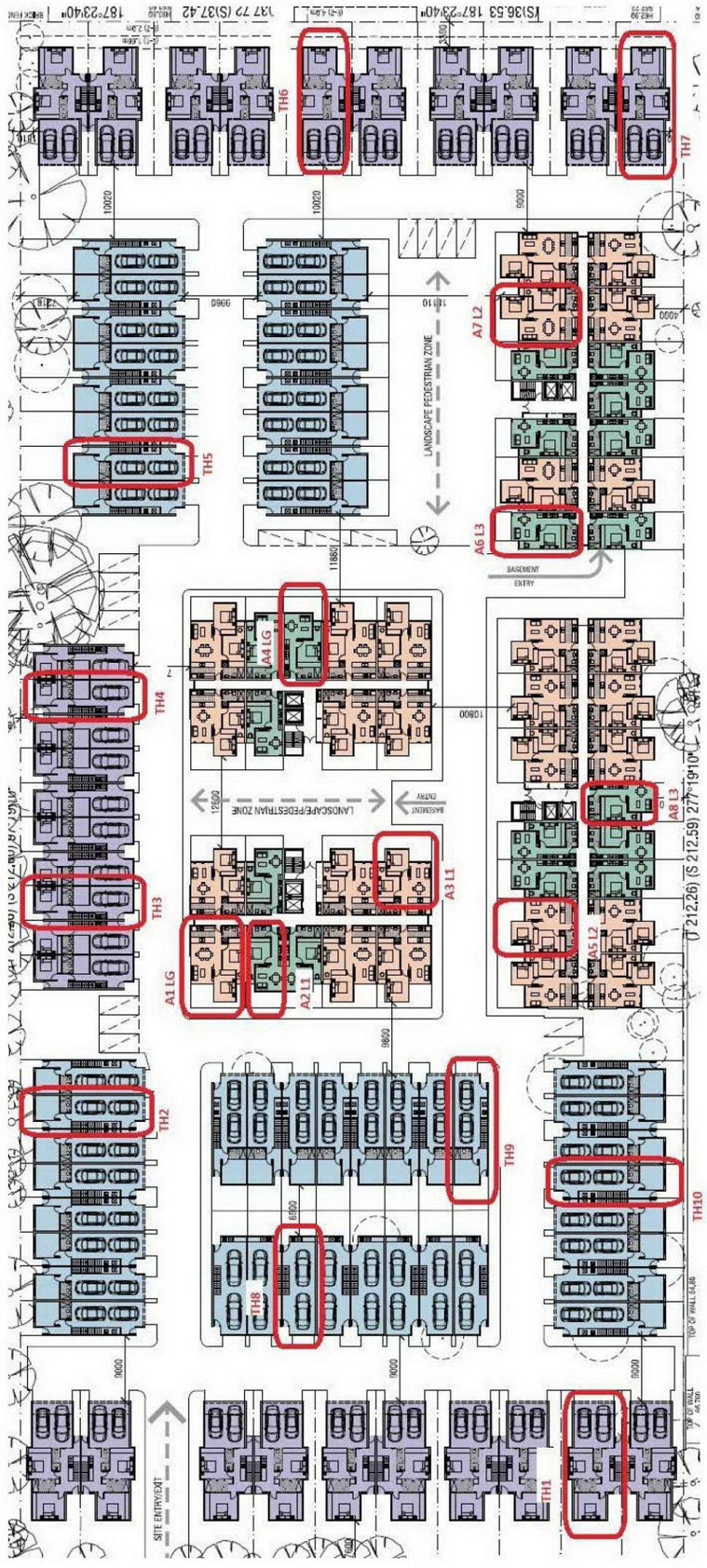
D19-334480



TH1 = all purple buildings

D19-334480



SAMPLE UNIT RATINGS

D19-334480

7 Commercial Drive
Lynbrook 3975
T: 1300 033 343
E: admin@energylab.com.au
www.energylab.com.au

SAMPLE UNITS – 29 BROWNS ROAD, CLAYTON

Summary of Results

Unit No.	Star Rating	Unit No.	Star Rating
TH1	6.0	A1	5.6
TH2	6.0	A2	6.8
TH3	6.0	A3	5.0
TH4	6.0	A4	6.1
TH5	6.0	A5	6.6
TH6	6.0	A6	6.6
TH7	6.0	A7	6.4
TH8	6.2	A8	5.5
TH9	6.0	THM2	6.1
TH10	6.1		
Average 6.0 stars estimated			

6-Star Energy Report Inclusions

Indicative Energy Efficiency items for all units: (refer to spreadsheet data for specific inclusions)

- Wall insulation to reach R2.0 – R2.5 + foil (no foil to party walls)
- Ceiling insulation to reach R2.5 – R6.0
- Intermediate floor insulation required to selected townhouses
- Suspended slab insulation required to all ground floor apartments
- Windows to be glazed in accordance with spreadsheet data for sample apartments
- Weatherseals to entry doors and windows
- Gaps and cracks to be sealed
- Exhaust fans to be sealed

Sharelle Haines
VIC/BDAV/11/2078

7 Commercial Drive
Lynbrook VIC 3975
T: 1300 033 343
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Sample Townhouses / 29 Browns Road, Clayton

	HEATING	COOLING	STAR RATIN	N.C.F.A	Wall ins.	Floor Ins. b/w ground & 1st floors	Ceiling Ins	DG windows	
TH1	103.6	18.4	6.0	133.2	2.5	2.5	5.0	all	2 storey TH semi
TH2	108.8	14.8	6.0	119.2	2.0	0.0	2.5	none	3 storey TH
TH3	106.4	17.3	6.0	69.7	2.5	2.5	6.0	all bedrooms	2 storey TH
TH4	106.5	17.9	6.0	69.1	2.5	2.5	6.0	all bedrooms	2 storey TH
TH5	109.5	14.1	6.0	119.3	2.0	0.0	2.5	none	3 storey TH
TH6	104.9	19.4	6.0	132.8	2.5	2.5	6.0	all	2 storey TH semi
TH7	104.4	19.8	6.0	132.8	2.5	2.5	6.0	All DG A&L (3.	2 storey TH semi
TH8	95.8	21.1	6.2	88.6	2.0	2.5	2.5	none	3 storey TH
TH9	103.6	20.1	6.0	119.5	2.5	2.5	6.0	Bedroom 1 an	2 storey TH semi
TH10	111.2	13.8	6.0	119.4	2.0	2.5	2.5	none	3 storey TH
TH2-M	101.6	18.4	6.1	149.0	2.0	0.0	2.5	NONE	2 storey TH
SUM	1156.3	195.1	66.3	1252.6					
AVERAGE	105.1	17.7	6.0	113.9					

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Sample Apartments / 29 Browns Road, Clayton

	HEATING	COOLING	STAR RATING	N.C.F.A	Wall ins.	Floor Ins. Over carpark	Ceiling Ins	DG windows	floor no.
A1	115.0	21.5	5.6	62.2	2.0	1.2	0.0	none	ground
A2	80.4	16.4	6.8	40.6	2.0	0.0	0.0	none	1st floor
A3	144.3	20.3	5.0	62.2	2.0	0.0	0.0	900mm bedroom window	1st floor
A4	108.2	13.4	6.1	40.6	2.0	1.2	0.0	none	ground
A5	88.8	12.6	6.6	54.5	2.0	0.0	0.0	none	2nd floor
A6	84.9	16.6	6.6	40.3	2.0	0.0	4.0	none	3rd floor
A7	97.1	12.1	6.4	61.7	2.0	0.0	0.0	none	2nd floor
A8	121.8	21.9	5.5	36.3	2.0	0.0	4.0	none	3rd floor
SUM	840.5	134.8	48.6	398.4					
AVERAGE	105.1	16.9	6.1	49.8					

Provisional Diagnostic Information

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Apartment 1/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	13-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	136.5
Heating	115.0
Cooling	21.5

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	62.2
Unconditioned Room Area	0.0
Garage Area	0.0

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Bedroom 2	12.7	bedroom	Y
Bedroom 1	14.4	bedroom	Y
Kitchen/Living	30.3	kitchen	Y
Bathroom	4.8	otherDayCond	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	2.0	1	63.9
Party Wall	4.0	0	18.6

Floors

Type	Insulation	Ventilation	Area (m²)
SuspSlab	1.2	encl	62.2

Roofs/Ceilings

Type	Insulation	Area (m²)
Slab:Slab - Suspended Slab	0.0	62.2

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	29.52

Window Directions

Direction	Area (m²)
N	13.9
W	15.6

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	2	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Bathroom	249.8	1211.3	0.0	0.0
Kitchen/Living	107.1	3242.1	37.0	1121.7
Bedroom 2	238.2	3028.2	25.9	329.3
Bedroom 1	30.2	433.8	2.0	28.3

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Apartment 2/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	13-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	96.8
Heating	80.4
Cooling	16.4

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	40.6
Unconditioned Room Area	0.0
Garage Area	0.0

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Kitchen/Living	21.2	kitchen	Y
Bedroom	14.6	bedroom	Y
Bathroom	4.8	otherDayCond	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Party Wall	4.0	0	39.1
Brick Veneer	2.0	1	25.6

Floors

Type	Insulation	Ventilation	Area (m²)
SuspSlab	0.0	encl	40.6

Roofs/Ceilings

Type	Insulation	Area (m²)
Slab:Slab - Suspended Slab	0.0	40.6

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	10.32

Window Directions

Direction	Area (m²)
W	10.3

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	2	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Bathroom	122.8	590.8	0.2	0.9
Kitchen/Living	127.2	2692.8	30.8	652.4
Bedroom	5.5	80.2	2.2	31.8

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Assessor's Accreditation Number:VIC/BDAV/11/2078

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Deign Studio
Rated Address	Sample Apartment 3/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	13-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	164.6
Heating	144.3
Cooling	20.3

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	62.2
Unconditioned Room Area	0.0
Garage Area	0.0

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Bedroom 2	12.7	bedroom	Y
Bedroom 1	14.4	bedroom	Y
Kitchen/Living	30.3	kitchen	Y
Bathroom	4.8	otherDayCond	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	2.0	1	63.9
Party Wall	4.0	0	18.6

Floors

Type	Insulation	Ventilation	Area (m²)
SuspSlab	0.0	encl	62.2

Roofs/Ceilings

Type	Insulation	Area (m²)
Slab:Slab - Suspended Slab	0.0	62.2

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	27.36
Generic 15: Aluminium improved double-glazed: clear/6 air gap/clear: U = 3.95: SHGC = 0.68	3.95	0.68	2.13

Window Directions

Direction	Area (m²)
S	13.9
E	15.6

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	2	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Bathroom	139.9	678.2	0.5	2.6
Kitchen/Living	184.4	5583.9	33.7	1020.7
Bedroom 2	251.6	3198.1	23.1	293.6
Bedroom 1	9.6	137.7	2.5	35.4

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Apartment 4/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	13-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	121.5
Heating	108.2
Cooling	13.4

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	40.6
Unconditioned Room Area	0.0
Garage Area	0.0

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Kitchen/Living	21.2	kitchen	Y
Bedroom	14.6	bedroom	Y
Bathroom	4.8	otherDayCond	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Party Wall	4.0	0	39.1
Brick Veneer	2.0	1	25.6

Floors

Type	Insulation	Ventilation	Area (m²)
SuspSlab	1.2	encl	40.6

Roofs/Ceilings

Type	Insulation	Area (m²)
Slab:Slab - Suspended Slab	0.0	40.6

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	10.32

Window Directions

Direction	Area (m²)
E	10.3

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	2	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Bathroom	259.4	1248.6	0.0	0.0
Kitchen/Living	148.6	3146.1	26.2	554.9
Bedroom	13.1	191.6	0.8	12.1

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Apartment 5/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	13-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	101.4
Heating	88.8
Cooling	12.6

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	54.5
Unconditioned Room Area	0.0
Garage Area	0.0

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Bedroom 1	12.0	bedroom	Y
Bedroom 2	10.6	bedroom	Y
Bathroom	4.8	otherDayCond	Y
Kitchen/Living	27.1	kitchen	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	2.0	1	42.4
Party Wall	4.0	0	33.6

Floors

Type	Insulation	Ventilation	Area (m²)
SuspSlab	0.0	encl	54.5

Roofs/Ceilings

Type	Insulation	Area (m²)
Slab:Slab - Suspended Slab	0.0	54.5

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	19.44

Window Directions

Direction	Area (m²)
N	15.6
E	3.8

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	2	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Bathroom	146.9	699.5	0.5	2.3
Kitchen/Living	68.3	1851.4	16.0	433.0
Bedroom 2	214.1	2271.0	23.2	246.5
Bedroom 1	18.9	227.1	2.9	34.3

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Assessor's Accreditation Number:VIC/BDAV/11/2078

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Apartment 6/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	13-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	101.5
Heating	84.9
Cooling	16.6

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	40.3
Unconditioned Room Area	0.0
Garage Area	0.0

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Bedroom	14.5	bedroom	Y
Kitchen/Living	21.0	kitchen	Y
Bathroom	4.8	otherDayCond	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	2.0	1	46.1
Party Wall	4.0	0	18.4

Floors

Type	Insulation	Ventilation	Area (m²)
SuspSlab	0.0	encl	40.3

Roofs/Ceilings

Type	Insulation	Area (m²)
Framed:Flat - Flat Framed (Metal Deck)	4.0	40.3

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	10.32

Window Directions

Direction	Area (m²)
N	10.3

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	2	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Bathroom	222.5	1058.0	2.4	11.2
Bedroom	32.8	476.4	6.2	90.5
Kitchen/Living	111.1	2334.4	31.2	656.0

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Apartment 7/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	13-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	109.2
Heating	97.1
Cooling	12.1

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	61.7
Unconditioned Room Area	0.0
Garage Area	0.0

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Kitchen/Living	30.1	kitchen	Y
Bathroom	4.8	otherDayCond	Y
Bedroom 1	14.3	bedroom	Y
Bedroom 2	12.5	bedroom	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Party Wall	4.0	0	37.2
Brick Veneer	2.0	1	45.6

Floors

Type	Insulation	Ventilation	Area (m²)
SuspSlab	0.0	encl	61.7

Roofs/Ceilings

Type	Insulation	Area (m²)
Slab:Slab - Suspended Slab	0.0	61.7

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	21.12

Window Directions

Direction	Area (m²)
N	15.8
W	5.3

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	2	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Bathroom	148.7	712.6	0.6	2.8
Kitchen/Living	76.3	2298.9	14.2	427.5
Bedroom 2	238.3	2987.9	24.6	308.5
Bedroom 1	16.4	234.0	2.7	39.0

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Apartment 8/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	13-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	143.7
Heating	121.8
Cooling	21.9

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	36.3
Unconditioned Room Area	0.0
Garage Area	0.0

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Kitchen/Living	21.2	kitchen	Y
Bathroom	5.1	otherDayCond	Y
Bedroom	10.0	bedroom	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Party Wall	4.0	0	24.8
Brick Veneer	2.0	1	33.7

Floors

Type	Insulation	Ventilation	Area (m²)
SuspSlab	0.0	encl	36.3

Roofs/Ceilings

Type	Insulation	Area (m²)
Framed:Flat - Flat Framed (Metal Deck)	4.0	36.3

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	12.96

Window Directions

Direction	Area (m²)
S	13.0

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	2	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Bathroom	188.8	968.5	5.2	26.5
Kitchen/Living	135.3	2866.9	34.3	727.4
Bedroom	126.5	1261.7	16.1	161.0

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Assessor's Accreditation Number:VIC/BDAV/11/2078

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 1/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	122.0
Heating	103.6
Cooling	18.4

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	133.2
Unconditioned Room Area	0.0
Garage Area	34.1

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	34.1	garage	N
Pdr1	2.9	otherDayCond	Y
Entry	15.7	otherDayCond	Y
Bedroom 2	14.9	bedroom	Y
Bathroom 1	5.4	otherDayCond	Y
Bedroom 1	16.0	bedroom	Y
Stairs1	2.8	otherDayCond	Y
Bedroom 3	14.7	bedroom	Y
Bathroom 2	4.5	otherDayCond	Y
Bedroom 4	11.5	bedroom	Y
Passage	10.1	otherDayCond	Y
Pdr2	2.3	otherDayCond	Y
Stairs2	3.8	otherDayCond	Y

Kitchen/Living	30.5	kitchen	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	39.3
Brick Veneer	2.5	1	130.5
Party Wall	4.0	0	36.5

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	91.9
Timber	2.5	encl	77.4

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	78.2
Framed:Flat - Flat Framed (Metal Deck)	0.0	9.0
Framed:Flat - Flat Framed (Metal Deck)	5.0	82.1

Windows

Type	U-Value	SHGC	Area (m²)
Generic 15: Aluminium improved double-glazed: clear/6 air gap/clear: U = 3.95: SHGC = 0.68	3.95	0.68	25.95

Window Directions

Direction	Area (m²)
W	7.2
N	5.8
E	13.0

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	5	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Kitchen/Living	73.1	2231.8	65.1	1987.7
Bathroom 2	213.1	961.7	12.4	55.9
Passage	92.5	938.5	1.9	19.3
Bedroom 3	48.2	706.1	22.9	335.8
Bedroom 2	30.4	451.7	1.6	24.2
Bedroom 1	57.8	926.5	10.6	169.9
Pdr2	142.6	325.9	1.2	2.7
Entry	296.0	4655.8	1.0	15.8
Bedroom 4	16.2	186.5	9.0	103.4
Pdr1	380.4	1108.8	0.8	2.4
Stairs2	62.9	237.8	0.4	1.7
Stairs1	225.7	641.1	0.0	0.0
Bathroom 1	364.1	1973.8	0.7	3.6

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Provisional Diagnostic Information

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 2/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	123.5
Heating	108.8
Cooling	14.8

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	119.2
Unconditioned Room Area	0.0
Garage Area	38.3

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	38.3	garage	N
Bedroom 1	10.9	bedroom	Y
Bathroom 1	3.4	otherDayCond	Y
Entry	8.2	otherDayCond	Y
Kitchen/Living	37.5	kitchen	Y
Bathrooom 2	3.7	otherDayCond	Y
Bedroom 2	14.9	bedroom	Y
Bedroom 3	15.0	bedroom	Y
Bathroom 3	4.6	otherDayCond	Y
Landing	10.3	otherDayCond	Y
Bedroom 4	15.0	bedroom	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	47.7
Brick Veneer	2.0	1	24.1
Party Wall	4.0	0	138.0
Fibro Clad Framed	2.0	0	34.4

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	60.8
Timber	0.0	encl	101.0

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	100.4
Framed:Flat - Flat Framed (Metal Deck)	2.5	61.4

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	24.87

Window Directions

Direction	Area (m²)
N	17.4
S	7.5

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	4	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Entry	283.6	2335.0	0.0	0.0
Bedroom 4	94.9	1421.3	13.2	198.2

Bedroom 4	94.9	1421.3	15.2	198.2
Kitchen/Living	89.9	3368.7	31.5	1179.9
Bathroom 3	169.7	786.9	8.8	40.9
Bathrooom 2	248.7	926.9	4.4	16.3
Bathroom 1	305.6	1047.3	0.1	0.2
Landing	125.8	1300.6	6.7	69.5
Bedroom 3	71.8	1077.0	12.6	189.6
Bedroom 2	77.3	1147.8	9.6	142.5
Bedroom 1	48.8	529.6	5.0	54.4

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 3/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	123.7
Heating	106.4
Cooling	17.3

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	69.7
Unconditioned Room Area	0.0
Garage Area	32.7

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	32.7	garage	N
Bedroom 1	11.4	bedroom	Y
Bathroom 1	3.5	otherDayCond	Y
Entry	7.7	otherDayCond	Y
Kitchen/Living	31.0	kitchen	Y
Bathroom 2	3.8	otherDayCond	Y
Bedroom 2	14.8	bedroom	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	42.5
Party Wall	4.0	0	80.6
Brick Veneer	2.5	1	27.1

Fibro Clad Framed	2.5	0	10.8

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	55.4
Timber	2.5	encl	49.6

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	49.0
Framed:Flat - Flat Framed (Metal Deck)	6.0	56.0

Windows

Type	U-Value	SHGC	Area (m²)
Generic 15: Aluminium improved double-glazed: clear/6 air gap/clear: U = 3.95: SHGC = 0.68	3.95	0.68	5.28
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	10.56

Window Directions

Direction	Area (m²)
N	13.2
S	2.6

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	3	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Entry	336.7	2600.5	0.0	0.0
Kitchen/Living	86.7	2691.0	40.4	1252.7
Bathroom 2	195.5	734.1	3.7	13.9
Bathroom 1	379.8	1333.8	0.0	0.0
Bedroom 2	52.8	782.3	7.4	110.3
Bedroom 1	41.5	473.5	2.4	27.0

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 4/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	124.4
Heating	106.5
Cooling	17.9

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	69.1
Unconditioned Room Area	0.0
Garage Area	32.7

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	32.7	garage	N
Bedroom 1	11.4	bedroom	Y
Bathroom 1	3.5	otherDayCond	Y
Entry	7.7	otherDayCond	Y
Kitchen/Living	31.0	kitchen	Y
Bathroom 2	3.8	otherDayCond	Y
Bedroom 2	14.8	bedroom	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	42.5
Brick Veneer	2.5	1	27.1
Party Wall	4.0	0	80.6
Fibro Clad Framed	2.5	0	10.8

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	55.4
Timber	2.5	encl	49.6

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	49.0
Framed:Flat - Flat Framed (Metal Deck)	6.0	56.0

Windows

Type	U-Value	SHGC	Area (m²)
Generic 15: Aluminium improved double-glazed: clear/6 air gap/clear: U = 3.95: SHGC = 0.68	3.95	0.68	5.28
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	10.56

Window Directions

Direction	Area (m²)
N	13.2
S	2.6

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	3	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Entry	337.3	2605.2	0.0	0.0
Kitchen/Living	85.5	2653.9	41.5	1288.4
Bathroom 2	190.4	715.1	4.0	15.1
Bathroom 1	379.0	1330.9	0.0	0.0

Bedroom 2	52.5	777.3	7.5	111.5
Bedroom 1	41.5	473.7	2.4	27.0

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 5/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	123.6
Heating	109.5
Cooling	14.1

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	119.3
Unconditioned Room Area	0.0
Garage Area	38.3

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	38.3	garage	N
Bedroom 1	10.9	bedroom	Y
Bathroom 1	3.4	otherDayCond	Y
Entry	8.2	otherDayCond	Y
Kitchen/Living	37.5	kitchen	Y
Bathrooom 2	3.7	otherDayCond	Y
Bedroom 2	14.9	bedroom	Y
Bedroom 3	15.0	bedroom	Y
Bathroom 3	4.6	otherDayCond	Y
Landing	10.3	otherDayCond	Y
Bedroom 4	15.0	bedroom	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	47.7
Brick Veneer	2.0	1	24.1
Party Wall	4.0	0	138.0
Fibro Clad Framed	2.0	0	34.4

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	60.8
Timber	0.0	encl	101.0

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	100.4
Framed:Flat - Flat Framed (Metal Deck)	2.5	61.4

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	24.87

Window Directions

Direction	Area (m²)
N	17.4
S	7.5

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	4	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Entry	283.3	2333.1	0.0	0.0
Bedroom 4	95.1	1423.2	13.3	198.4
Kitchen/Living	92.4	3460.4	29.0	1085.1
Bathroom 3	170.4	790.1	8.8	40.9
Bathrooom 2	251.6	937.7	4.4	16.5
Bathroom 1	306.4	1049.9	0.1	0.2
Landing	126.2	1304.6	6.7	69.5
Bedroom 3	72.1	1080.9	12.6	189.6
Bedroom 2	77.6	1152.2	9.9	146.9
Bedroom 1	47.4	514.2	5.5	60.0

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Provisional Diagnostic Information

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 6/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	124.5
Heating	104.4
Cooling	20.1

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	132.8
Unconditioned Room Area	0.0
Garage Area	34.1

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	34.1	garage	N
Pdr1	2.9	otherDayCond	Y
Entry	15.7	otherDayCond	Y
Bedroom 2	14.9	bedroom	Y
Bathroom 1	5.4	otherDayCond	Y
Bedroom 1	16.0	bedroom	Y
Stairs1	2.8	otherDayCond	Y
Bedroom 3	14.7	bedroom	Y
Bathroom 2	4.5	otherDayCond	Y
Bedroom 4	11.5	bedroom	Y
Passage	10.1	otherDayCond	Y
Pdr2	2.3	otherDayCond	Y
Stairs2	3.8	otherDayCond	Y
Kitchen/Living	30.5	kitchen	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	39.3
Brick Veneer	2.5	1	130.5
Party Wall	4.0	0	36.5

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	91.9
Timber	2.5	encl	46.9
Timber	4.1	encl	30.5

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	78.2
Framed:Flat - Flat Framed (Metal Deck)	0.0	9.0
Framed:Flat - Flat Framed (Metal Deck)	6.0	82.1

Windows

Type	U-Value	SHGC	Area (m²)
Generic 15: Aluminium improved double-glazed: clear/6 air gap/clear: U = 3.95: SHGC = 0.68	3.95	0.68	25.95

Window Directions

Direction	Area (m²)
E	7.2
N	5.8
W	13.0

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	5	0
Downlight	0	0
Chimney	0	0

Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Kitchen/Living	91.5	2791.7	77.7	2371.1
Bathroom 2	193.1	871.6	13.8	62.2
Passage	88.0	893.6	1.9	18.8
Bedroom 3	38.6	566.5	16.8	245.8
Bedroom 2	29.9	443.9	2.2	32.9
Bedroom 1	53.9	863.1	7.5	119.5
Pdr2	138.1	315.7	1.5	3.5
Entry	293.6	4617.7	0.6	9.3
Bedroom 4	15.4	177.5	9.0	103.6
Pdr1	376.6	1097.5	0.9	2.6
Stairs2	65.4	247.2	0.4	1.5
Stairs1	226.5	643.3	0.0	0.0
Bathroom 1	349.9	1897.1	0.7	3.6

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Assessor's Accreditation Number:VIC/BDAV/11/2078

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 7/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	124.2
Heating	104.4
Cooling	19.8

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	132.8
Unconditioned Room Area	0.0
Garage Area	34.1

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	34.1	garage	N
Pdr1	2.9	otherDayCond	Y
Entry	15.7	otherDayCond	Y
Bedroom 2	14.9	bedroom	Y
Bathroom 1	5.4	otherDayCond	Y
Bedroom 1	16.0	bedroom	Y
Stairs1	2.8	otherDayCond	Y
Bedroom 3	14.7	bedroom	Y
Bathroom 2	4.5	otherDayCond	Y
Bedroom 4	11.5	bedroom	Y
Passage	10.1	otherDayCond	Y
Pdr2	2.3	otherDayCond	Y
Stairs2	3.8	otherDayCond	Y

Kitchen/Living	30.5	kitchen	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	39.3
Brick Veneer	2.5	1	130.5
Party Wall	4.0	0	36.5

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	91.9
Timber	2.5	encl	77.4

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	78.2
Framed:Flat - Flat Framed (Metal Deck)	0.0	9.0
Framed:Flat - Flat Framed (Metal Deck)	6.0	82.1

Windows

Type	U-Value	SHGC	Area (m²)
A&L: Aluminium Awning Window - Double Glazed: 3mm Clear/12mm Air Gap/3mm Clear	3.31	0.69	25.95

Window Directions

Direction	Area (m²)
E	7.2
S	5.8
W	13.0

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	5	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Kitchen/Living	85.0	2593.9	76.9	2347.2
Bathroom 2	206.6	932.6	12.7	57.1
Passage	94.0	953.8	1.6	16.6
Bedroom 3	33.4	489.4	17.3	253.4
Bedroom 2	39.0	579.9	1.3	18.7
Bedroom 1	50.4	808.1	7.8	124.7
Pdr2	137.4	314.2	1.3	2.9
Entry	266.1	4185.7	0.7	10.8
Bedroom 4	16.2	186.6	8.1	93.1
Pdr1	466.3	1359.2	0.5	1.6
Stairs2	64.8	245.1	0.4	1.4
Stairs1	223.8	635.7	0.0	0.0
Bathroom 1	394.0	2136.1	0.3	1.7

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 8/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	116.9
Heating	95.8
Cooling	21.1

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	88.6
Unconditioned Room Area	0.0
Garage Area	57.5

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	57.5	garage	N
Kitchen/Living	33.9	kitchen	Y
Bathroom 1	3.7	otherDayCond	Y
Bedroom 1	11.9	bedroom	Y
Bedroom 3	14.1	bedroom	Y
Bathroom 2	3.9	otherDayCond	Y
Bedroom 2	13.3	bedroom	Y
Landing	9.3	otherDayCond	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	85.9
Fibro Clad Framed	2.0	0	32.1
Party Wall	4.0	0	95.8
Brick Veneer	2.0	1	13.9

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	57.5
Timber	2.5	encl	49.5
Timber	0.0	encl	40.5

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	98.8
Framed:Flat - Flat Framed (Metal Deck)	2.5	48.7

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	21.96

Window Directions

Direction	Area (m²)
W	15.1
E	6.8

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	3	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Kitchen/Living	111.3	3771.7	34.5	1170.1
Bathroom 2	191.4	739.8	12.4	48.0
Bathroom 1	177.5	665.7	10.0	37.6
Landing	133.2	1236.9	8.8	81.8

Landing	133.3	1236.9	6.8	81.8
Bedroom 3	96.4	1357.5	19.9	279.8
Bedroom 2	89.9	1195.5	20.0	265.5
Bedroom 1	54.6	647.7	19.9	236.2

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 9/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	123.8
Heating	103.6
Cooling	20.2

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	119.5
Unconditioned Room Area	0.0
Garage Area	38.7

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	38.7	garage	N
Entry	8.4	otherDayCond	Y
Bathroom	3.5	otherDayCond	Y
Bedroom 1	11.0	bedroom	Y
Bedroom 2	14.6	bedroom	Y
Bathroom 2	3.7	otherDayCond	Y
Kitchen/Living	37.4	kitchen	Y
Bedroom 3	15.0	bedroom	Y
Bathroom 3	4.6	otherDayCond	Y
Landing	11.9	otherDayCond	Y
Bedroom 4	13.3	bedroom	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	47.9
Brick Veneer	2.5	1	98.2
Party Wall	4.0	0	66.5
Fibro Clad Framed	2.5	0	32.0

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	61.5
Timber	2.5	encl	55.6
Timber	0.0	encl	44.8

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	100.6
Framed:Flat - Flat Framed (Metal Deck)	0.0	6.4
Framed:Flat - Flat Framed (Metal Deck)	6.0	55.0

Windows

Type	U-Value	SHGC	Area (m²)
Generic 15: Aluminium improved double-glazed: clear/6 air gap/clear: U = 3.95: SHGC = 0.68	3.95	0.68	5.28
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	18.84

Window Directions

Direction	Area (m²)
W	9.5
E	14.6

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	4	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Entry	452.3	3805.0	0.8	6.5
Bedroom 4	68.8	918.8	30.4	405.2
Bathroom	421.5	1466.1	0.3	0.9
Bathroom 2	145.3	534.1	5.7	21.0
Kitchen/Living	79.1	2956.3	38.6	1440.8
Bathroom 3	161.9	747.0	8.2	37.9
Landing	113.9	1351.2	6.4	76.5
Bedroom 3	76.6	1148.6	21.5	321.9
Bedroom 2	28.7	419.0	15.2	221.7
Bedroom 1	49.4	542.9	15.7	172.3

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FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 10/29 Browns Road Clayton
Accredited Rater	Sharelle Haines
Date	11-08-15
Reference	

Energy Usage

Type	Energy MJ/m²
Total	121.2
Heating	107.0
Cooling	14.2

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	119.4
Unconditioned Room Area	0.0
Garage Area	38.2

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	38.2	garage	N
Bedroom 1	10.9	bedroom	Y
Bathroom 1	3.4	otherDayCond	Y
Entry	8.2	otherDayCond	Y
Kitchen/Living	37.9	kitchen	Y
Bathroom 2	3.7	otherDayCond	Y
Bedroom 2	14.8	bedroom	Y
Bedroom 3	15.0	bedroom	Y
Bathroom 3	4.6	otherDayCond	Y
Landing	11.9	otherDayCond	Y
Bedroom 4	13.4	bedroom	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	0.0	0	47.6
Brick Veneer	2.0	1	24.2
Party Wall	4.0	0	138.1
Fibro Clad Framed	2.0	0	34.4

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	60.8
Timber	2.5	encl	56.4
Timber	0.0	encl	45.0

Roofs/Ceilings

Type	Insulation	Area (m²)
Ceil: Ceiling	0.0	101.1
Framed:Flat - Flat Framed (Metal Deck)	0.0	5.4
Framed:Flat - Flat Framed (Metal Deck)	2.5	55.6

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	24.24

Window Directions

Direction	Area (m²)
S	9.5
N	14.8

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	4	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
Entry	365.4	3008.6	0.0	0.0
Bedroom 4	74.5	1001.4	13.4	180.4
Kitchen/Living	70.2	2658.2	29.4	1113.1
Bathroom 2	154.6	578.3	4.5	16.8
Bathroom 3	181.8	842.8	8.5	39.5
Bathroom 1	424.5	1454.9	0.0	0.0
Landing	115.2	1371.1	6.6	78.8
Bedroom 3	91.1	1365.1	13.3	199.7
Bedroom 2	45.0	666.0	10.6	156.9
Bedroom 1	72.5	786.6	3.7	39.7

Provisional Diagnostic Information 18-08-2015 13:15:11 Ver:5.1.11c Engine Ver:2.13 Accredited Rater:Sharelle Haines
Assessor's Accreditation Number:VIC/BDAV/11/2078

FirstRate® Provisional Diagnostic Information

Project Information

Mode	New Home
Climate	62 Moorabbin Airport
Site Exposure	suburban
Client Name	Mushan Design Studio
Rated Address	Sample Townhouse 2 / Moriah Street Clayton
Accredited Rater	Sharelle Haines
Date	01-10-2015
Reference	MOR-SAMPLE-TH2

Energy Usage

Type	Energy MJ/m²
Total	120.0
Heating	101.6
Cooling	18.4

Areas

Area	Size (m²)
Net Conditioned Floor Area (NCFA)	149.0
Unconditioned Room Area	16.2
Garage Area	35.2

Zones

Zone	Area (m²)	Conditioning Type	Conditioned
Garage	35.2	garage	N
bed1	12.9	bedroom	Y
kitch-din-liv	58.3	kitchen	Y
stairwell	4.9	otherDayCond	Y
entry	3.6	otherDayCond	Y
laundry	7.1	otherDayCond	N
hall2	3.7	otherDayCond	Y
wc	2.2	otherDayCond	N
ens	4.0	otherNightCond	Y
bed2	11.9	bedroom	Y
retreat	17.5	living	Y
master	18.2	bedroom	Y
bed3	12.6	bedroom	Y

bath	6.9	otherDayCond	N
ens2	4.0	otherNightCond	Y

Walls

Type	Insulation	Num Reflective Airgaps	Area (m²)
Brick Veneer	2.0	0	224.7

Floors

Type	Insulation	Ventilation	Area (m²)
CSOG: Slab on Ground	0.0	encl	131.7
Timber	0.0	encl	71.2

Roofs/Ceilings

Type	Insulation	Area (m²)
Framed:Flat - Flat Framed (Metal Deck)	0.0	35.2
Ceil: Ceiling	0.0	80.5
Framed:Flat - Flat Framed (Metal Deck)	2.5	16.0
Cont:Attic-Continuous	2.5	71.2

Windows

Type	U-Value	SHGC	Area (m²)
Generic 02: Aluminium improved single-glazed: clear glass: U = 6.35: SHGC = 0.77	6.35	0.77	32.91

Window Directions

Direction	Area (m²)
S	8.8
N	22.3
E	1.8

Air leakage

Item	Sealed	Unsealed
Generic Vent	-	0
Unflued Gas Heater	-	0
Exhaust Fan	0	0
Downlight	0	0
Chimney	0	0
Heater Flue	-	0

Zone Energy Loads

Zone	Heating (MJ/m2)	Total Heating (MJ)	Cooling (MJ/m2)	Total Cooling (MJ)
retreat	124.5	2184.6	13.9	243.5
entry	411.5	1468.6	2.4	8.6
ens2	140.8	563.5	27.0	107.9
kitch-din-liv	102.4	5965.2	34.7	2022.7
stairwell	151.7	747.8	0.1	0.5
ens	65.1	259.8	1.6	6.5
bed3	83.1	1046.2	11.9	150.0
bed1	66.5	854.3	6.2	80.1
hall2	352.9	1302.5	0.3	1.2
master	62.5	1138.9	10.7	194.5
bed2	82.7	982.6	15.5	184.5

Provisional Diagnostic Information 01-10-2015 15:50:00 Ver:5.1.11c Engine Ver:2.13 Accredited Rater:Sharelle Haines Assessor's Accreditation Number:VIC/BDAV/11/2078

Appendix E: Stormwater Management Plan

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4.4 Existing Site Peak Flow Estimate

4.4.1 Existing Site Catchment Plan

The existing site catchment plan is illustrated in Figure 4-3.

Figure 4-3 Pre-Development Catchment Plan

Area take-off for the pre-developed site is provided in Table 3-1.

Table 3.1 Pre-Development Site Catchment Areas

Catch	Total Area (m^2)	Hard Pavement			Roof			Grass Surface			Total	
		Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Eff. Imp Area (m^2)	C_v
1	20,106	5,067	90%	4,560	1,805	100%	1,805	13,166	15%	1,975	**8,340**	**41%**

The impervious fraction of the existing site for the use in hydrological calculations has been calculated to be 41%.

Calculation of 5 year ARI peak flows for the existing site catchment has been calculated from the XPSWMM model discussed above.

Multiple storm durations have been trialled to identify the peak value for catchment. The peak rate of discharge was found to result from the 30 minute storm duration with values 126 litres/sec.

Refer discharge hydrographs presented in Figures 4-4 below.

document control

project name Proposed Residential Development - 29 Browns Road, Clayton

project number 14ME0779

Revision	Date	File name 14ME0779-Rpt-SMP-pm1-R0.1.docx			
0	21/08/2015	Description Draft for Comment			
			Prepared	Checked	Approved
		Initial	PM1	LOT	PM1
1	15/09/2015	File name 14ME0779-Rpt-SMP-pm1-R1.docx			
		Description Final Report			
			Prepared	Checked	Approved
		Initial	PM1	LOT	PM1
2	07/10/2015	File name 14ME0779-Rpt-SMP-pm1-R2.docx			
		Description Final Report (Minor Revision)			
			Prepared	Checked	Approved
		Initial	PM1	LOT	PM1
		File name			
		Description			
			Prepared	Checked	Approved
		Initial			
		File name			
		Description			
			Prepared	Checked	Approved
		Initial			

contents

Proposed Residential Development
29 Browns Road, Clayton
Stormwater Management Plan

Glossary of Terms

Average Return Interval (ARI)	The average or expected value of the periods between exceedances of a given rainfall total accumulated over a given duration. Eg. 100 year ARI flood is expected to be exceeded every 100 years. It is implicit in this definition that the periods between exceedances are generally random.
Australian Height Datum (AHD)	A common national surface level datum approximately corresponding to mean sea level.
Catchment	Area draining to a site. It always relates to a particular location and may include the catchment of tributaries as well as main stream.
Discharge	The rate of flow of water measured in terms of volume over time.
Geographical Information Systems (GIS)	A system of software and procedures designed to support the management, manipulation, analysis and display of spatially referenced data.
Hydraulics	Is the topic in civil engineering with the mechanical properties water flow through such things as pipe drainage networks, dams rivers, stream and across land.
Hydrograph	A graph that shows the discharge to time relationship of a hydraulic flow at a particular location.
Hydrology	The term given to the study of the rainfall and runoff processes as it relates to the derivation of hydrographs for given floods.
Intensity Frequency Duration (IFD) Analysis	Statistical analysis, describing the rainfall intensity (mm/hr), frequency (probability measured by the AEP), duration (hrs). This analysis is used to generate design rainfall estimates.
Peak flow	The maximum discharge occurring during a flood event.
Legal Point of Discharge	The point which is specified by Council as the stormwater outlet point for an individual property,
Runoff	The amount of rainfall that actually ends up as stream or pipe flow, also known as rainfall excess.
Topography	A surface that describes the ground profiles of a chosen land area.
XP-SWMM	The hydrological and hydraulic model used in this study to simulate the site catchments runoff and flow of water through the pipe drainage network.

1 Introduction

1.1 General

This Stormwater Management Plan (SMP) has been prepared for the proposed residential development at 29 Browns Road, Clayton (referred to herein as The Development). The SMP has been prepared in support of the town planning application to the City of Monash Council being completed by Mushan Architects.

The SMP will provide details of the stormwater drainage scheme proposed for The Development and will demonstrate compliance with the Council's drainage requirements for the site as well as other relevant Australian Standards and best practice Water Sensitive Urban Design (WSUD) principles.

More specifically key aims of the SMP are to define:

- the Legal Point of Discharge for The Development;
- the design criteria for the on-site drainage in accordance with requirements of AS 3500;
- the stormwater drainage scheme plan for The Development including notional drainage alignments, building connection points, location of detention systems and WSUD features;
- on-site detention requirements including calculation of volumes required to meet Council requirements;

and to:

- outline the proposed WSUD systems to achieve pollution reduction targets set for the development.

2 Existing Site Conditions

2.1 Locality

The Development site is a disused secondary school at 29 Browns Road Clayton. The site fronts onto Browns Road and connects to the rear with Moriah Street in Clayton. The overall area of the Development site is 1.92 hectares.

2.1 Site Topography and Features

The Development site and surrounding area has been surveyed by Bosco Johnson and a topographical plan showing existing conditions is presented in Figure 2-1 below.

Inspection of the site was conducted by Peter Munzel of Irwinconsult in August 2015 and brief discussion on the site features follows.

The site topography generally falls from north-west to south-east with levels ranging from RL65.2m AHD to 60.3m AHD. The average grade across the site is ~2.2%. Grading of the site is even with no appreciable depressions or low lying land.

The site is currently occupied by a derelict school with old school building and infrastructure remaining that includes asphalt car parking and play areas, stormwater drainage, sewer and grassed playing fields. This remaining infrastructure will need to be demolished to make way for The Development

Proposed Residential Development
29 Browns Road, Clayton
Stormwater Management Plan

The remainder of the site is grassed and there a number of small to medium size gum trees dotted around the sites perimeter.

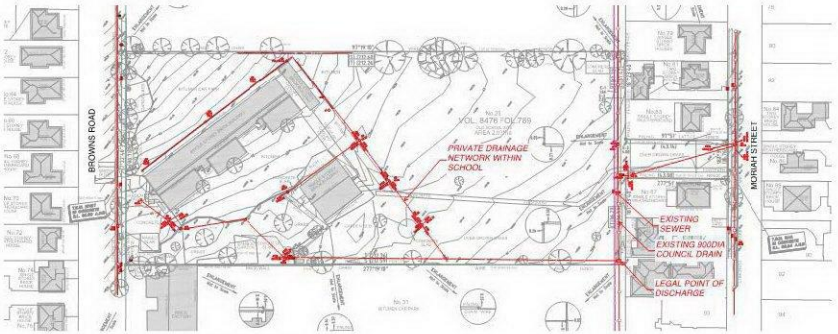


Figure 2-1 Existing Site Survey Plan

Through the visual inspection, the ground across the site was observed to be loamy clay in nature.

2.2 Existing Drainage

Asset records of existing Council drainage assets have been obtained from City of Monash and presented in Figure 2-2 below.

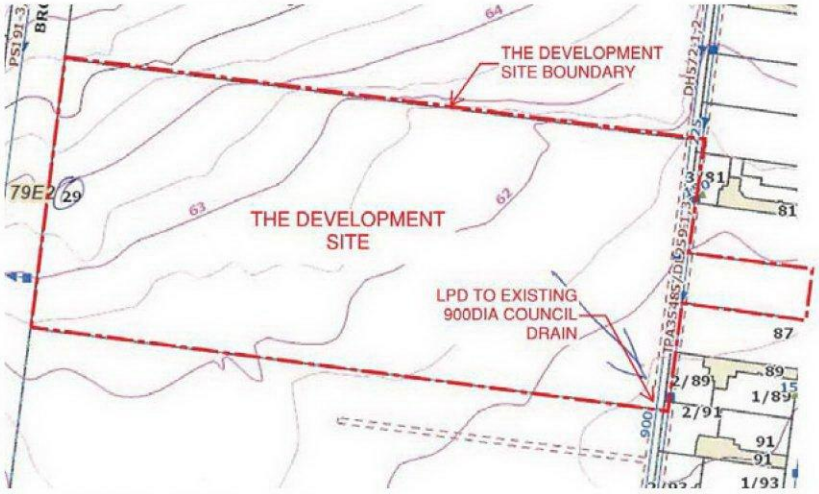


Figure 2-2 Existing Site Drainage Plan

There are a number of Council drainage assets around The Development site, including:

- a 375Ø drain in Browns Road
- a 525Ø drain in Moriah Street, and
- 900Ø drain that runs along the eastern side of the site in a sewer/drainage easement (Note there is a South East Water sewer in the easement also).

There is existing private drainage across the school site the ranges in size from 150Ø to 300Ø that connect to the 900Ø Council drain on the east side of the site. This private drainage is redundant infrastructure and will be removed when the school infrastructure is demolished.

3 The Development

The Development plan by Mushan Architects proposes the construction of residential apartments including:

- Two and three story townhouses
- Apartment blocks
- Below the apartment blocks there is a basement car park

The apartment block will be positioned central to the site with townhouses positioned on the east, west and north sides of the site.

Hard surfacing across the site will include vehicular driveways, car parking and pedestrian pathways. The remainder of the site will be soft landscaped with lawns and garden beds

A copy of The Development site plan proposed by Mushan Architects is provided in Figure 3-1 below.

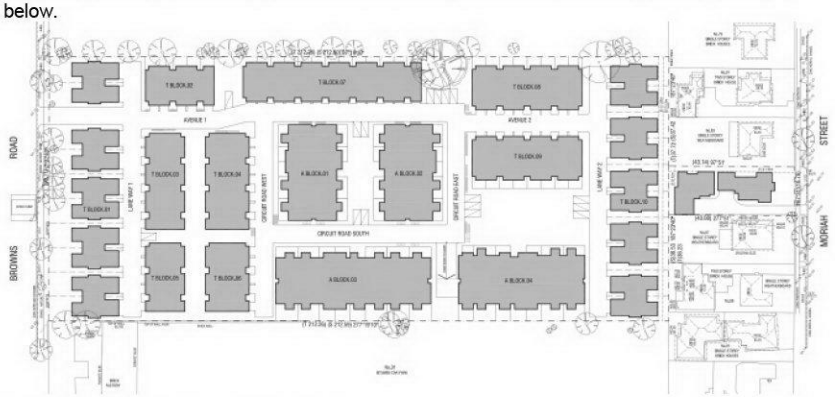


Figure 3-1 The Development Site plan

4 Drainage Strategy

4.1 Drainage Design Criteria

4.1.1 Legal Point of Discharge

The Legal Point of Discharge (LPD) for the development site has been provided by the City of Monash in their response dated 17/03/2015. The nominated point discharge is the 900mm Ø Council drain located in the sewerage easement along the eastern boundary of The Development site. Connection to the drain is to be made via a 900x600mm pit to be constructed to Council standards.

Copy of the approved LPD from Council is provided in Appendix A.

The LPD approval from the Council also stipulates that the development needs to also provide on-site detention. Council has confirmed that stormwater detention is required for The Development to balance the 10 year ARI post development peak flows with the existing 5 year ARI peak flow rate.

4.1.2 Australian Standards

The design criterion for below ground pipe drainage has been adopted from Table 5.1 of AS3500 Pt 3 as follows:

- Minor below ground drainage system inside the development 10 year ARI
- Major overland flow drainage 100 year ARI

4.2 Drainage Scheme Plan

4.2.1 Ground Level Drainage

The drainage scheme plan for the Development is presented in Figure 4-1 below and repeated in Appendix B for clarity.

Figure 4-1 Stormwater Drainage Scheme Plan

The stormwater drainage system for The Development will include both above ground and below ground systems. The drainage system is to be designed with minor below ground drainage

systems for the 10 year Annual Return Interval (ARI) storm events, and overland flow paths provided around and away from buildings for the major 100 year events.

Below ground stormwater detention tanks are proposed to meet attenuation requirements by the Council. Refer to Section 4.3 for details of the proposed stormwater detention system.

Stormwater pollution reduction is proposed by the inclusion of rainwater harvesting and oil/bio-retention separation unit installed at the end of the system and prior to water discharging off site. Refer to Section 4.5 for discussion of proposed WSUD systems.

4.2.2 Basement Drainage

Basement drainage will be provided to take away groundwater from behind retaining walls and any water that may seep through walls into the building.

All groundwater collected from the basement will be to a small pump station and pumped out to the external building drainage system.

Any water that may seep through the basement walls will be collected in spoon drains that will run around the perimeter of the basement. Water collected in the spoon drains will discharge to basement perimeter drainage system via floor wastes fitted into the spoon drainage at discrete locations.

The basement subsoil pump station will be a two pump duty standby system with each pump rated to pump at 2 litres/sec. The pump will have high level and failure alarm system that will be connected to the core building control systems. A rising main from the pump station will connect to the stormwater drainage system external to the building at ground level.

4.3 Stormwater Detention Calculations

4.3.1 General

Hydrological and hydraulic modelling of the stormwater detention system has been undertaken using the computer software XPSWMM. The software is recommended in AR&R Volume 1 Book VIII Urban Stormwater for modelling of complex drainage systems and is considered suitable for this project.

This computer modelling has been completed to determine the existing discharge rate from the site as well as sizing the stormwater detention system.

4.3.2 Rainfall Intensity-Frequency-Duration

Rainfall Intensity Frequency Data (IFD) used in the hydrological model has been derived using procedures and data provided in AR&R Volumes 1 and 2. A copy of the IFD chart is Figure 4-2 below.

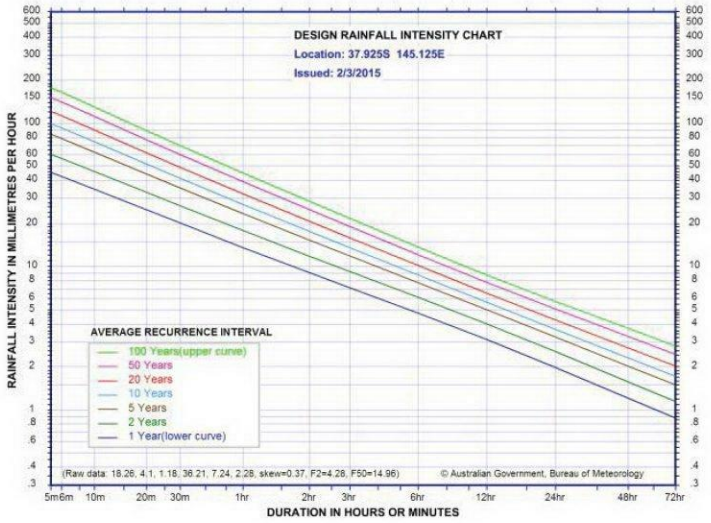


Figure 4-2 Rainfall IFD Data

4.3.3 Hydrological Model

The hydrological model used is the SWMM Non-linear Runoff Routing Method utilising the Horton Infiltration model. Parameters adopted are summarised below;

- Horton Infiltration Model (values estimated for dry loamy soils)
  - Max Infiltration Rate (Fo): 150mm/hr
  - Min (Asymptotic) Infiltration: 1.3mm/hr
  - Decay rate of infiltration: 1.18×10^{-3} 1/sec
  - Max Infiltration volume 0.0mm
- Pervious Area
  - Manning's n: 0.03
  - Depression storage: 2.5mm
- Impervious
  - Manning's n: 0.014
  - Depression storage 1mm
  - Zero Detention (%) 25

The maximum or initial infiltration capacity, mm/hr. This parameter depends primarily on soil type, initial moisture content and surface vegetation conditions. The values adopted are typical for loamy soils as recommended by Akan (1993) – Reference XPSWMM User Manual.

4.4 Existing Site Peak Flow Estimate

4.4.1 Existing Site Catchment Plan

The existing site catchment plan is illustrated in Figure 4-3.

Figure 4-3 Pre-Development Catchment Plan

Area take-off for the pre-developed site is provided in Table 3-1.

Table 3.1 Pre-Development Site Catchment Areas

Catch	Total Area (m^2)	Hard Pavement			Roof			Grass Surface			Total	
		Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Eff. Imp Area (m^2)	C_v
1	20,106	5,067	90%	4,560	1,805	100%	1,805	13,166	15%	1,975	**8,340**	**41%**

The impervious fraction of the existing site for the use in hydrological calculations has been calculated to be 41%.

Calculation of 5 year ARI peak flows for the existing site catchment has been calculated from the XPSWMM model discussed above.

Multiple storm durations have been trialled to identify the peak value for catchment. The peak rate of discharge was found to result from the 30 minute storm duration with values 126 litres/sec.

Refer discharge hydrographs presented in Figures 4-4 below.

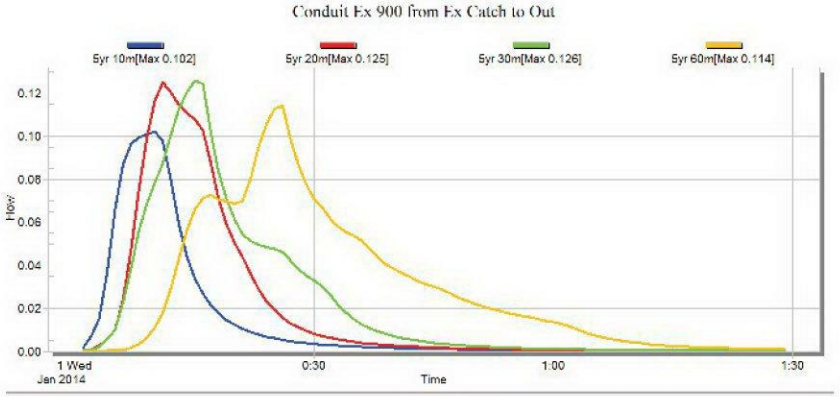


Figure 4-4 Existing Site 5 Year ARI Peak Flow Estimate

4.4.2 Development Catchment Plan

Catchment plan for the development is presented in Figure 4-5 below.

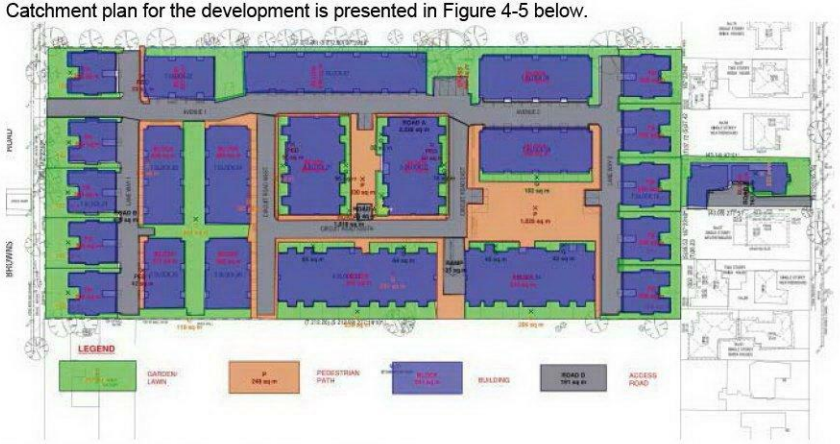


Figure 4-5 Post Development Catchment Plan

Area take-off for the post-developed site is provided in Table 4-2 below.

Table 4.1 Post-Development Site Catchment Areas

Catch	Total Area (m^2)	Hard Pavement			Roof			Grass Surface			Total	
		Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Sub-Total Area (m^2)	C_v	Eff. Imp Area (m^2)	Eff. Imp Area (m^2)	C_v
1	20,106	6,562	90%	5,906	8,261	100%	8,261	5,283	15%	792	**14,959**	**74%**

The site will be fully developed with roofs, access roads and hard standing covering the majority of the site. The impervious fraction of the site for the use in hydrological calculations has been calculated to be 74%.

4.4.3 Stormwater Detention

The strategy for stormwater detention is to balance peak flows from The Development for all events up to 10 year ARI with the existing site 5 year ARI peak flow values.

Existing site 5 year ARI peak flow estimates is 126 litres/sec (Ref. Section 4.4.1).

Stormwater detention is achieved by inclusion of two (2) no. $75m^3$ below ground detention tanks providing a total storage volume of $150m^3$. The tanks are proposed to be located on the west and east sides of the site as presented in Figure 4-1. Notional design parameters of the tank are as follows:

- Eastern Tank : Plan Area $50m^2$, 1.5m depth
- Western Tank : Plan Area $50m^2$, 1.5m depth

Peak discharge flow control from the detention tanks is to be achieved by fitting 160mm Ø orifice plates fitted to the junction pit directly downstream of each tank.

The detention tank system has been evaluated using the XPSWMM model for the 10 year ARI critical storm event. The detention system has been tested for all relevant storm durations with calculated peak flow rate leaving the site presented in Figure 4-6 below.

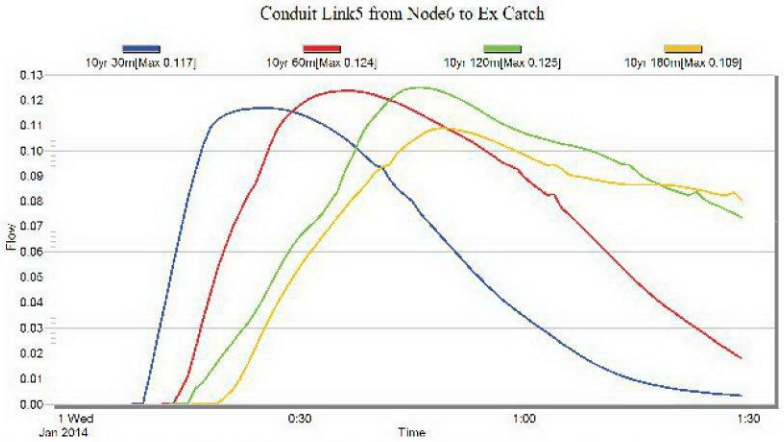


Figure 4-6 Developed Site Calculated 10 Year ARI Peak Discharge Rates

The peak discharge rate from the basin for the critical 10 year 120minute storm event has been calculated to be 125 litres/second. This value is just below the existing site calculated 5 year ARI peak (126 litres/sec) hence considered acceptable.

4.5 Water Sensitive Urban Design

The WSUD scheme has been developed with the aim to comply with the City of Monash's planning requirements, specifically Council's Stormwater Management Policy Clause 22.04 that set the objective to minimise the introduction of polluted stormwater to the drainage waterway system.

For The Development it is proposed to target typical best practice water quality performance objectives meeting reduction targets as follows:

- Suspended solids – 80% retention of typical urban annual load
- Total Nitrogen – 45% retention of typical urban annual load
- Total Phosphorous – 45% retention of typical urban annual load
- Litter - 70% retention of typical urban annual load.

To achieve the pollution reduction target WSUD initiatives have been recommended for The Development, including:

It is proposed to deal with gross pollutants both at source and through structural controls. Litter control measures proposed to be implemented at the source include:

- Provision of grated covers to all stormwater collection points to restrict large litter entering the drainage system.
- Drainage pits to be fitted with trash baskets

Total Suspended Solids (TSS), Total Petroleum Hydrocarbons and Free Oils

To meet this criterion, end of line structural controls are proposed in the form of the Jellyfish filter system by Humes (or approved equivalent). This unit provides treatment of the runoff from external road and carpark pavement areas.

Total Nitrogen (TN) and Phosphorus (TP)

The existence of phosphorus and nitrogen pollutants in stormwater typically comes from pet waste, detergents and garden and lawn fertilisers. Reduction of TP and TN load will be achieved by a series of the treatment systems along the stormwater drainage system that will include:

- Roof areas from the apartment building and Townhouse Lot 1 may be directed to rainwater harvesting tanks for re-use. This harvesting will in turn reduce the total volume of water leaving the development and will therefore reduce the overall pollutant load.
- Final polishing of stormwater will be achieved by the end of line treatment system Jellyfish filter system by Humes (or approved equivalent).

The water quality systems described above are considered to be in line with water quality management best practices and have been selected to achieve the required pollution reduction targets.

Details of the WSUD system are to be developed through the detail design phase pf the project with WSUD systems supported by MUSIC analysis.

5 Reference Documents

Relevant Australian Standards:

- AS3500.3 Stormwater Drainage

Other guidance documents:

- City of Monash Council, Policy Engineering Requirements for Infrastructure Construction
- Australian Rainfall and Runoff Volumes 1 & 2
- Victoria State Planning Policy Framework, Clause 19 Infrastructure
- CSIRO, Urban Stormwater: Best Practice Environmental Management Guidelines

Proposed Residential Development
29 Browns Road, Clayton
Stormwater Management Plan

Appendix A – Legal Point of Discharge

Appendix B – Stormwater Drainage Scheme Plan

Appendix C – WSUD Product Literature

Appendix A – Legal Point of Discharge

FILE NO: DRAIN52

ENGINEERING REPORT ON PROPERTY – POINT OF DISCHARGE

CITY OF MONASH

Send To: Gervaise Christie C/O Irwinconsult **Email:** gervaise.christie@irwinconsult,com.au

Property Address: 29 Browns Road CLAYTON

NOTE: THE COST FOR POINT OF DISCHARGE REPORTS IS $55.00

The location of the nominated point of discharge for a **unit development** on this site is the corner where all stormwater is to be collected and piped to **900mm Council drain located in the drainage and sewerage easement along the Eastern property boundary via a 900mm x 600mm junction pit to be constructed to Council Standards. ALL ON-SITE DRAINAGE SHOULD BE CONNECTED TO THIS POINT. THESE WORKS REQUIRE A ROAD OPENING PERMIT AND MAY REQUIRE A REFUNDABLE SECURITY DEPOSIT.**

*** NB The owner / developer must confirm the precise location of the point of discharge, prior to any work being carried out on site. If the point of discharge cannot be located, Council's Engineering Office should be notified immediately.**

Conditions relevant to the Point of Discharge

- ☐ Proposed additions to the dwelling should be connected to the existing stormwater system serving the property.
- ☑ Council records indicate that a **900mm** diameter stormwater drain (offset **Unknown**, depth **Unknown)** is contained within the **Eastern** Drainage and Sewerage easement. Sewer information should be obtained from **South-East Water.**
- ☐ Development plans indicate that fill has been used on this site and it is recommended that you obtain information from the land developer/Council records prior to the issue of a Building Permit.
- ☐ This property is located in an area which has been identified as requiring further drainage assessment by Council Engineers /Melbourne Water and Building plans should be forwarded to Council Engineers/Melbourne Water for comment prior to the issue of a Building Permit.

Other Council Requirements

- ☑ Any proposed removal and/or addition of a vehicle crossing/s requires a Vehicular Crossing Permit. The Vehicle Crossing Permit must be obtained from the Council's Engineering Department prior to any crossing works commencing. A copy of the approved Town Planning Plan **must** be presented when obtaining the Vehicle Crossing Permit.
- ☑ This property may be subject to Town Planning Overlays/Controls. Please contact Council's Town Planning Department for further information.
- ☑ For developments of this nature a on-site detention system may be required. A drainage levy may be accepted in lieu of the detention system. These developments require Town Planning approval prior to any Building Permit being issued. **During the Town Planning Permit approval process any Detention System Requirement and/or Drainage Contribution for this development will be determined. If a Town Planning Permit has already been approved please refer to it for further details.**
- ☑ Any new drainage connection into a Council easement drain requires the approval of the Council's Engineering Division prior to the works commencing. **Three copies of the plans (*A3-A1 size*) for the drainage works must be submitted to and approved by the Engineering Division prior to the commencement of works.** The plans are to show sufficient information to determine that the drainage works will meet all drainage conditions of the permit.

Please note, this information is provided from design plans/records held by Council.
The City of Monash does not guarantee the accuracy of this information and disclaims any liability resulting from its usage.

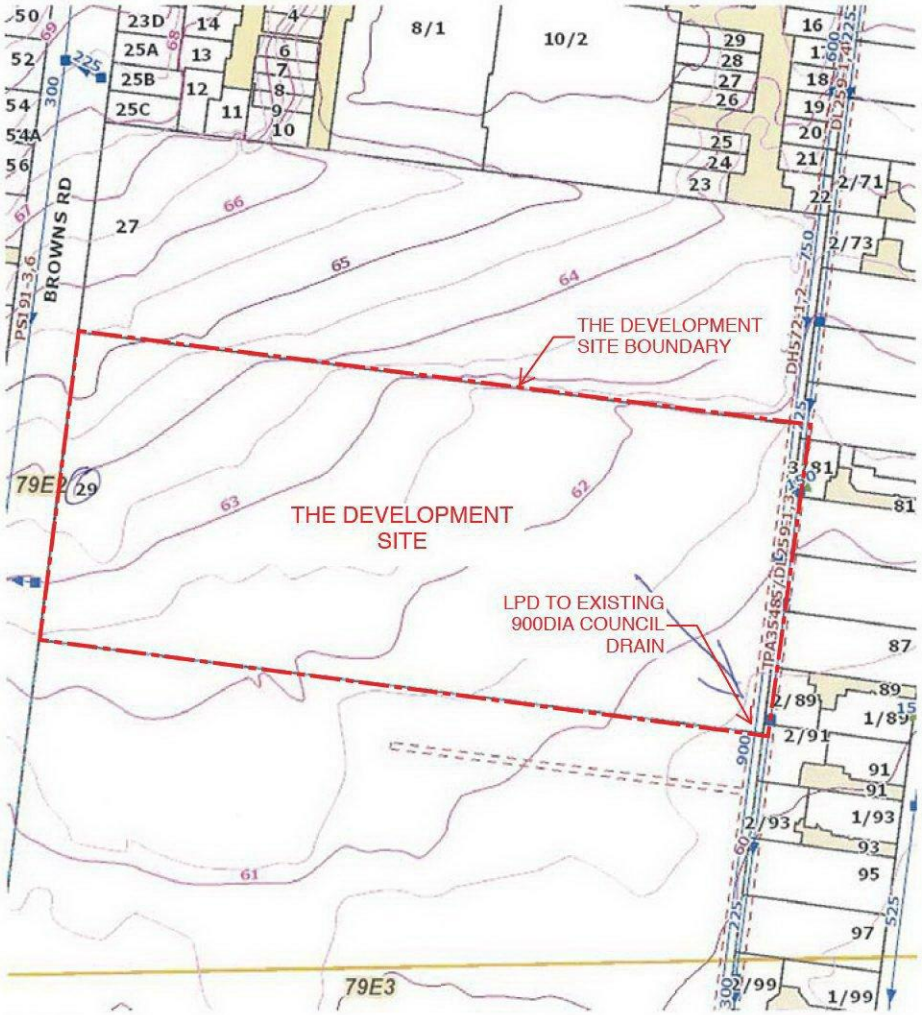
Existing Council and Service Authority assets (trees, pits, poles, shelters, hydrants, parking bays, etc, are not to be altered, removed or relocated without the approval of the Responsible Authority. The property **owner** is required to identify and take into account the location of any existing assets in the design of driveways and vehicle crossings and notify the Responsible Authority prior to the construction of any buildings where these assets may be affected. Approval for relocation or removal may not be given at a later date.

Responsible Officer — Date: 17.3.15

Constituted as Monash City Council 293 Springvale Road (PO Box 1) Glen Waverley VIC 3150
Telephone **(03) 9518 3555** Facsimile (03) 9518 3444 Ausdoc DX15005 TTY (Hearing Impaired) (03) 9518 3655
Email mail@monash.vic.gov.au Website www.monash.vic.gov.au

Appendix B – Stormwater Drainage Scheme Plan

Legal Point of Discharge



Address:
29 Browns Rd Clayton

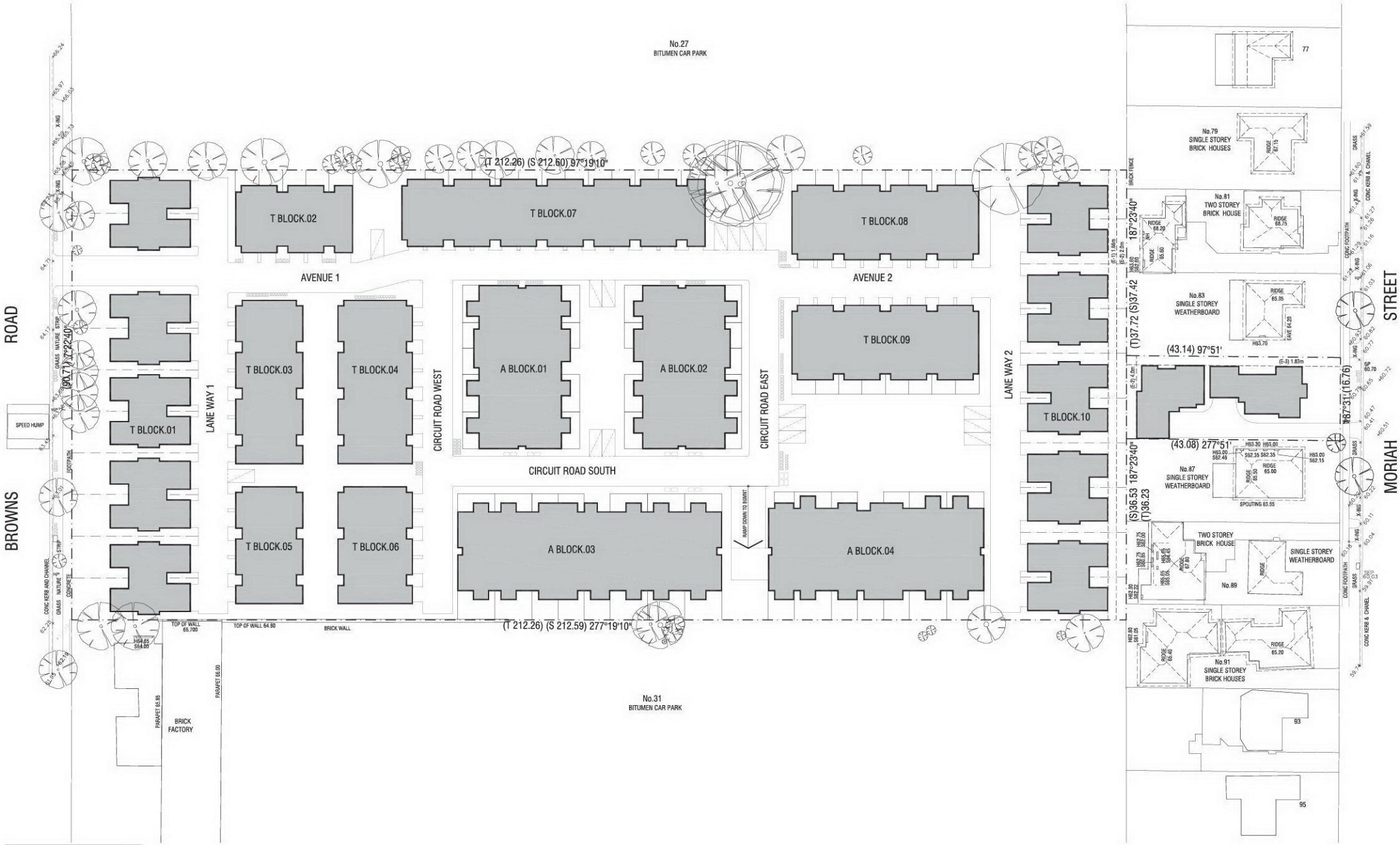
Legend

Engineers Referral (LPD)

1:1500

Map Produced: 16/03/2015 6:16 PM

D19-334480



PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION PURPOSES

REV	DATE	AMENDMENT	INITIALS
-	09.09.15	ISSUED FOR CONSULTANT CO-ORDINATION	DZP/XX
A	30.09.15	ISSUED FOR CONSULTANT CO-ORDINATION	DZP/XX

NORTH

MUSHAN DESIGN STUDIO PTY LTD
LEVEL 15, 333 COLLINS STREET
MELBOURNE VIC 3000
ABN: 44 162 772 714
PH: 03 8611 7926
EMAIL: INFO@MUSHAN.COM.AU

PROJECT
PROPOSED RESIDENTIAL DEVELOPMENT
29 BROWNS ROAD, CLAYTON
VIC 3168

TITLE
OUTLINE PLAN

Date	SEPTEMBER 3015
Scale	1:350 @ A1
Drawn by	DZP/XX
Checked	DZP
Job number	M023
Drawing number	A SK01

Appendix C – WSUD Product Literature

JellyFish® filter Technical manual

Issue 5

Contents

enviro DEVELOPMENT™ PROFESSIONAL

JellyFish® filter

The JellyFish® filter is a tertiary stormwater treatment system featuring membrane filtration to provide exceptional pollutant removal at high treatment flow rates with minimal head loss and low maintenance costs.

The JellyFish® filter uses gravity, flow rotation, and up-flow membrane filtration to provide tertiary treatment to stormwater in an underground structure. Using unique filtration cartridges, each JellyFish® filter provides a large membrane surface area, resulting in high flow rates and pollutant removal capacity.

The JellyFish® filter efficiently captures a high level of stormwater pollutants, including:

- Total Suspended Solids (TSS), median removal efficiency of 89%, including particles down to two microns
- Total Nitrogen (TN), median removal efficiency of 55%
- Total Phosphorous (TP), median removal efficiency of 65%
- Total Copper (Cu), median removal efficiency of 61%
- Total Zinc (Zn), median removal efficiency of 91%.

Designed as a polishing device for constrained sites, the JellyFish® filter is available in a range of sizes to cater for both at-source and end-of-pipe solutions.

- **The system provides tertiary level performance with a small footprint**
  The proven performance of the JellyFish® filter and high flow rate membranes enables water quality objectives to be met with a smaller footprint system than typical bioretention systems.
- **It has been independently researched and proven**
  The JellyFish® filter has been independently researched under both laboratory and field conditions in the United States and Australia. In the United States, it has received verification under the stringent New Jersey Corporation for Advanced Technology (NJCAT) protocol.
- **It treats higher flow rates than most filters**
  Each filter cartridge has an effective filter area of 35.4 m^2 designed to treat 5 litres per second (L/s) during operation.
- **Above-ground land use is maintained**
  The system is assembled within a fully-trafficable, precast concrete structure for underground installations on constrained sites, allowing maximum use for above-ground activities.
- **Maintenance is easy**
  The filter backwashes after peak flows so it can self-clean several times in each storm event. Manual backwash is recommended annually. When cartridge replacement is required (usually every three to five years), it is a safe and simple process.
- **We provide world class treatment solutions**
  Humes has a team of water specialists dedicated to delivering sustainable solutions, creating maximum value for your project, accommodating your site conditions, design requirements and construction factors.

System components

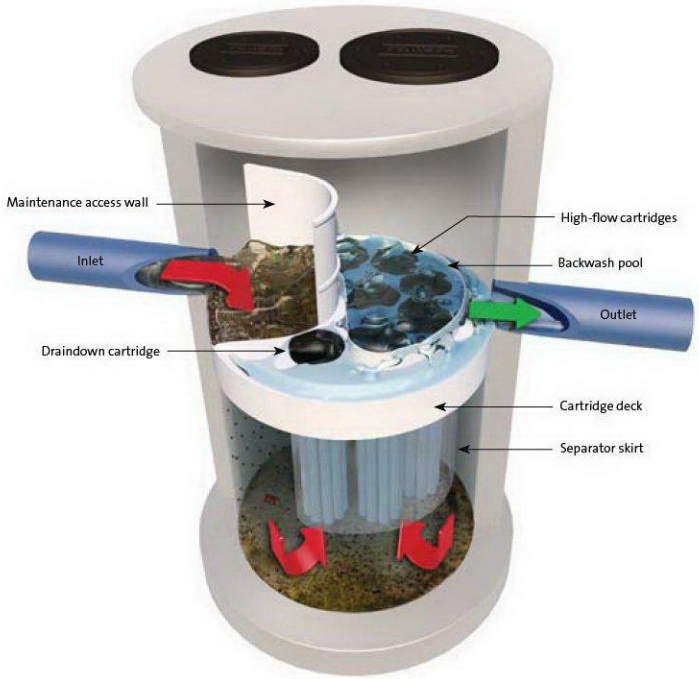
The JellyFish® filter is comprised of several structural and functional components:

- A cylindrical precast concrete structure which is available in a range of diameters and depths that serves as a vessel providing structural support for a 50 year design life and provides storage for accumulated filtered pollutants.
- A rigid high-strength fibreglass cartridge deck separates the vessel into a lower chamber and upper chamber. This houses the filter cartridges, provides a surface and flow path for treated water to the effluent pipe, and provides containment of oil and other hydrocarbons below the deck and also provides a platform for maintenance personnel to safely service the filter cartridges.
- The lower chamber provides storage for pollutant separation and membrane filtration.
- The upper chamber provides adequate clearance for inspection and maintenance.
- A rigid high-strength fibreglass Maintenance Access Wall (MAW) attenuates influent water velocity and directs flow into the lower chamber through a large opening in the cartridge deck. In addition, it provides storage for floatable pollutants. It also serves as an inspection and maintenance access point.
- JellyFish® membrane filtration cartridges are secured to the deck by the cartridge lids. Each filter cartridge consists of multiple membrane filter tentacles, which treat the stormwater by filtering out fine suspended particulates (TSS) and particulate-bound pollutants on the membrane of each tentacle. Filtered water passes through the membranes, up the centre tube of each tentacle and exits through the top.
- Filter cartridges are designated as either high-flow or draindown cartridges, depending on their location in the cartridge deck. High-flow cartridges placed within the backwash pool are automatically backwashed after each storm event.
- Draindown cartridges located outside the backwash pool facilitate the draindown of the backwash pool. The design flow rate (2.5 L/s) of a draindown cartridge is controlled by the lid orifice. The lower design flow rate of the draindown cartridge ensures the membranes last for longer periods between scheduled maintenance.
- Cartridge lids are fastened into the deck to securely anchor the filter cartridges. The lids are removable to allow manual rinsing and replacement of the filter cartridges when required. Cartridge lids contain a flow control orifice that is specifically sized for use with high-flow and draindown cartridges. Blank lids have no orifice and are used to cover unoccupied deck apertures in systems that do not use the full rated flow capacity of the system.
- A rigid fibreglass backwash pool weir extends 150 mm above the cartridge deck and encloses the high-flow cartridges. During inflow, filtered water leaving the high-flow cartridges forms a pool inside the weir. When the water level in the pool exceeds the weir height it overflows and spills to the cartridge deck where it then flows to the outlet pipe. As the inflow event subsides and pressure decreases, water in the backwash pool reverses flow direction and automatically backwashes the high-flow cartridges, cleaning the membrane surfaces. Water in the lower chamber (below deck) is displaced through the draindown cartridges.

  This self-cleaning mechanism may occur multiple times during a single storm event as rainfall/runoff intensities rise and fall, thereby significantly extending the service life of the cartridges and the maintenance interval.
- A separator skirt encloses the filtration cartridge and defines the filtration zone. The separator skirt extends the full length of the filtration tentacles and prevents contamination of the membranes with oil and floatable debris. The separator skirt also forces water to enter the filtration zone under low velocities. The separator skirt is attached to the underside of the cartridge deck.
- As an option, the inlet pipe can be located below the deck for drainage networks with deep invert levels. In these systems, a deflector plate is installed across the inlet pipe to induce tangential water flow through the channel between the chamber wall and separator skirt.
- Large diameter access lids are installed at the surface and are removed to allow access for maintenance of the system. The upper chamber is designed with tapered surrounds to match with finished surface grades.

The JellyFish® filter and components are depicted in Figure 1 below.

Figure 1 – JellyFish® filter components



Membrane filtration cartridge

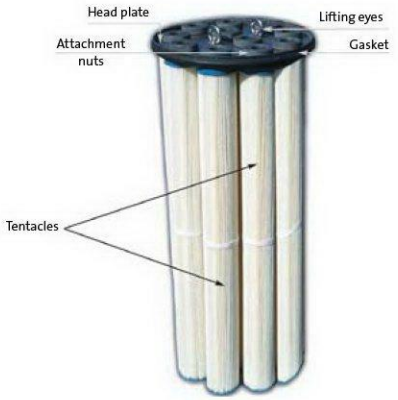
The JellyFish® filter utilises multiple lightweight membrane filtration cartridges. Each cartridge consists of multiple removable filter elements ("filtration tentacles") attached to a cartridge head plate. Each filtration tentacle consists of a central perforated tube surrounded by a specialised membrane. A removable oil-resistant polymeric gasket provides a watertight seal between the cartridge and the deck. A JellyFish® membrane filtration cartridge is depicted in Figure 2.

The cartridge length is 1,372 mm. The dry weight of a new cartridge is less than 9 kg, and the wet weight of a used cartridge is less than 23 kg. No heavy lifting equipment is required during exchange.

The filtration tentacle membranes provide a large surface area, resulting in high flow and suspended sediment removal capacities. A typical JellyFish® cartridge with 11 filtration tentacles has 35.4 m^2 of membrane surface area. Hydraulic testing on clean filter cartridges demonstrated a flow rate of 11.3 L/s at 455 mm of driving head.

Extensive independent field testing, including testing at an urban site with high intensity rainfall and runoff, has demonstrated consistently high pollutant removal performance with a conservative design flow rate of 5 L/s for the high-flow cartridges and 2.5 L/s for the draindown cartridges.

Figure 2 – JellyFish® membrane filtration cartridge



These values translate to a conservative design membrane filtration flux rate (flow per unit surface area) of 0.14 L/s/m^2 for the high-flow cartridge and 0.07 L/s/m^2 for the draindown cartridge.

In addition, the filtration membrane has been treated to allow biofilm to grow but not clog the pores of the membrane. The flow rating of a particular JellyFish® filter cartridge is based on the membrane filtration surface area of the cartridge and data collected from both laboratory testing and field testing. The cartridge deck contains apertures for each filter cartridge.

System operation

As a tertiary treatment system, the JellyFish® filter is designed to be an "offline" structure, as part of a treatment train. For effective operation, the system requires a difference in elevation between upstream and downstream water levels. Typically, a minimum 455 mm of driving head is designed into the system but may vary from 305 mm to 610 mm depending on specific site requirements.

The JellyFish® filter uses gravity, flow rotation and membrane filtration treatment to remove pollutants from stormwater runoff. These functions are depicted in Figure 3 below.

Gravitational forces remove coarse sediment (generally >50 microns), particulate-bound pollutants (nutrients, toxic metals, hydrocarbons), free oil and floatable trash and debris (that may bypass upstream primary treatment devices). Large, heavy particles fall to the sump (sedimentation) and low specific gravity pollutants rise to the surface (floatation) behind the MAW.

Treatment begins when flow enters the system through the inlet pipe (standard). Below-deck inlet pipes are offered as an option. Influent enters the MAW zone and passes through a large opening in the deck to the lower chamber. The large deck opening and change in flow direction attenuate the influent flow velocity. Buoyant pollutants remain on the surface in the MAW zone.

Figure 3 – JellyFish® filter functions

Flow into the lower chamber must then pass tangentially around the separator skirt protecting the cartridges and increasing the flowpath length. Coarse sediment settles out of the MAW zone into the sump. As water flows tangentially around the separator skirt in the lower chamber, the large opening in the bottom of the separator skirt and upward change in direction further reduces flow velocity and enhances particle separation. As a result, sediment settles in the sump.

Flows pass through the cartridge in the filtration zone. Each filter cartridge consists of multiple tentacles. Hydraulic pressure across the entire membrane surface area causes water to penetrate the filtration tentacles. Water enters the membrane pores radially and deposits fine particulates on the exterior membrane surface. Filtered water flows into the centre drain tube of each tentacle, the water then flows upward and out the top.

Water exiting the top of the tentacles combines under the lid, where the combined flow exits the cartridge through the orifice with a pulsating fountain effect into the backwash pool. When the water level in the backwash pool exceeds the weir height it overflows to the outlet pipe.

Outside the backwash pool, the draindown cartridge provides treatment at a reduced flow rate (2.5 L/s) and allows the treated water captured in the backwash pool to return through the cartridges and balance water pressure as the storm event ends.

As particles build up on the external membrane surface, the pores progressively become smaller. This process, referred to as "filter ripening", significantly improves the removal efficiency relative to a brand new or clean membrane. Filter ripening accounts for the ability of the JellyFish® filter to remove particles finer than the nominal pore size. An animation of the JellyFish® filter operation and maintenance is available at humes.com.au.

Self-cleaning functions

The JellyFish® filter utilises several self-cleaning processes to remove accumulated sediment from the external surfaces of the filtration membranes, including automatic backwash of the high-flow cartridges, vibrational pulses, and gravity. These processes have been confirmed by more than 12 months of full scale prototype testing. Combined, these processes significantly extend the cartridge life, maintenance interval and reduce life-cycle costs.

Automatic backwash occurs with the high-flow cartridges at the end of each runoff event. This can occur multiple times during a single storm event as intensity and driving head varies. As the inflow subsides and driving head decreases, water in the backwash pool reverses flow direction and automatically backwashes the high-flow cartridges, removing sediment from the membrane surfaces. Water in the lower chamber (below deck) is displaced through the draindown cartridges.

Vibrational pulses occur as a result of complex and variable pressure and flow direction conditions that arise in the deck during operation. During forward flow a stream of filtered water exits the top of each filtration cartridge and encounters resistance from the turbulent pool of water in the backwash pool. Water is forced through the cartridge lid orifice into the backwash pool with a pulsating fountain effect. The resulting pulses transmit vibrations through the deck to the membranes, thereby dislodging accumulated sediment. The effect is pronounced at higher flow rates, and influences all cartridges.

Accumulated sediment on the membranes will settle under gravity both during inflow events and inter-event dry periods. As fine particles form into larger masses on the membrane surface, adhesion to the membrane surface lessens, and sediment sheds away from the membrane. Chemical processes and biofilm effects also play a role.

System performance

The JellyFish® filter has been designed to provide tertiary level treatment and may be combined with a Gross Pollutant Trap (GPT) as part of a treatment train to optimise overall performance.

Treatment efficiency

Extensive research of the JellyFish® filter has proven its performance under Australian laboratory, US field conditions and Australian field conditions. Field testing in the United States has received independent verification under the stringent New Jersey Corporation for Advanced Technology (NJCAT) protocol. The results are summarised in Table 1 below.

Table 1 – JellyFish® filter performance summary

Pollutant	Median reduction
TSS	89%
TP	65%
TN	55%
Cu	61%
Zn	91%
Total oil and grease	62%

Reference: University of Florida (2011) and West Ipswich (2014).

Inlet and outlet pipes

An above-deck inlet pipe configuration is standard for the JellyFish® filter and an optional below-deck inlet configuration is available on request. Specific site constraints generally determine the configuration that is most favourable. In both configurations, the invert level of the outlet pipe is identical to the cartridge deck elevation.

Appendix F: Waste Management Plan

mecone

D19-334480

WASTECH SERVICES Pty Ltd.

Waste Management Plan

Site Address: 29 Browns Road Clayton

Prepared for Nanxin Investment Browns Road Pty Ltd

Author: Kristian Horana BEng (Civil)
Date: 24TH February 2017

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List of Figures

List of Appendices

1. INTRODUCTION

Wastech Services Pty Ltd was commissioned by Nanxin Investment Browns Road Pty Ltd to prepare a waste and recycling plan associated with a proposed development consisting of the following:

- Seventy Eight (74) two and three storey townhouses
- One hundred and seventy two (172) apartments

The development is to be located at 29 Browns Road Clayton.

1.1 Conditions

This waste management plan is based on the following conditions

- On-going use of the premises. Does not include demolition or construction stages
- Figures and calculations are based on drawings and information supplied by Mushan Design Studios
- Waste volume figures are estimates only and will be influenced by the tenant, resident and/or the operator's disposition toward waste disposal and recycling, and by the development's occupancy rate. Refer to the enclosed tables for rates and assumptions.

The recommendations, estimates and plan contained in this Waste Management Plan (Plan) have been prepared by analysing information, guidelines, documents and regulations provided by you and third parties, including local government and council bodies (Information). Wastech Engineering does not verify the accuracy of the Information and you acknowledge that the Information, and assumptions based on the Information within the Plan, is outside the control and knowledge of Wastech Engineering.

Wastech Engineering has prepared the Plan with due care and skill. However, no assurance or representation is made that the Plan reflects a guaranteed outcome and Wastech Engineering will not be liable to you for Plans or outcomes that are not suitable for your purpose, whether as a result of incorrect or unsuitable Information or otherwise. Except as specifically stated, no warranty or representation of accuracy or reliability in respect of the Plan is given by Wastech Engineering.

2. WASTE STORAGE

Each townhouse dwelling will be provided with an area of 1.5m² for the storage of waste bins within their property, the area required and provided *for each residence* is detailed in the table below;

Townhouse Waste Storage				
Bin Type	Length (mm)	Width (mm)	Quantity	Area (m²)
120 Litre Garbage	480	550	1	0.26
240 Litre Commingled	585	730	1	0.44
240 Litre Garden	585	730	1	0.44
Total Area Required				**1.14**
Total Area Provided				**1.50**

Table 1: Townhouse Waste Storage

Each apartment block will have a bin room with the areas detail in the table below.

Apartment Bin Rooms				
Bin Type	Length (mm)	Width (mm)	Quantity	Area (m²)
660 Litre Garbage	1370	850	3	3.49
660 Litre Commingled	1370	850	3	3.49
Total Area Required				**7.00**
Total Area Provided				**15.00**

Table 2: Apartment Waste Storage

3. GENERATED WASTE ESTIMATE

The enclosed waste estimates are summarized as follows in the tables below; refer to the enclosed waste generation calculations in the Appendix for further detail. Commingled recycling incorporates Glass, HDPE and PET containers, paper and cardboard.

Residential Waste	**Garbage**	**Commingled Recycling**	**Garden Waste**
Town Houses	8.88	8.88	8.88
Apartments	13.76	6.88	--
Total (m³/week)	**23.12**	**16.24**	**9.36**
Disposal Bin Size	120/660 Litre	240/660 Litre	240 Litre

Table 3: Residential Waste Estimate

4. RESIDENTIAL WASTE MANAGEMENT

4.1 Waste Streams

Residential waste shall be sorted on-site by the residents into the following streams and associated bins:

- Garbage; and
- Recycling (Glass, PET, aluminium, steel, HDPE, and Paper/Cardboard)
- Garden (for townhouses only)

4.2 Residential Garbage Disposal

Residential townhouses and apartments shall be furnished with plastic lined storage bins, with a minimum capacity of 15 litres, for the temporary holding of garbage waste. Residents of townhouses shall dispose of bagged garbage, as required, into their 120 litre garbage bin allocated for their residence and kept within their property.

Residents of apartments shall dispose of bagged garbage into the garbage chute located opposite each lift core. The chutes, three in total, shall serve all apartment levels and discharge into a 660 litre bin located in the bin room at basement level 1. The building manager will exchange bins underneath the chutes with a clean empty bin as required.

4.3 Residential Recyclable Disposal

Residential townhouses and apartments shall be furnished with storage bins, with a minimum capacity of 10 litres, for the temporary holding of recyclable waste. Residents of townhouses will dispose of recyclables, as required, into the 240 litre recycling bin allocated for their residence and kept within their property. Containers are to be rinsed and cardboard flattened prior to disposal. Organic waste generated by landscaped areas (such as grass clippings, branches, scrubs etc.) will be disposed of into a separate 240 litre garden waste bin.

Residents of apartments shall dispose of recycling into the recycling chute located next to each garbage chute. The chutes, three in total, will serve all apartment levels and discharge into a 660 litre bin located in the bin room at basement level 1. The building manager will exchange bins underneath the chutes with a clean empty bin as required. Any oversized cardboard should be disposed of directly into the recycling bins.

4.4 Residential Garbage and Recyclable Collection

4.4.1 Townhouses

Residents will be responsible for moving and returning their own 120 and 240 litre bins from their storage areas within their property to specified collection zones (as shown in the appendix). Collections will occur once a week for garbage and alternating fortnightly collections for recycling and garden waste. All collections are to be performed by a private contractor using a medium or small rigid rear lift vehicle.

4.4.2 Apartments

The building manager will be responsible for transferring full apartment bins for collection from each bin room, move them to the temporary apartment bin store using a bin tug, as shown in the appendix before returning the bins to their original location once collections have been completed.

The collection of waste and recycling bins is to be performed by a private contractor using a small or medium rigid rear loading vehicle. Garbage collection are to occur up four times a week, recycling collections are to occur up to twice a week.

5. RESIDENTIAL WASTE CALCULATIONS

5.1 Townhouses

Garbage		
Weekly Garbage Volume (Uncompacted)	8.88	Cubic metres
Bin Type	120	Litres
Frequency of Collection	1	Per week
Bins Required for Collection	74	
Spare Bins Required	0	
Garbage Bins Required	74	

Table 4: Garbage Summary

Recycling		
Weekly Recycling Volume	8.88	Cubic metres
Bin Type	240	Litres
Frequency of Collection	1	Per fortnight
Bins Required for Collection	74	
Spare Bins Required	0	
Recycling Bins Required	74	

Table 5: Recycling Summary

Garden Waste		
Weekly Garden Volume	8.88	Cubic metres
Bin Type	240	Litres
Frequency of Collection	1	Per fortnight
Bins Required for Collection	74	
Spare Bins Required	0	
Garden Bins Required	74	

Table 6: Garden Summary

5.2 Apartments

Garbage		
Weekly Garbage Volume (Uncompacted)	13.76	Cubic metres
Bin Type	660	Litres
Frequency of Collection	4	Per week
Bins Required for Collection	6	
Spare Bins Required	3	
Garbage Bins Required	9	

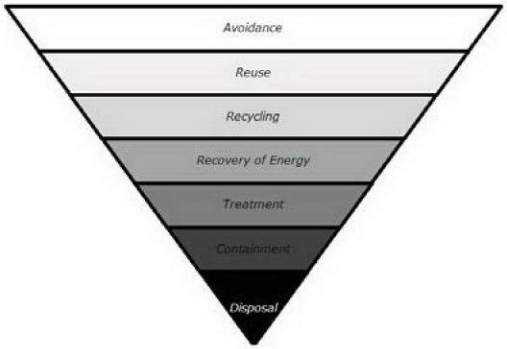
Table 7: Garbage Summary

Recycling		
Weekly Recycling Volume	6.88	Cubic metres
Bin Type	660	Litres
Frequency of Collection	2	Per week
Bins Required for Collection	6	
Spare Bins Required	3	
Recycling Bins Required	9	

Table 8: Recycling Summary

6. *Waste Minimization Strategies*

Each resident/occupier will be responsible for familiarising themselves with the practices of waste reduction/minimisation to divert waste from landfill. This will be achieved by the following:



- Document and distribute details of the waste management system that is in place on site to all residents
- Distribution of notices to all residents and tenants encouraging waste separation
- All bins to be labelled and colour coded stating types of waste that can be deposited i.e. paper/cardboard bins, container recycling bins, garbage bins

7. *Recommendations and Additional Information*

Items unsuitable for disposal via garbage or recycling bins would need to be disposed with the assistance of an appropriate contractor nominated by each residence/tenant/occupant. This would include: large, heavy, and liquid waste items.

To minimise security, vandalism, odour/visual impact, and health/safety issues, the following shall be implemented:

Transferring waste and shifting bins shall require the minimum possible manual handling. The operator will assess manual handling risks as per regulatory requirements and provide appropriate documentation to each resident/occupant/tenant.

- Signage and usage labels for the garbage and recycling bins will be provided by the operator;
- Waste areas will be secure and vermin proof;
- Residents shall keep waste areas clean and keep bins clean, keep bin lids closed and wash bins regularly;

Extract of Section 5 Victoria Noise Control Guidelines

The main annoyance produced by domestic refuse collections occurs in the early morning (in other words, before 7 am). Therefore, if possible, routes should be selected to provide the least impact on residential areas during that time. Collection of refuse should follow the following criteria:

- Collections occurring once a week should be restricted to the hours 6 am — 6 pm Monday to Saturday
- Collections occurring more than once a week should be restricted to the hours 7 am — 6 pm Monday to Saturday
- Compaction should only be carried out while on the move.
- Bottles should not be broken up at the point of collection.
- Routes that service entirely residential areas should be altered regularly to reduce early morning disturbance.
- Noisy verbal communication between operators should be avoided where possible.

8. CONTACT INFORMATION

Wastech Services Pty. Ltd.
Waste Equipment Designer & Manufacturer
33 Wedgewood Road, Hallam VIC 3803
Ph 03 8787 1600
wmp@wastech.com.au

Monash City Council
293 Springvale Road, Glen Waverley
(03) 9518 3555
mail@monash.vic.gov.au

SITA Environmental Solutions
(private waste collector)
64-84 Waterview Close, Hampton Park, VIC 3976
Ph 8795 2000

VISY Waste Management Integrated Solutions
(private waste collector)
Lot 2, 46-48 Dohertys Road, Laverton, VIC 3025
Tel: 03 9369 7477

Veolia Environmental Services
(private waste collector)
Level 1, 85 Buckhurst St, South Melbourne VIC 3205
Ph 132 955

JJ Richards & Sons Pty Ltd
(private waste collector)
50 Elliott Road, Dandenong, VIC, 3175
Ph 9794 5722

APPENDIX I: WASTE ESTIMATES

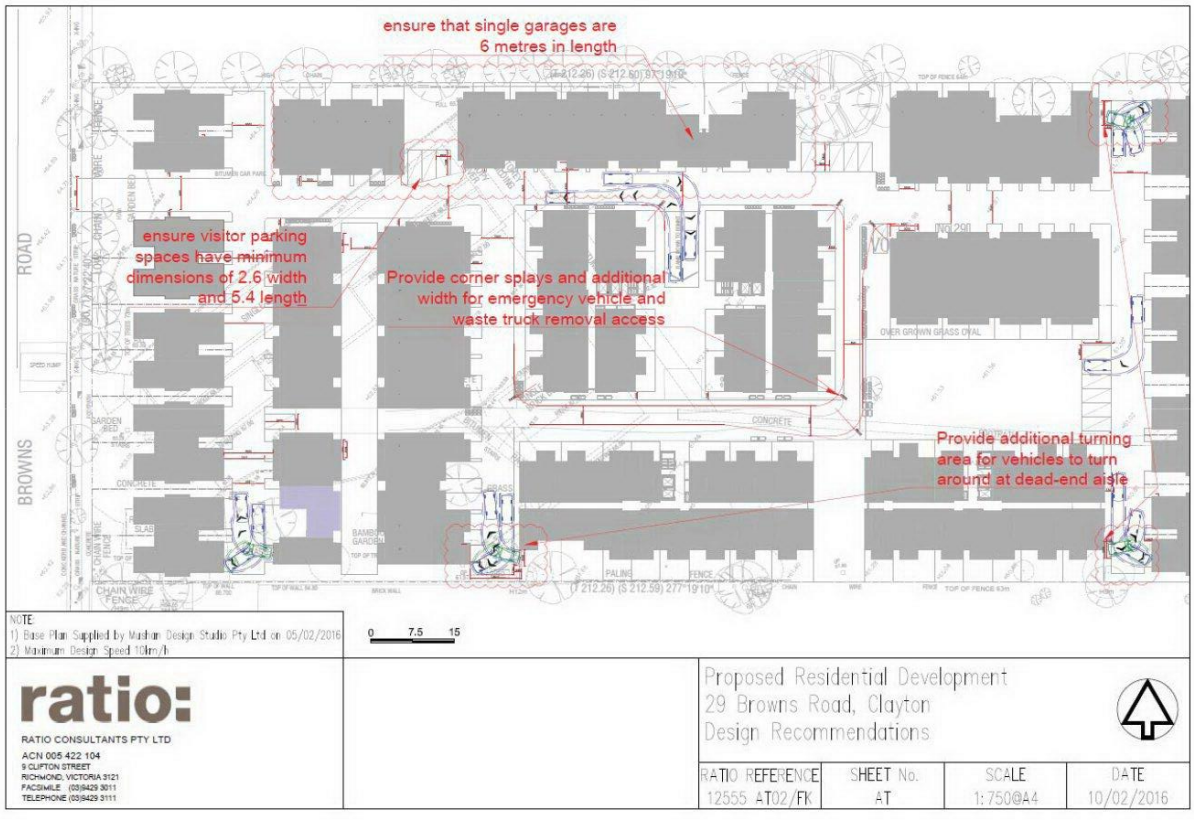
No. OF TOWNHOUSES	**74**		
Garbage (m^3/week uncompacted):	8.88	(Rate/townhouse/week)	**0.120**
Commingled Recycling. (m^3/week uncompacted):	8.88	(Rate/townhouse/week)	**0.120**
Garden Waste. (m^3/week uncompacted):	8.88	(Rate/townhouse/week)	**0.120**
TOTAL RESIDENTIAL TOWNHOUSE WASTE			
Garbage (m^3/week uncompacted):	**8.88**		
Commingled Recycling (m^3/week uncompacted):	**8.88**		
Garden Waste. (m^3/week uncompacted):	**8.88**		

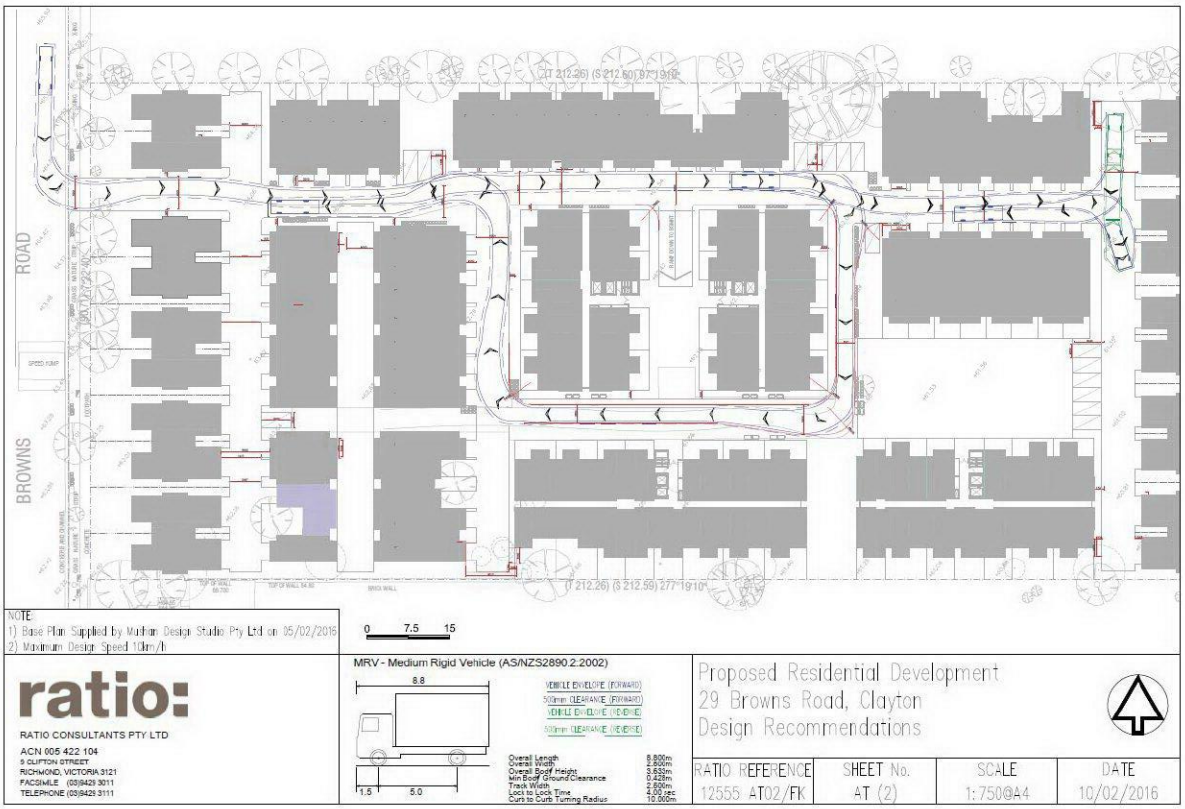
No. OF APARTMENTS	**172**		
Garbage (m^3/week uncompacted):	13.76	(Rate/townhouse/week)	**0.080**
Commingled Recycling. (m^3/week uncompacted):	6.88	(Rate/townhouse/week)	**0.040**
TOTAL RESIDENTIAL APARTMENT WASTE			
Garbage (m^3/week uncompacted):	**13.76**		
Commingled Recycling (m^3/week uncompacted):	**6.88**		

APPENDIX II: SWEPT PATH DIAGRAMS

29 Browns Road

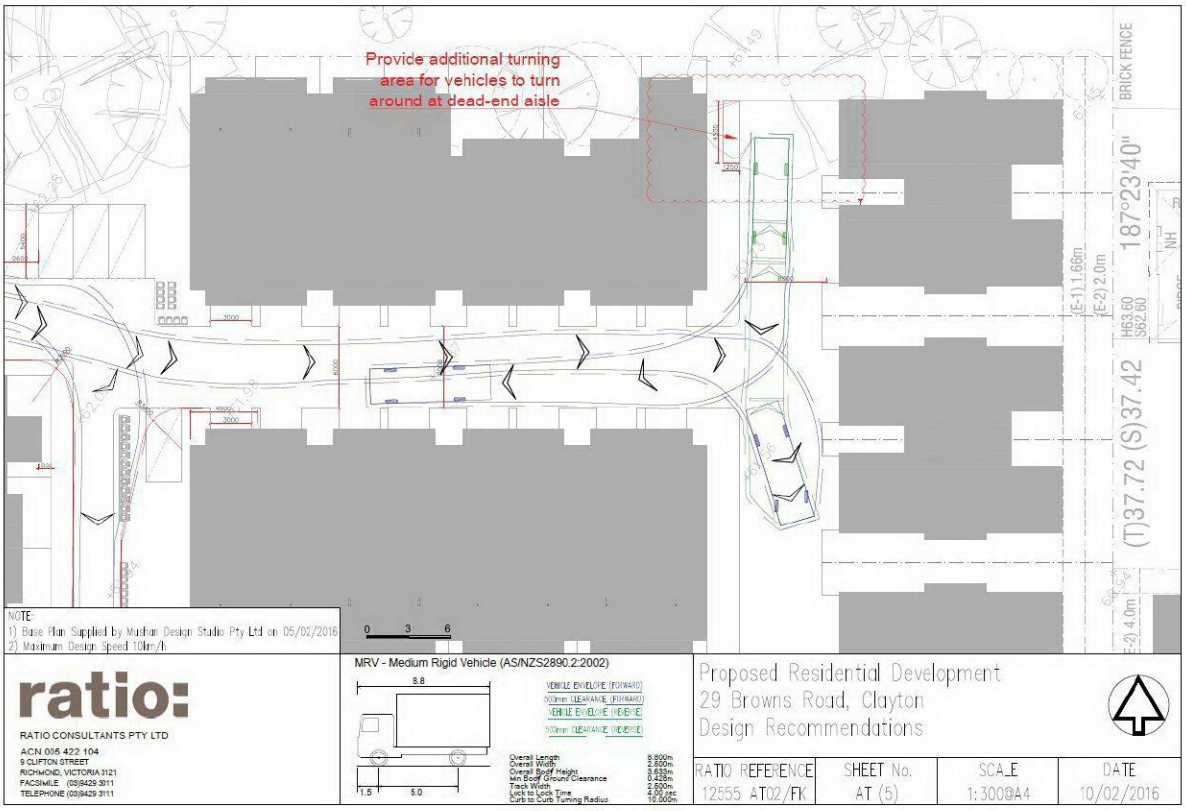
• • •

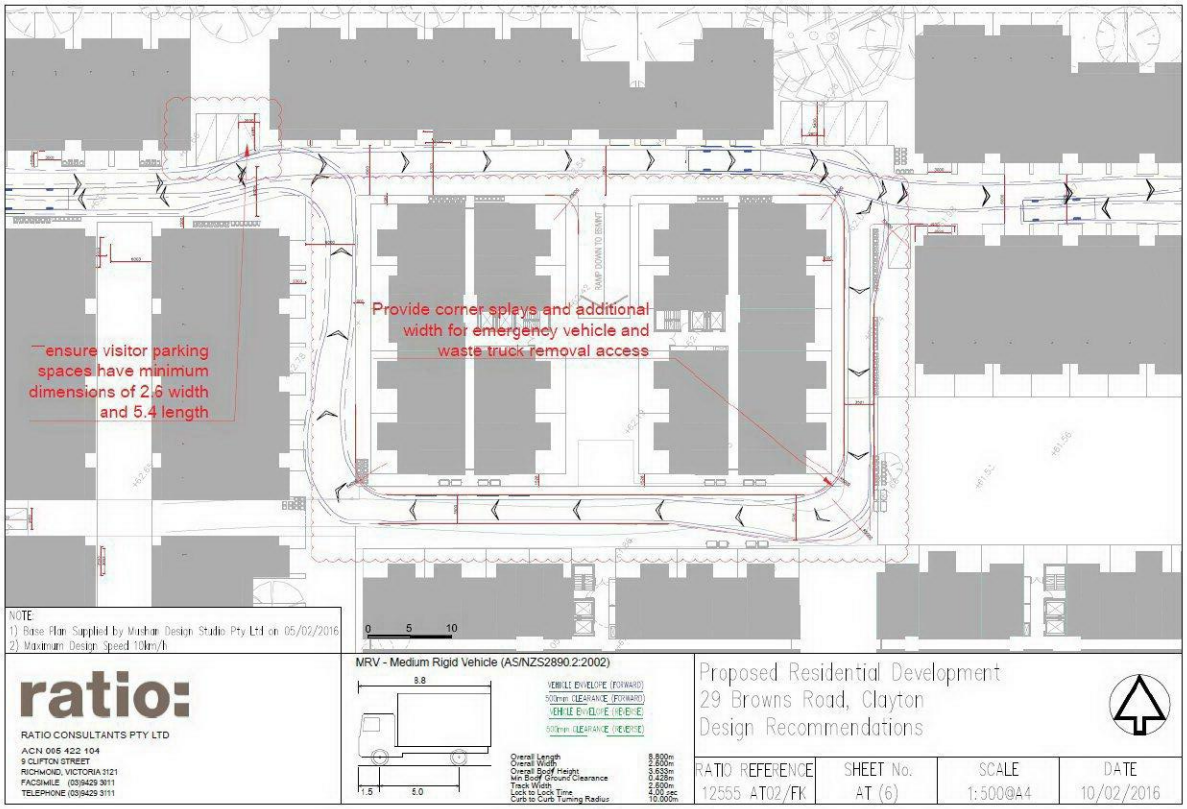



BROWNS ROAD
(T 212.26) (S 212.59) 277°19'10"
NOTE:
1) Base Plan Supplied by Mucham Design Studio Pty Ltd on 05/02/2016
2) Maximum Design Speed 10km/h
0 7.5 15
MRV - Medium Rigid Vehicle (AS/NZS2890.2:2002)
8.8
1.5 5.0
VEHICLE ENVELOPE (FORWARD)
500mm CLEARANCE (FORWARD)
VEHICLE ENVELOPE (REVERSE)
500mm CLEARANCE (REVERSE)
Overall Length 8.800m
Overall Width 2.500m
Overall Roof Height 3.633m
Min Roof Ground Clearance 0.428m
Track Width 2.500m
Lock to Lock Time 4.00 sec
Curb to Curb Turning Radius 10.000m
ratio:
RATIO CONSULTANTS PTY LTD
ACN 005 422 104
9 CLIFTON STREET
RICHMOND, VICTORIA 3121
FACSIMILE (03)9429 3011
TELEPHONE (03)9429 3111
Proposed Residential Development
29 Browns Road, Clayton
Design Recommendations
RATIO REFERENCE 12555 AT02/FK
SHEET No. AT (2)
SCALE 1:750@A4
DATE 10/02/2016


Provide additional turning area for vehicles to turn around at dead-end aisle
TOP OF WALL 64.80
BRICK WALL
(T 212.26) (S 212.59) 277°19'10"
NOTE:
1) Base Plan Supplied by Mucham Design Studio Pty Ltd on 05/02/2016
2) Maximum Design Speed 10km/h
0 3 6
MRV - Medium Rigid Vehicle (AS/NZS2890.2:2002)
8.8
1.5 5.0
VEHICLE ENVELOPE (FORWARD)
500mm CLEARANCE (FORWARD)
VEHICLE ENVELOPE (REVERSE)
500mm CLEARANCE (REVERSE)
Overall Length 8.800m
Overall Width 2.500m
Overall Roof Height 3.633m
Min Roof Ground Clearance 0.428m
Track Width 2.500m
Lock to Lock Time 4.00 sec
Curb to Curb Turning Radius 10.000m
ratio:
RATIO CONSULTANTS PTY LTD
ACN 005 422 104
9 CLIFTON STREET
RICHMOND, VICTORIA 3121
FACSIMILE (03)9429 3011
TELEPHONE (03)9429 3111
Proposed Residential Development
29 Browns Road, Clayton
Design Recommendations
RATIO REFERENCE 12555 AT02/FK
SHEET No. AT (3)
SCALE 1:300@A4
DATE 10/02/2016


Provide additional turning area for vehicles to turn around at dead-end aisle
(S)36.53 187°23'40"
H62.75
H62.90
S62.22
H62.80
S61.05
NOTE:
1) Base Plan Supplied by Mushan Design Studio Pty Ltd on 05/02/2016
2) Maximum Design Speed 10km/h
0 3 6
MRV - Medium Rigid Vehicle (AS/NZS2890.2:2002)
8.8
1.5
5.0
VEHICLE ENVELOPE (FORWARD)
500mm CLEARANCE (FORWARD)
VEHICLE ENVELOPE (REVERSE)
500mm CLEARANCE (REVERSE)
Overall Length 8.800m
Overall Width 2.500m
Overall Body Height 3.533m
Min Body Ground Clearance 0.428m
Track Width 2.500m
Lock to Lock Time 4.00 sec
Curb to Curb Turning Radius 10.000m
ratio:
RATIO CONSULTANTS PTY LTD
ACN 005 422 104
9 CLIFTON STREET
RICHMOND, VICTORIA 3121
FACSIMILE (03)9429 3011
TELEPHONE (03)9429 3111
Proposed Residential Development
29 Browns Road, Clayton
Design Recommendations
RATIO REFERENCE 12555 AT02/FK
SHEET No. AT (4)
SCALE 1:300@A4
DATE 10/02/2016

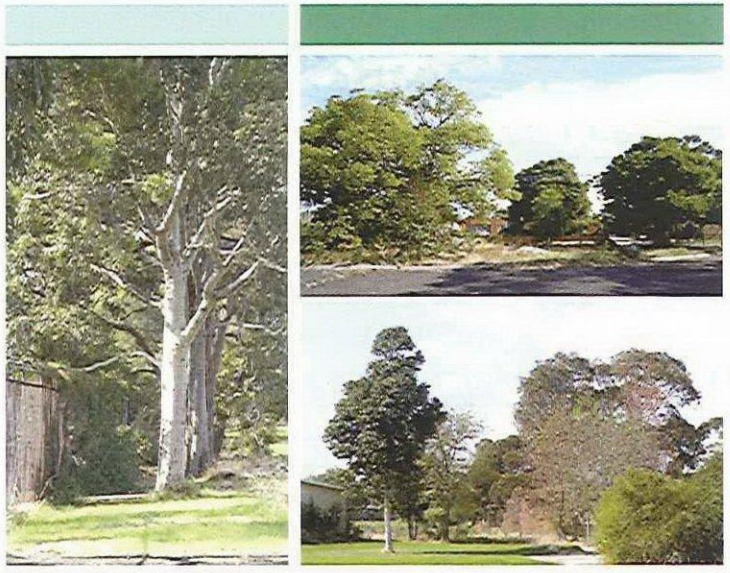

Provide additional turning area for vehicles to turn around at dead-end aisle
BRICK FENCE
187°23'40"
(T)37.72 (S)37.42
H63.60
S62.60
NOTE:
1) Base Plan Supplied by Mushan Design Studio Pty Ltd on 05/02/2016
2) Maximum Design Speed 10km/h
0 3 6
MRV - Medium Rigid Vehicle (AS/NZS2890.2:2002)
8.8
1.5
5.0
VEHICLE ENVELOPE (FORWARD)
500mm CLEARANCE (FORWARD)
VEHICLE ENVELOPE (REVERSE)
500mm CLEARANCE (REVERSE)
Overall Length 8.800m
Overall Width 2.500m
Overall Body Height 3.533m
Min Body Ground Clearance 0.428m
Track Width 2.500m
Lock to Lock Time 4.00 sec
Curb to Curb Turning Radius 10.000m
ratio:
RATIO CONSULTANTS PTY LTD
ACN 005 422 104
9 CLIFTON STREET
RICHMOND, VICTORIA 3121
FACSIMILE (03)9429 3011
TELEPHONE (03)9429 3111
Proposed Residential Development
29 Browns Road, Clayton
Design Recommendations
RATIO REFERENCE 12555 AT02/FK
SHEET No. AT (5)
SCALE 1:300@A4
DATE 10/02/2016


ensure visitor parking spaces have minimum dimensions of 2.6 width and 5.4 length
Provide corner splays and additional width for emergency vehicle and waste truck removal access
RAMP DOWN TO BASMT
NOTE:
1) Base Plan Supplied by Mucham Design Studio Pty Ltd on 05/02/2016
2) Maximum Design Speed 10km/h
0 5 10
ratio:
RATIO CONSULTANTS PTY LTD
ACN 005 422 104
9 CLIFTON STREET
RICHMOND, VICTORIA 3121
FACSIMILE (03)9429 3011
TELEPHONE (03)9429 3111
MRV - Medium Rigid Vehicle (AS/NZS2890.2:2002)
8.8
1.5
5.0
VEHICLE ENVELOPE (FORWARD)
500mm CLEARANCE (FORWARD)
VEHICLE ENVELOPE (REVERSE)
500mm CLEARANCE (REVERSE)
Overall Length 8.800m
Overall Width 2.500m
Overall Roof Height 3.633m
Min Roof Ground Clearance 0.428m
Track Width 2.500m
Lock to Lock Time 4.00 sec
Curb to Curb Turning Radius 10.000m
Proposed Residential Development
29 Browns Road, Clayton
Design Recommendations
RATIO REFERENCE
12555 AT02/FK
SHEET No.
AT (6)
SCALE
1:500@A4
DATE
10/02/2016

Appendix G: Arboricultural Assessment Report

mecone

D19-334480



Arboricultural Assessment
29 Browns Road, Clayton
Former Clayton Primary School

Prepared for
Department of Education and Early Childhood Development

Prepared by David Phillips

30/04/2013

treelogic

Tree management for the urban forest

Tree Logic Pty Ltd Unit 4, 21 Eugene Terrace Ringwood Vic 3134 Ph 03 9870 7700 **treelogic.com.au**

Contents.

Ref: 29 Browns Road, Clayton.

File No.	Version	Author	Issue date	Issued by.
13_4880	1	David Phillips	30/04/2013	DP

Client Brief

The Department of Education and Early Childhood Development contracted Tree Logic to undertake an assessment of trees associated with rezoning and potential development of the former Clayton Primary School at 29 Browns Road, Clayton.

The arboricultural consultancy was required to provide;

- A description of the assessment methods.
- A detailed tree assessment including species, dimensions, condition and arboricultural rating.
- Guidelines for tree protection.
- A plan (aerial image) that geographically locates and identifies (unique identifier - Tree No.) the assessed trees.
- Additional information included
  - Recommendations on any tree pruning works required to successfully retain suitable trees.
  - Geo-location point data for each tree point (X, Y co-ordinates).

1. Summary

1 Thirty-four (34) trees were assessed within the tree study area.

2 In general, the site comprised trees of average quality, located mostly around the northern, southern and western boundaries. Several trees were considered to be landscape features within the site.

3 All trees were attributed an arboricultural rating that reflects the retention value of each tree.

- Seventeen (17) trees were attributed an arboricultural rating of Moderate. (50%)
- Eleven (11) trees were rated Low. (32.4%)
- Six (6) trees were attributed an arboricultural rating of None. (17.6%)

Refer to Table 5 in Section 3 for tree numbers and tree assessment data in Appendix 1.

3.1 High and Moderate rated trees represent the best opportunity to retain established trees of Fair or better quality.

3.2 Low rated trees had health or structural deficiencies or were established tree weed species. Such trees are not considered worthy of being a constraint on reasonable design intent.

3.3 Trees rated None generally had structural defects, were hazardous or were self-sown weeds that should be removed for environmental reasons.

4 Tree protection zones (TPZ) have been calculated for each tree in accordance with the Australian Standard for Protection of Trees on Development Sites (AS 4970-2009). The TPZ is provided in the tree assessment data in Appendix 1, as a radial measurement.

4.1 The nominated TPZ may be reduced by 10% on one side if a commensurate area is allocated elsewhere and contiguous with the TPZ. TPZs have also been supplied in Appendix 1.

4.2 Existing soil grades must remain unaltered within the tree protection zone.

4.3 Excavation or trenching for installation of footings or underground services must not occur within the TPZ of any retained trees unless based on results of Non-destructive root investigation (NDRI) and approved by the site arborist and the relevant authority.

2. Method:

2.1 Site inspection methodology;

A site inspection was undertaken during mild conditions on the morning of Monday, April 8, 2013. The trees were inspected from the ground and observations were made of the growing environment and surrounding area. The trees were not climbed and no samples of the trees or site soil were taken.

Observations were made of the trees to determine age and condition, with measurements taken to establish tree height (measured with a height meter), crown width (paced) and trunk diameter (measured at 1.4m above grade unless otherwise stated). Definitions of arboricultural descriptors can be seen in Appendix 3.

The trees were plotted on orthorectified aerial imagery with GIS based software on field tablet computers with GPS and measuring tool capabilities. Geographical latitude and longitudinal reference points (X, Y coordinates) have been generated and included in the assessment data tables supplied with the report. These coordinates are accurate to within 2 to 3 metres and are considered adequate for pre-planning purposes. The location of trees nominated to be retained should be accurately located by conventional survey means prior to preparing any final designs.

The report includes assessment details in the Tree Assessment Tables in Appendix 1 and relate to the trees numbered on the site plan in Appendix 2.

Photographs of some trees and site conditions were taken for further reference and inclusion in the report.

2.2 Arboricultural assessment method;

The health and structural characteristics of each tree were assessed and each tree was attributed an 'Arboricultural Rating'. The arboricultural rating correlates the combination of tree condition factors (health, structure & form) with tree amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics within a built environment. The arboricultural rating in combination with other factors can assist the project team and planners in nominating trees suitable for retention. The four arboricultural ratings used by Tree Logic include:

- **High:** Trees of high quality in good to fair condition. Retention of such trees is highly desirable.
- **Moderate**: Trees with a Moderate arboricultural rating were generally suitable for retention and design should attempt to incorporate these trees and provide adequate clearances during development stages where reasonable design intent is not unduly hampered.
- **Low**: Trees with a Low arboricultural rating generally had low retention values. They were either fair specimens of relatively small size or displayed general health or structural deficiencies. Retention of Low rated trees may be considered in some instances if not requiring a disproportionate expenditure of resources to successfully incorporate into the design or manage ongoing condition.
- **None**: Trees attributed an arboricultural rating of None have health or structural characteristics that were beyond arboricultural maintenance or were environmental weed species.

Full tree descriptors are attached as Appendix 3.

2.3 Establishing Tree Protection Zones (TPZ);

2.3.1 To successfully retain suitable trees within or around a development site, consideration must be given to protecting the trunk, crown and roots of each specimen. Tree protection zones (TPZ's) are used to provide adequate space for the preservation of sufficient roots to maintain

tree health (particularly important for mature trees) whilst providing a buffer zone between construction activity and the tree trunk and crown.

2.3.2 The method for determining tree protection zones adopted in this report is the 'Australian Standard for Protection of trees on development sites' (AS4970-2009). The TPZ area is based on the trunk diameter measurement measured in metres at 1.4m and multiplied by 12 and is a guide for planning purposes. The trunk of the tree is used as the centre point for the measurement. TPZ measurements are included in the tree assessment data in Appendix 1.

2.3.3 Additional measurements can be calculated to determine the allowable encroachment on one side of the TPZ (Reduced TPZ) and the Structural Root Zone (SRZ) which is the absolute minimum required to maintain tree stability without consideration to ongoing health. Details of tree protection zone establishment, permissible encroachment and management guidelines are outlined in Appendix 4.

2.4 Documents reviewed include;

- Planning property reports and City of Monash Council planning zones and overlays. The site is zoned Public Use Zone – Education (PUZ2) and no specific overlays apply relating to tree management.
- Clause 22.05 Tree conservation policy of the City of Monash covers all properties in City of Monash. It is policy that existing semi-mature and mature canopy trees be retained wherever possible to ensure maintenance of the tree canopy.

  Clause 52.17 of the Victorian Planning Provisions of the Planning and Environment Act, 1987 (Vic) applies to the site because the allotment is greater than 4,000 m^2 (0.4Ha) in area.

  Under clause 52.17 it is necessary to demonstrate what steps have been taken
  - To avoid the removal of (Victorian) native vegetation.
  - To minimise the removal of native vegetation.
  - To appropriately offset the loss of native vegetation.
  - Clause 52.17 applies only to vegetation native to Victoria. Vegetation planted for purposes of 'shelter belts, woodlots, street trees, gardens or the like' are exempt under 52.17-6 *unless planted with assistance from public funding*.

3 Observations

The tree study area is the former Clayton Primary School on Browns Road in Clayton. It is a flat allotment of approximately 2Ha with no creeks or natural drainage lines within the site. Industrial sites abut the northern and southern boundaries and residential housing allotments are located to the east and west. The school buildings, foundations and asphalt areas have been retained.

The majority of trees are located in around the perimeters and only provided limited screening to the neighbouring properties on the north and south sides. A row of trees were located in a garden bed along the western boundary and other trees were located in grassed areas and open space.

A Group of trees were located in the adjoining property to the north and were not assessed. These trees abutted against the northern boundary in close proximity to an asphalt area. This asphalt area was located within the school site and aligned within one metre of the northern boundary.

Tree population:

3.1 Thirty-four (34) trees were inspected.
Refer to Appendix 2 for tree locations and numbering.

3.2 The origin of all trees was assessed to determine if any trees were indigenous to the local area or of other botanical significance. The origin of the assessed trees is indicated in Table 1.

Table 1: Tree origin	Total	
Victorian Native	12	35.3%
Australian Native	12	35.3%
Exotic Deciduous	9	26.5%
Exotic Evergreen	1	2.9%
Total	34	100%

Based on the species selection and spatial arrangement, it is concluded that all trees were specimens planted primarily for garden and amenity purposes.

Tree 8 was a semi-mature River Red Gum which is likely to have been planted due to tree age and the absence of other large River Red Gums from which it may have naturally seeded from. The second River Red Gum had self-seeded, due to observations of smaller seedlings and the size of the tree in relation to the time frame in which the site has been disused.

3.3 Twenty-three (23) different species were observed within the tree population. The six most prevalent species on site are indicated in Table 2.

Table 2. Predominant species	Number of trees
Desert Ash (*Fraxinus angustifolia* subsp. *angustifolia*)	5
Spotted Gum (*Corymbia maculata*)	4
Brush Box (*Lophostemon confertus*)	2
River Red Gum (*Eucalyptus camaldulensis*)	2
Silver Wattle (*Acacia dealbata*)	2
Smooth-barked Apple (*Angophora costata*)	2
Total	17 of 34

These species represented 50 % of the total tree population. The most prominent specie is considered to be an environmental weed species and was self-seeding within the site. The Spotted Gums were established trees of Moderate arboricultural value and suitable for retention within site development.

3.4 Tree health:

The health rating was assessed based on foliage colour, size and density as well as shoot initiation and elongation.

In general the trees displayed Fair health (91.2 %) which is considered to be typical for the species growing in this environment under the current conditions and one tree, Tree 7 was dead.

3.5 Tree structure:
The structure of the trees was assessed for structural defects and deficiencies, likelihood of failures and presence of targets.

In general, Sixteen (47.1 %) trees displayed Fair and Sixteen (47.1 %) trees displayed a Fair – poor structural condition. Trees with a Fair – poor structural condition generally displayed an inherent structural defect of included bark forks, while two (5.9 %) trees were of poor structural condition.

3.6 Trees may be considered significant to the landscape because of their size, dominance within the site, presence within outlooks and general amenity in terms of shade, screen, foliage and flowers and historic, cultural or horticultural characteristics. The key requirement for successful tree retention is to identify the trees that represent the best opportunity for retention and implement tree protection and design amendments before any site works commence. The arboricultural rating in combination with other factors can assist the project team and planners in nominating trees suitable for retention.

Each of the assessed trees was attributed an 'Arboricultural Rating'. The arboricultural rating correlates the combination of tree condition factors (health, structure & form) with tree amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics within an urban landscape context and its ability to continue to provide these qualities into the medium to long term future.
It should be noted that the arboricultural rating is different to the conservation/ecological values placed on trees by other professions.

Table 3 indicates the arboricultural ratings attributed to the trees inspected.

Table 3: Arb. Rating	Total	Trees number
Moderate	17	1, 3, 8, 14, 18, 20, 22, 23, 24, 25, 26, 28, 29, 31, 32, 33, 34
Low	11	2, 5, 11, 12, 13, 15, 16, 17, 19, 21, 30
None	6	4, 6, 7, 9, 10, 27
Total	34	

3.7.1 High and Moderate rated trees represent trees of fair or better condition. These trees are considered to be suitable to retain and as having the best potential to be medium to long term features of the surrounding landscape if retained.

Pruning recommendations should be undertaken to enhance the longevity and safe retention of these trees.

Low rated trees were generally either of relatively small dimensions, of unremarkable quality, had a relatively short useful life expectancy or displayed below typical health or structure.

Low rated trees are not considered to be worthy of being a constraint on reasonable design intent and development within the site.
However, not all Low rated trees should be dismissed as some may still contribute to the landscape amenity as an established tree resource and have the potential to be safely retained if appropriate tree protection measures and arboricultural maintenance is provided as required.

3.7.2 Trees rated None were generally defective, hazardous or were self-sown weeds that should be removed for environmental reasons.

(Refer to Appendix 2 for tree location and numbering and Appendix 3 for tree descriptors).

4 Permit requirement:

Based on the species selection and spatial arrangement, it is concluded that all trees were specimens planted primarily for garden and amenity purposes.

Monash has a Tree Conservation Policy (22.05) that applies to all properties in City of Monash. It is policy that existing semi-mature and mature canopy trees be retained wherever possible to ensure maintenance of the tree canopy.

5 Design proposal:

5.1 The pre-development arboricultural inspection report provides planners and designers with information on the measures required to protect trees suitable to be retained. At the time of undertaking the tree assessment there was no requirement to undertake a concept design review.

5.2 In the absence of formal design plans, it is not appropriate to speculate on which trees are most appropriate for retention beyond the general guide provided by the arboricultural ratings attributed to each tree feature.

5.3 It is recommended that trees of High and Moderate arboricultural value be considered for retention and protection over trees of Low or No arboricultural value during any redevelopment of the site.

5.4 The Low rated trees within the site were either deficient in health or structure or were of small size and were not worthy of being a constraint on reasonable design intent.

5.4.1 However not all Low rated trees should be dismissed altogether. Some Low rated trees can be retained as an established tree resource where they are not impacted directly by any proposed construction activity or where they perform a role such as screening neighbouring properties or the like or protect from erosion, winds, frosts or other actions.

5.5 Weed species should generally be removed for sound environmental reasons.

5.6 The tree protection zones (TPZ) have been determined for each tree based on the Australian Standard for Protection of Trees on Development Sites (AS 4970-2009). The method for calculating, applying and managing the tree protection zone is described in Appendix 4.

5.6.1 Where construction related activity is confined to only one side of the tree, the nominal TPZ may be reduced by 10% of the TPZ area which is equivalent to approximately 1/3 radial distance.

5.7 It is well understood that trees develop a relatively shallow lateral root system as opposed to a 'tap' root. Managing these surface roots must be considered with regard to any tree that is to be retained. Ensuring that existing soil levels are maintained within the nominated tree protection zone is important and any construction proposed within the TPZ of a retained tree must adopt a root sensitive design and construction method approved under consultation with the site arborist or the relevant authorities.

5.8 It is recommended that exclusion fencing be established around all retained trees prior to any further works occurring on site including bulk earthworks, excavation for footings or installation of underground services or any construction related activity to prevent damage to roots, buttress, trunk or limbs and to prevent soil compaction.

5.8.1 The area within the TPZ should be mulched to 100mm depth with matured wood chip mulch with a particle size of 25mm for 75% of the volume.

5.8.2 The growth of self-sown saplings or weed invasion should be controlled within the TPZ areas.

6. Photographic examples

1. Shows the relative size, condition and location of Tree 3, a Spotted Gum. The tree was of Moderate arboricultural value and is desirable and suitable to be retained.
2. Shows a section of the site looking towards the playing oval to the rear of the school buildings with Tree 14, a Honey Locust (*Gleditsia tricanthos*) located in the centre.
3. Shows the relative size, location and condition of trees located along part of the northern boundary. These were trees of Moderate arboricultural value.
4. Shows several trees located on the western boundary. These trees are of Moderate arboricultural value and are desirable and suitable for retention. TPZ distances should be maintained when construction occurs near these trees.
5. Shows trees in the adjoining northern property. The area next to these trees has been covered in asphalt and may contain roots underneath. A survey and assessment of these trees is required to calculate TPZ if construction is to occur within close vicinity to these trees.
6. Shows the relative size, condition and location of Tree 1, a Spotted Gum and Tree 2, a Silky Oak. Tree 1 was of Moderate arboricultural and is desirable and suitable to be retained. Tree 2 had its roots partially severed on the south side which may reduce the structural integrity of the tree.

7. Conclusion and Recommendations:

7.1. Thirty-four (34) individual trees were inspected within the site of the former Clayton Primary School at 29 Browns Road, Clayton.

7.2. All trees were attributed an arboricultural rating that reflects the retention value of each tree.

- Seventeen trees were attributed an arboricultural rating of Moderate.
- Eleven trees were rated Low.
- Six trees were attributed an arboricultural rating of None.

Refer to Page 7, Table 3 for tree numbers, Appendix 2 for tree locations and Appendix 3 for tree descriptors.

7.3. It is recommended that trees in the adjoining northern property be surveyed by conventional survey methods to identify their exact location and be assessed to calculate tree protection zones if construction works are to be carried out in close vicinity to the trees.

7.4. To successfully retain the nominated suitable trees, tree protection measures must be implemented prior to any commencing any construction related activity including demolition, bulk earthworks and must be maintained for the duration of the construction process including landscaping.

7.4.1. Tree protection zones must be appropriately fenced to prevent vehicle access, excavation, trenching, contamination or raised soil levels occurring within the reduced TPZ.

7.5. Any pruning recommendations must be undertaken by a suitably qualified and experienced arborist and comply with Australian Standard AS 4373-2007 - Pruning of Amenity trees to extend the useful life expectancy of retained trees.

I am available to answer any questions arising from this report.

No part of this report is to be reproduced unless in full.

Signed

D. Phillips

David Phillips

Consulting Arborist- Treelogic P/L

Associate Degree (Env Hort)

M 0433 813 587 E david.phillips@treelogic.com.au

References:

Australian Standard (4970-2009) Protection of Trees on development sites. Standards Australia, Sydney NSW Australia

Clark, J.R. & Matheny, N.P (1998), Trees and Development: A technical guide to preservation of trees during land development. ISA , Champaign, Illinois.

Standards Australia (2007), Australian Standard (4373-2007) - Pruning of Amenity trees, Standards Australia, Homebush, NSW.

Appendix 1: Tree details: 29 Browns Road, Clayton.

Refer to following 3 pages.

DBH = Diameter at Breast Height (measured in centimetres at 1.4m above ground unless otherwise stated).

TPZ = Tree Protection Zone (metre radius). Radius distances measured in metres from the centre of the trunk.

For tree location and numbering refer Appendix 2. See Appendix 3 for Tree descriptors.

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (Radial metres)	Recommended Work
1	Spotted Gum (Corymbia maculata)	Victorian Native	26	13	7	Semi-mature	Fair	Fair	Moderate		3.1	
2	Silky Oak (Grevillea robusta)	Australian Native	34	11	10	Semi-mature	Fair	Fair - Poor	Low	Partial root severance on south side.	4.1	
3	Spotted Gum (Corymbia maculata)	Victorian Native	27	13	7	Semi-mature	Fair	Fair	Moderate		3.2	
4	Desert Ash (Fraxinus angustifolia subsp. angustifolia)	Exotic Deciduous	16,23	8	7	Semi-mature	Fair	Fair	None	Weed Species.	3.4	
5	Brush Box (Lophostemon confertus)	Australian Native	20	9	4	Semi-mature	Poor	Fair	Low		2.4	
6	Desert Ash (Fraxinus angustifolia subsp. angustifolia)	Exotic Deciduous	12,10,10	9	6	Semi-mature	Fair	Fair - Poor	None	Weed Species.	2.2	
7	Narrow-leaved Peppermint (Eucalyptus nicholii)	Australian Native	50	10	10	Semi-mature	Dead	Poor	None	Fungal bracket.	6.0	Remove
8	River Red Gum (Eucalyptus camaldulensis)	Victorian Native	41,54	16	13	Semi-mature	Fair	Fair	Moderate	Uplift on south east side.	8.1	Crown Uplift
9	Desert Ash (Fraxinus angustifolia subsp. angustifolia)	Exotic Deciduous	21	8	9	Semi-mature	Fair	Fair - Poor	None	Weed Species.	2.5	

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (Radial metres)	Recommended Work
10	Desert Ash (Fraxinus angustifolia subsp. angustifolia)	Exotic Deciduous	22,10	9	7	Semi-mature	Fair	Fair - Poor	None	Weed Species.	2.9	
11	Magenta Cherry (Syzygium paniculatum)	Australian Native	12,18,10, 12,6	10	7	Semi-mature	Fair	Fair - Poor	Low		3.3	
12	River Red Gum (Eucalyptus camaldulensis)	Victorian Native	11,14,14	6	7	Semi-mature	Fair	Fair	Low	Self seeded.	2.7	
13	Golden Rain Wattle (Acacia prominens)	Australian Native	37	8	10	Mature	Fair	Poor	Low	Branch failures.	4.4	
14	Honey Locust (Gelditsia tricanthos)	Exotic Deciduous	31 @ 1.0m	6	12	Semi-mature	Fair	Fair - Poor	Moderate		3.7	
15	Weeping Bottlebrush (Callistemon viminalis)	Australian Native	15,10,11 @ 1.0m	4	7	Semi-mature	Fair	Fair - Poor	Low		2.5	
16	Bushy Sugar Gum (Eucalyptus cladocalyx 'Nana')	Australian Native	60	11	15	Mature	Fair - Poor	Fair	Low	Dieback Crown.	7.2	
17	Blackwood (Acacia melanoxylon)	Victorian Native	18,15	6	8	Semi-mature	Fair	Fair - Poor	Low		2.8	
18	Smooth-barked Apple (Angophora costata)	Australian Native	63	15	16	Semi-mature	Fair	Fair	Moderate		7.6	
19	Silver Wattle (Acacia dealbata)	Victorian Native	36 @ 1.0m	10	9	Mature	Fair	Fair - Poor	Low	Partly Suppressed. Short life expectancy	4.3	
20	Box Elder (Acer negundo)	Exotic Deciduous	45 @ 1.0m	10	14	Semi-mature	Fair	Fair	Moderate		5.4	Crown Uplift
21	Silver Wattle (Acacia dealbata)	Victorian Native	32 @ 1.0m	10	14	Mature	Fair	Fair	Low	Short life expectancy	3.8	
22	Yellow Gum (Eucalyptus leucoxylon)	Victorian Native	35	12	8	Semi-mature	Fair	Fair - Poor	Moderate		4.2	

Tree No.	Common Name (Botanical Name)	Origin	DBH (cm)	Height (m)	Width (m)	Life Stage	Health	Structure	Retention Value	Comments	TPZ (Radial metres)	Recommended Work
23	Smooth-barked Apple (Angophora costata)	Australian Native	37,39	12	17	Semi-mature	Fair	Fair - Poor	Moderate	Partly Suppressed.	6.5	
24	Tasmanian Blue Gum (Eucalyptus globulus)	Victorian Native	82	21	14	Mature	Fair	Fair - Poor	Moderate	Trunk wound	9.8	
25	Spotted Gum (Corymbia maculata)	Victorian Native	51	20	15	Semi-mature	Fair	Fair	Moderate		6.1	
26	Spotted Gum (Corymbia maculata)	Victorian Native	47	16	15	Semi-mature	Fair	Fair	Moderate		5.6	
27	Desert Ash (Fraxinus angustifolia subsp. angustifolia)	Exotic Deciduous	33	12	10	Semi-mature	Fair	Fair	None	Weed Species.	4.0	
28	Brush Box (Lophostemon confertus)	Australian Native	42	10	8	Semi-mature	Fair	Fair	Moderate	Past Power line clearance.	5.0	
29	Pin Oak (Quercus palustris)	Exotic Deciduous	39	10	15	Semi-mature	Fair	Fair - Poor	Moderate	Included Bark Fork.	4.7	Reduce Lesser Co-dominant Stem
30	Scented Paperbark (Melaleuca styphelioideas)	Australian Native	29,31	7	8	Semi-mature	Fair	Fair - Poor	Low	Partly Suppressed.	5.1	
31	European Ash (Fraxinus excelsior 'Area')	Exotic Deciduous	14,16,23	5	8	Semi-mature	Fair	Fair	Moderate		3.8	
32	Willow Myrtle (Agonis flexuosa)	Australian Native	64	8	8	Mature	Fair	Fair - Poor	Moderate		7.7	
33	Camphor Laurel (Cinnamomum camphora)	Exotic Evergreen	54,34 @ 1.0m	10	14	Semi-mature	Fair	Fair	Moderate		7.7	
34	Lilly Pilly (Acmena smithii)	Victorian Native	20,29	7	8	Semi-mature	Fair	Fair - Poor	Moderate		4.2	

Appendix 2: Tree numbers & locations: 29 Browns Road, Clayton.

Refer to following 3 pages.

D19-334480

Appendix 3: Arboricultural Descriptors (October 2011)

Tree Condition

The assessment of tree condition evaluates factors of health and structure. The descriptors of health and structure attributed to a tree evaluate the individual specimen t o what could be considered typical for that species growing in its location. For example, some species can display inherently poor branching architecture, such as multiple acute branch attachments with included bark. Whilst these structural defects may technically be considered arboriculturally poor, they are typical for the species and may not constitute an increased risk of failure. These trees may be assigned a structural rating of fair-poor (rather than poor) at the discretion of the author.

Diagram 1, provides an indicative distribution curve for tree condition to illustrate that within a normal tree population the majority of specimens are centrally located within the condition range (normal distribution curve). Furthermore, that those individual trees with an assessed condition approaching the outer ends of the spectrum occur less often.

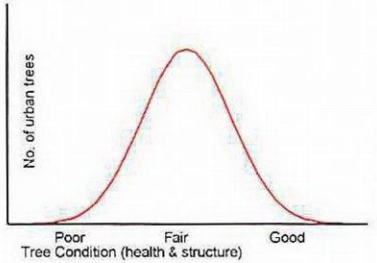


Diagram 1: Indicative normal distribution

Tree Name

Provides botanical name, (genus, species, variety and cultivar) according to accepted international code of taxonomic classification, and common name.

Tree Type

Describes the general geographic origin of the species and its type e.g. deciduous or evergreen.

Category	Description
Indigenous	Occurs naturally in the area or region of the subject site
Victorian native	Occurs naturally within some part of the State of Victoria (not exclusively) but is not indigenous
Australian native	Occurs naturally within Australia but is not a Victorian native or indigenous
Exotic deciduous	Occurs outside of Australia and typically sheds its leaves during winter
Exotic evergreen	Occurs outside of Australia and typically holds its leaves all year round
Exotic conifer	Occurs outside of Australia and is classified as a gymnosperm
Native conifer	Occurs naturally within Australia and is classified as a gymnosperm
Native Palm	Occurs naturally within Australia. Woody monocotyledon
Exotic Palm	Occurs outside of Australia. Woody monocotyledon

Height and Width

Indicates height and width of the individual tree; dimensions are expressed in metres. Crown heights are measured with a height meter where possible. Due to the topography of some sites and/or the density of vegetation it may not be possible to do this for every tree. Tree heights may be estimated in line with previous height meter readings in conjunction with author's experience. Crown widths are generally paced (estimated) at the widest axis or can be measured on two axes and averaged. In some instances the crown width can be measured on the four cardinal direction points (North, South, East and West).

Diameter at Breast Height (DBH)

Indicates the trunk diameter (expressed in centimetres) of an individual tree measured at 1.4m above the existing ground level or where otherwise indicated, multiple leaders are measured individually. Plants with multiple leader habit may be measured at the base. The range of methods to suit particular trunk shapes, configurations and site conditions can be seen in Appendix A of Australian Standard AS 4970-2009 Protection of trees on development sites. Measurements undertaken with forestersØ tape or builders tape.

Health

Assesses various attributes to describe the overall health and vigour of the tree.

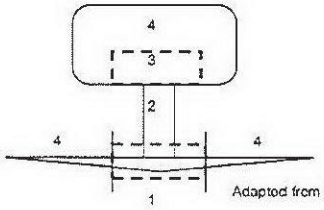
Category	Vigour/Extension growth	Decline symptoms/Deadwood	Foliage density, colour, size, intactness	Pests and or disease
Good	Above typical	None or minimal	Better than typical	None or minimal
Fair	Typical	Typical or expected	Typical	Typical, within damage thresholds
Fair to Poor	Below typical	More than typical	Exhibiting deficiencies	Exceeds damage thresholds
Poor	Minimal	Excessive and large amount/size	Exhibiting severe deficiencies	Extreme and contributing to decline
Dead	N/A	N/A	N/A	N/A

Structure

Assesses principal components of tree structure (Diagram 2).

Descriptor	Zone 1 - Root plate & lower stem	Zone 2 - Trunk	Zone 3 - Primary branch support	Zone 4 - Outer crown and roots
Good	No damage, disease or decay; obvious basal flare / stable in ground	No damage, disease or decay; well tapered	Well formed, attached, spaced and tapered	No damage, disease, decay or structural defect
Fair	Minor damage or decay. Basal flare present.	Minor damage or decay	Typically formed, attached, spaced and tapered	Minor damage, disease or decay; minor branch end-weight or over-extension
Fair to Poor	Moderate damage or decay; minimal basal flare	Moderate damage or decay; approaching recognised thresholds	Weak, decayed or with acute branch attachments; previous branch failure evidence	Moderate damage, disease or decay; moderate branch end-weight or over-extension
Poor	Major damage, disease or decay; fungal fruiting bodies present. Excessive lean placing pressure on root plate	Major damage, disease or decay; exceeds recognised thresholds; fungal fruiting bodies present. Acute lean. Stump resprout	Decayed, cavities or has acute branch attachments with included bark; excessive compression flaring; failure likely	Major damage, disease or decay; fungal fruiting bodies present; major branch end-weight or over-extension
Very Poor	Excessive damage, disease or decay; unstable / loose in ground; altered exposure; failure probable	Excessive damage, disease or decay; cavities. Excessive lean. Stump resprout	Decayed, cavities or branch attachments with active split; failure imminent	Excessive damage, disease or decay; excessive branch end-weight or over-extension

Diagram 2: Tree structure zones
1. Root plate & lower stem
2. Trunk
3. Primary branch support
4. Outer crown & roots



Adapted from Coder (1996)

Trees are assessed and the given a rating for a point in time. Generally, trees with a poor or very poor structure are beyond the benefit of practical arboricultural treatments. The lowest or worst descriptor assigned to the tree in any column could generally be the overall rating assigned to the tree. The assessment for structure is limited to observations of external and above ground tree parts. It does not include any exploratory assessment of underground or internal tree parts unless this is requested as part of the investigation.

Structure ratings will also take into account general tree architecture which considers aspects of stem taper, live crown ratio, branch distribution or crown bias and position such as a tree being suppressed amongst more dominant trees.

The management of trees in the urban environment requires appropriate arboricultural input and consideration of risk. Risk potential will take into account the combination of likelihood of failure and impact, including the perceived importance of the target(s).

Life Stage

Relates to the physiological stage of the tree's life cycle.

Category	Description
Young	Sapling tree and/or recently planted
Semi-mature	Tree rapidly increasing in size and yet to achieve expected size in situation
Maturing	Specimen approaching expected size in situation, with reduced incremental growth
Over-mature	Tree is senescent and in decline

Arboricultural Rating

Relates to the combination of tree condition factors, including health and structure (arboricultural merit), and also conveys an amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics (Hitchmough 1994) within an urban landscape context.

Category	Description
High	Tree of high quality in good to fair condition. Generally a prominent arboricultural feature. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is highly desirable.
Moderate	Tree of moderate quality, in fair or better condition. Tree may have a condition, and or structural problem that will respond to arboricultural treatment. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is generally desirable.
Low	Tree of low quality and/or little amenity value. Tree in poor health and/or with poor structure. Tree is not significant for its size and/or young. These trees are easily replaceable. Tree (species) is functionally inappropriate to specific location and would be expected to be problematic if retained. Retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location.
None	Tree has a severe structural defect and/or health problem that cannot be sustained with practical arboricultural techniques and the loss of tree would be expected in the short term. Tree whose retention would not be viable after the removal of adjacent trees (includes trees that have developed in close spaced groups and would not be expected to acclimatise to severe alterations to surrounding environment – removal of adjacent shelter trees). Tree has a detrimental effect on the environment, for example, the tree is a woody weed with potential to spread into waterways or natural areas.

Tree significance

Trees have many values, not all of which are considered when an arboricultural assessment is undertaken. However, individual trees or tree group features may be considered important community resources because of unique or noteworthy characteristics or values other than their age, dimensions, health or structural condition. Recognition of one or more of the following criterion is designed to highlight other considerations that may influence the future management of such trees.

Significance	Description
Horticultural Value/ Rarity	Outstanding horticultural or genetic value; could be an important source of propagating stock, including specimens that are particularly resistant to disease or exposure. Any tree of a species or variety that is rare.
Historic, Aboriginal Cultural or Heritage Value	Tree could have value as a remnant of a particular important historical period or a remnant of a site or activity no longer in action. Tree has a recognised association with historic aboriginal activities, including scar trees. Tree commemorates a particular occasion, including plantings by notable people, or having associations with an important event in local history.
Ecological Value	Tree could have value as habitat for indigenous wildlife, including providing breeding, foraging or roosting habitat, or is a component of a wildlife reserve. Remnant indigenous vegetation that contribute to biological diversity

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Appendix 4: Tree protection zones. Tree logic Pty. Ltd. © 2005

1.0 Introduction

In order to sustain trees on a development site consideration must be given to the establishment of tree protection zones.

The physical dimensions of tree protection zones can sometimes be difficult to define. The projection of a tree's crown can provide a guide but is by no means the definitive measure. The unpredictable nature of roots and their growth, differences between species and their tolerances, and observable and hidden changes to the trees growing environment, as a result of development, are variables that must be considered.

Most vigorous, broad canopied trees survive well if the area within the drip-line of the canopy is protected. Fine root density is usually greater beneath the canopy than beyond (Gilman, 1997). If few to no roots over 3cm in diameter are encountered and severed during excavation the tree will probably tolerate the impact and root loss. A healthy tree can sustain a loss of between 30% and 50% of absorbing roots (Harris, Clark, Matheny, 1999), however encroachment into the structural root system of a tree may be problematic.

The structural root system of a tree is responsible for ensuring the stability of the entire tree structure in the ground. A tree could not sustain loss of structural root system and be expected to survive let alone stand up to average annual wind loads upon the crown.

2.0 Allocation of tree protection zone (TPZ)

The method of allocating a TPZ to a particular tree will be influenced by site factors, the tree species, its age and developed form.

Once it has been established, through an arboricultural assessment, which trees and tree groups are to be retained, the next step will require careful management through the development process to minimise any impacts on the designated trees. The successful retention of trees on any particular site will require the commitment and understanding of all parties involved in the development process. The most important activity, after determining the trees that will be retained is the implementation of a TPZ.

The intention of tree protection zones is to:

- mitigate tree hazards;
- provide adequate root space to sustain the health and aesthetics of the tree into the future;
- minimise changes to the trees growing environment, which is particularly important for mature specimens;
- minimise physical damage to the root system, canopy and trunk; and
- define the physical alignment of the tree protection fencing

Tree protection

The most important consideration for the successful retention of trees is to allow appropriate above and below ground space for the trees to continue to grow. This requires the allocation of tree protection zones for retained trees.

The Australian Standard AS 4970-2009 Protection of trees on development sites has been used as a guide in the allocation of TPZs for the assessed trees. The TPZ for individual trees is calculated based on trunk (stem) diameter (DBH), measured at 1.4 metres up from ground level. The radius of the TPZ is calculated by multiplying the trees DBH by 12. The method provides a TPZ that addresses both the stability and growing requirements of a tree. TPZ distances are measured as a radius from the centre of the trunk at (or near) ground level. The minimum TPZ should be no less than 2m and the maximum no more than 15m radius. The TPZ of palms should be not less than 1.0m outside the crown projection.

Encroachment into the TPZ is permissible under certain circumstances though is dependent on both site conditions and tree characteristics. Minor encroachment, up to 10% of the TPZ, is generally permissible provided encroachment is compensated for by recruitment of an equal area contiguous with the TPZ. Examples are provided in Diagram 1. Encroachment greater than 10% is considered major encroachment under AS4970-2009 and is only permissible if it can be demonstrated that after such encroachment the tree would remain viable.

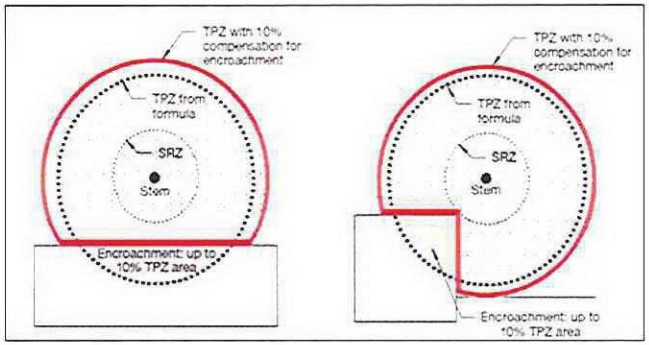

Diagram 1: Examples of minor encroachment into a TPZ. Extract from: AS4970-2009, Appendix D, p30 of 32

The 10% encroachment on one side equates to approximately ⅓ radial distance. Tree root growth is opportunistic and occurs where the essentials to life (primarily air and water) are present. Heterogeneous soil conditions, existing barriers, hard surfaces and buildings may have inhibited the development of a symmetrically radiating root system.

Existing infrastructure around some trees may be within the TPZ or root plate radius. The roots of some trees may have grown in response to the site conditions and therefore if existing hard surfaces and building alignments are utilised in new designs the impacts on the trees should be minimal. The most reliable way to estimate root disturbance is to find out where the roots are in relation to the demolition, excavation or construction works that will take place (Matheny & Clark, 1998). Exploratory excavation prior to commencement of construction can help establish the extent of the root system and where it may be appropriate to excavate or build.

The TPZ should also give consideration to the canopy and overall form of the tree. If the canopy requires severe pruning in order to accommodate a building and in the process the form of the tree is diminished it may be worthwhile considering altering the design or removing the tree.

General tree protection guidelines

The most important factors are:

- Prior to construction works the trees nominated for tree works should be pruned to remove larger dead wood. Pruning works may also identify other tree hazards that require remedial works.
- Installation of tree protection fencing. Once the tree protection zones have been determined the next step is to mulch the zone with woodchip and erect tree protection fencing. This must be completed prior to any materials being brought on-site, erection of temporary site facilities or demolition/earth works. The protection fencing must be sturdy and withstand winds and construction impacts. The protection fence should only be moved with approval of the site supervisor. Other root zone protection methods can be incorporated if the TPZ area needs to be traversed.
- Appropriate signage is to be fixed to the fencing to alert people as to importance of the tree protection zone.
- The importance of tree preservation must be communicated to all relevant parties involved with the site.
- Inspection of trees during excavation works.

Exploratory excavation

The most reliable way to estimate root disturbance is to find out where the roots are in relation to the demolition, excavation or construction works that will take place (Matheny & Clark, 1998).

Exploratory excavation prior to commencement of construction can help establish the extent of the root system and where it may be appropriate to excavate or build. This also allows management decisions to be made and allows time for redesign works if required.

Any exploratory excavation within the allocated TPZ is to be undertaken with due care of the roots. Minor exploration is possible with hand tools. More extensive exploration may require the use of high pressure water or air excavation techniques. Either hydraulic or pneumatic excavation techniques will safely expose tree roots; both have specific benefits dependent on the situation and soil type. An arborist is to be consulted on which system is best suited for the site conditions.

Substantial roots are to be exposed and left intact.

Once roots are exposed decisions can be made regarding the management of the tree. Decisions will be dependent on the tree species, its condition, its age, its relative tolerance to root loss, and the amount of root system exposed and requiring pruning.

Other alternative measures to encroaching the TPZ may include boring or tunnelling.

Construction Guidelines

The following are guidelines that must be implemented to minimise the impact of the proposed construction works on the retained trees.

- The Tree Protection Zone (TPZ) is fenced and clearly marked at all times. The actual fence specifications should be a minimum of 1.2 - 1.5 metres of chain mesh or like fence with 1.8 meter posts (e.g. treated pine or star pickets) or like support every 3-4 metres and a top line of high visibility plastic hazard tape. The posts should be strong enough to sustain knocks from on site excavation equipment. This fence will deter the placement of building materials, entry of heavy equipment and vehicles and also the entry of workers and/or the public into the TPZ. Note: There are many different variations on the construction type and material used for TPZ fences, suffice to say that the fence should satisfy the responsible authority.
- Contractors and site workers should receive written and verbal instruction as to the importance of tree protection and preservation within the site. Successful tree preservation occurs when there is a commitment from all relevant parties involved in designing, constructing and managing a development project. Members of the project team need to interact with each other to minimise the impacts to the trees, either through design decisions or construction practices. The importance of tree preservation must be communicated to all relevant parties involved with the site.
- The consultant arborist is on-site to supervise excavation works around the existing trees where the TPZ will be encroached.
- A layer of organic mulch (woodchips) to a depth of no more than 100mm should be placed over the root systems within the TPZ of trees, which are to be retained so as to assist with moisture retention and to reduce the impact of compaction.
- No persons, vehicles or machinery to enter the TPZ without the consent of the consulting arborist or site manager.
- Where machinery is required to operate inside the TPZ it must be a small skid drive machine (i.e Dingo or similar) operating only forwards and backwards in a radial direction facing the tree trunk and not altering direction whilst inside the TPZ to avoid damaging, compacting or scuffing the roots.
- Any underground service installations within the allocated TPZ should be bored and utility authorities should common trench where possible.
- No fuel, oil dumps or chemicals shall be allowed in or stored on the TPZ and the servicing and re-fuelling of equipment and vehicles should be carried out away from the root zones.
- No storage of material, equipment or temporary building should take place over the root zone of any tree.
- Nothing whatsoever should be attached to any tree including temporary services wires, nails, screws or any other fixing device.
- Supplementary watering should be provided to all trees through any dry periods during and after the construction process. Proper watering is the most important maintenance task in terms of successfully retaining the designated trees. The areas under the canopy drip lines should be mulched with woodchip to a depth of no more than 100mm. The mulch will help maintain soil moisture levels. Testing with a soil probe in a number of locations around the tree will help ascertain soil moisture levels and requirements to irrigate. Water needs to be applied slowly to avoid runoff. A daily watering with 5 litres of water for every 30 mm of trunk calliper may provide the most even soil moisture level for roots (Watson & Himelick, 1997), however light frequent irrigations should be avoided. Irrigation should wet the entire root zone and be allowed to dry out prior to another application. Watering should continue from October until April.

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D19-334480

Arboricultural Assessment
29 Browns Road, Clayton

April 29, 2015
Prepared for: Daniel Podlewski. Mushan Design Studio

Prepared by: David Phillips. Tree Logic Pty. Ltd.

Client Brief

Daniel Podlewski of Mushan Design Studio commissioned Tree Logic to undertake an assessment of trees adjacent to the subject site at 29 Browns Road in Clayton. In addition, trees attributed a Moderate arboricultural rating were reviewed for changes in condition since an initial tree assessment was undertaken within the site in 2013.

The arboricultural consultancy was required to provide;

- A description of the assessment methods.
- A detailed tree assessment including species, dimensions, condition and arboricultural rating.
- Provide an impact statement of the design proposal on the retained trees.
- Guidelines for tree protection.

1. **Summary**

Thirty-three (33) trees were assessed within the road reserve of Browns Road and the northern and southern properties adjacent to the former Clayton Primary School.

The trees located within the road reserve are the property of the Monash City Council and any intent to remove, lop or destroy the trees are subject to approval from Monash City Council. The trees located in the adjacent properties must be considered for retention under any design proposal for the site.

In general, the trees located within the adjacent northern property were considered to be canopy trees that contribute to the overall canopy cover. Trees within the adjacent southern property were smaller in stature and of lesser quality. The trees within the road reserve of Browns Road were mostly maturing Prickly-leaved Paperbarks in fair condition.

A review of the proposed design was undertaken to assess any potential impacts to the trees. Design amendments are recommended to retain trees 8, 9, 10 and 14 in addition to construction controls which also apply to tree 30. The remaining trees are not expected to be impacted under the proposed design or will be impacted to levels which are expected to be tolerated.

An initial tree assessment and accompanied report was undertaken by Tree Logic and issued on April 30, 2013. The review of the existing moderate rated trees within the former Clayton Primary School showed reduced changes in condition of several trees since the previous assessment with some now considered to be of Low arboricultural value.

Tree protection measures as set out in Appendix 4 must be applied for the duration all phases of the redevelopment, including demolition.

The removal of existing sections of bitumen within the TPZs of retained trees must be undertaken in a manner that preserves tree condition, with the site arborist on location to observe the demolition work.

TPZ fencing is to be erected at the edges of the TPZ where it extends into the subject site and a ground protection system is to be installed where the TPZ is to be temporarily encroached to preserve the growing environment and minimise impacts to retained trees.

2. **Method**:

Site inspection methodology;

A site inspection was undertaken during mild conditions on Wednesday, March 4, 2015.
The trees were inspected from the ground and observations were made of the growing environment and surrounding area. The trees were not climbed and no samples of the trees or site soil were taken.

Observations were made of the trees to determine age and condition, with measurements taken to establish tree height (measured with a height meter), crown width (paced) and trunk diameter (measured at 1.4m above grade unless otherwise stated). Definitions of arboricultural descriptors can be seen in Appendix 3.

Where trees were located in adjoining properties, estimates have been made to determine DBH and basal measurements and observations of health and structure were limited to one side of the tree only.

The report includes assessment details in the Tree Assessment Table in Appendix 1 and relate to the trees numbered on the site plan in Appendix 2.

Photographs of some trees and site conditions were taken for further reference and inclusion in the report.

Establishing Tree Protection Zones (TPZ);

To successfully retain suitable trees within or around a development site, consideration must be given to protecting the trunk, crown and roots of each specimen. Tree protection zones (TPZ's) are used to provide adequate space for the preservation of sufficient roots to maintain tree health (particularly important for mature trees) whilst providing a buffer zone between construction activity and the tree trunk and crown.

The method for determining tree protection zones adopted in this report is the 'Australian Standard for Protection of trees on development sites' (AS4970-2009). The TPZ area is based on the trunk diameter measurement measured in metres at 1.4m and multiplied by 12 and is a guide for planning purposes. The trunk of the tree is used as the centre point for the measurement. TPZ measurements are included in the tree assessment data in Appendix 1.

Additional measurements can be calculated to determine the allowable encroachment on one side of the TPZ (Reduced TPZ) and the Structural Root Zone (SRZ) which is the absolute minimum required to maintain tree stability without consideration to ongoing health.
Details of tree protection zone establishment and management guidelines are outlined in Appendix 4.

Several documents were viewed and reviewed which form the basis of the arboricultural report.

Documents reviewed;

- Boundary Re-establishment, Feature and Level Survey, Prepared by Bosco Johnson Pty Ltd, Job No. 30515, Sheet 1 of 1, Date 03/02/2015.

- Boundary Re-establishment, Feature and Level Survey, Prepared by Bosco Johnson Pty Ltd, Job No. 30515, Sheet 1 of 1, Date 23/04/2015.
- Proposed Ground Floor Plan, Prepared by Mushan Design Studio Pty Ltd, Job No. MO23, Dwg No. SKO1, Date February, 2015.
- Proposed First Floor Plan, Prepared by Mushan Design Studio Pty Ltd, Job No. MO23, Dwg No. SKO2, Date February, 2015.
- Proposed Second Floor Plan, Prepared by Mushan Design Studio Pty Ltd, Job No. MO23, Dwg No. SKO3, Date February, 2015.
- Proposed Third Floor Plan, Prepared by Mushan Design Studio Pty Ltd, Job No. MO23, Dwg No. SKO4, Date February, 2015.
- Arboricultural Assessment, Prepared by David Phillips, Tree Logic Pty Ltd, Ref No. 13-4880, Version 1, Issued 30/04/2013.

3. Observations

The assessed trees were located within the road reserve of Browns Road and the adjacent properties to the north and south of the subject site.

Trees within the road reserve of Browns Road were mostly Prickly-leaved Paperbarks *(Melaleuca styphelioides)* maturing in age, displaying fair health and typical structure. Pruning for powerline clearance had been undertaken on the trees. The younger Callery's Pear (*Pyrus calleryana*) was also in fair condition displaying typical structure that had not been previously pruned.

The trees located within the northern adjacent property were approaching maturity and lined along the common boundary and the adjacent car park of the industrial business. Trees 15 – 25 were situated on an embankment that sloped towards the subject site. Approximations of the distance from the root flare to the boundary line were made to aid in assessing the potential impacts to these eleven trees from the proposed development.

A section of bitumen was located on the southern side of trees 5 – 19 that was utilised as a recreation area for students at the former school. It would be expected that some root development had occurred beneath the bitumen due to the size of the trees and presumed shallow depth of the bitumen. The bitumen adjacent to tree 14 was lifting and cracking suggesting root growth is evident beneath the bitumen.

Trees 19-25 were growing on the northern side of maturing trees that were located within the subject site. It is expected that there has been some intermingling of roots between the trees, however the size of the trees within the site suggest the roots from the adjacent trees have been restricted and not developed extensively into the subject site. This would also be the case for tree 28 located in the adjacent southern property.

There were no trees located within the adjacent eastern properties.

4. Tree retention considerations

The most important consideration for the successful retention of trees is to allow appropriate above and below ground space for trees to continue to grow. This requires the allocation of tree protection zones (TPZ) for retained trees. The Australian Standard AS 4970-2009 Protection of Trees on Development Sites has been used as a guide in the allocation of TPZs for the assessed trees. This method provides a TPZ that addresses both the stability and growing requirements of a tree.

Encroachment into the TPZ is permissible under certain circumstances though this is dependent on both site conditions and tree characteristics. Minor encroachment, up to 10% of the TPZ, is generally permissible provided encroachment is compensated for by recruitment of an equal area contiguous with the TPZ. Examples of permissible encroachment can be seen in Appendix 5.

The structural root zone (SRZ) is an area in which woody roots required for tree stability are located. This is the minimum area recommended to maintain tree stability but does not reflect the area required to sustain tree health. The SRZ should not be encroached and no works are permitted within the SRZ. The area between the reduced TPZ and SRZ may only be encroached if root sensitive construction methods are adopted, based on the results of a non-destructive root investigation and approved by the consulting arborist or relevant authority.

5. Design considerations & Impact Assessment

The pre-development arboricultural inspection report provides planners and designers with information on the measures required to protect trees suitable to be retained.

A preliminary set of drawings was supplied by the client. The drawings show a proposed layout of town houses along the four boundaries of the site. Two multi-storey apartment blocks are situated in the centre of the site. Vehicular access is via Browns Road with connecting roads surrounding the two blocks. Two lots of five car spaces each are proposed on the northern and southern sides of the development site.

Trees located within the adjacent properties must be considered for retention within any proposed redevelopment of the site.

The trees located within the road reserve of Browns Road are the property of the Monash City Council and any intent to remove, lop or destroy the trees are subject to approval from Monash City Council.

A review of the drawings was undertaken to assess the impacts on all of the assessed trees.

Trees 1, 2, 3 and 4 are located within the road verge of Browns Road and trees 5, 6 and 7 are located to the north west of the subject site in the adjacent property. The proposed crossover alignment and the setback of the western townhouses are located outside their TPZs and no impact to these trees is expected.

Under the proposed design, the TPZs of trees 8, 9, 10, 14, 28 and 30 are to be encroached by greater than 10%, which is considered to be major encroachment under AS4970.

The 4.7 metre TPZ of tree 8, a Spotted Gum (*Corymbia maculata*) is to be encroached by 12.5% from the north western townhouse that could result in reduced tree health. Impact to tree health can be minimised by aligning the townhouse 4.5 metres from the tree, which represents a 10% encroachment of the TPZ. The 10% encroachment is likely to be tolerated by the tree as favourable growing conditions contiguous with the TPZ will become available to the southwest of the tree after the bitumen is removed.

An access road for vehicular traffic extending to the garages of the north-west townhouse is proposed to be constructed adjacent to tree 9, a Spotted Gum. The road is to encroach into the 4.4 metre TPZ by 15% which could adversely impact upon tree health. To minimise impacts to tree health, it is recommended to align the back of kerb, including drainage 1.5 metres from the northern boundary which represents a 10% encroachment into the TPZ. The area between the garage and the northern boundary must be preserved after the removal of the bitumen and during all phases of construction to ensure the area does not become degraded and allows additional soil volume for the development of new root growth. During construction works, a ground protection system (GPS) is to be installed if this area is to be temporarily accessed. See Appendix 7 for installation of a GPS.

The first and second townhouses along the northern boundary are to be constructed adjacent to tree 10, a Smooth-barked Apple (*Angophora costata*). The townhouses are expected to encroach into the 6.4 metre TPZ by 16.3% which could adversely impact upon tree health. To maintain tree condition, it is recommended for the northern walls of both units to be located outside the reduced TPZ of 4.5 metres, which represents a 10% encroachment of the TPZ. The row of townhouses allows only a minimal amount of area in the rear setback for new root development and therefore root severance or

damage must be avoided to minimise tree impacts. A pier and beam footing system is to be utilised within the TPZ for the northern external walls as opposed to a slab foundation.

Tree 14 a mature Smooth-barked Apple had developed some roots into the subject site as evident by lifting and cracking of the bitumen adjacent to the tree. The building footprint of the adjacent townhouses is located approximately 2.9m from the tree, which is within its 3.1 metre SRZ. Locating the townhouse into the SRZ is not recommended as tree stability maybe compromised and therefore design amendments would be required. It is recommended for the foot print of the adjacent townhouses be located outside the 5.9 metre reduced TPZ. If this distance cannot be achieved through a design solution, then exploratory investigation of the TPZ area as the bitumen is removed would be required to determine the extent of root development into the subject site.

Tree 28, a Sugar Gum (*Eucalyptus cladocalyx*) was located behind a second Sugar Gum of similar age and size, which was located within the subject site. The growing conditions to the south of tree 28 was favourable for root development and this is where the majority of its roots are expected to be as the adjacent northern tree would have restricted its roots from proliferating into the subject site. The roadway extending to the south east section and the adjacent townhouse encroach into the TPZ of tree 28 by 14%, however it is expected that root development into the site has been restricted, the actual amount of encroachment is expected to be less than this due to the bias of the root system. It would be expected that the design proposal around tree 28 would not adversely impact upon tree condition. The area south of the adjacent townhouse forms part of the trees 4.4 metre TPZ and it is imperative that this area is preserved during all phases of the development by either TPZ fencing or installing a GPS if the area is temporarily encroached to maintain favourable growing conditions within the allocated TPZ.

Tree 30, a Bushy Sugar Gum (*Eucalyptus cladocalyx* 'Nana') is located adjacent to the southern car park and adjacent properties. The car park and the southern walls of the townhouses are to encroach into the 5.3 metre TPZ by 11.7% that could initially result in reduced tree health. It would be expected that the tree's long term condition could be maintained if further encroachment is avoided by utilising a pier and beam footing system within the TPZ and maintaining favourable growing conditions in the rear setback of the townhouses, including erecting TPZ fencing or installing a GPS if the area is to be temporarily encroached.

A pier and beam footing system has been recommended to minimise soil disturbance and root damage to Trees 8, 10 and 30 that could impact upon tree condition. Where this system is utilised, it is recommended for the beam to be set above the natural soil grade after the removal of the top 100mm organic layer and the size of the footings are minimised as much as practical and hand dug for the first 600mm depth to avoid damaging, severing or tearing roots greater than 50mmØ. Roots less than 50mmØ that are exposed are to cut with a sharp pair of secateurs, handsaw or loppers and covered with a moistened fabric until the hole is backfilled to avoid root desiccation. The roots must not be cut with tools or machinery that are not designed for such a task or allowed to dry out.

Under the design proposal, trees 11, 12, 13, 15, 17, 26, 31 and 32 are to be impacted by less than 10% encroachment of their TPZs and tree condition is expected to be maintained. Further encroachment of the TPZs is not recommended as tree condition may be adversely impacted.

The proposed building footprints are outside the TPZs of trees 5, 6, 7, 16, 18, 19, 20, 21, 22, 23, 24, 25, 27, 29 and 33. No impact to these trees is expected under the current design proposal.

Pruning works would be required to provide adequate clearance between the canopy of trees 12, 13, 17, 18, 19, 20, 21, 30, 31, 32 and 33 and the proposed townhouses. Consideration must also be given to the balconies of each unit if they are to extend further than the ground floor footprint. Pruning works should allow for a safe work place and efficient work manner, however excessive pruning must be avoided that could adversely impact upon tree health. All pruning works must be undertaken before construction begins on site, including demolition and by a qualified arborist in accordance with AS4373 2007 *Pruning of amenity trees.* Once the building footprints adjacent to the trees are pegged or marked out, the site arborist is to reassess the need for additional pruning.

The removal of the existing section of bitumen must be undertaken in a manner that avoids tearing, severing or destroying tree roots (See Appendix 6 for bitumen removal method). Where bitumen is to be removed from within the TPZ of retained trees, the site arborist is to be on site.

Where temporary encroachment of the TPZ is to occur, the installation of a ground protection system (GPS) is recommended to cover the entire TPZ area that extends into the subject site. This system is designed to prevent root damage and soil compaction within the TPZ by repeated pedestrian and machinery movement. The GPS is to be laid over existing grass or natural soil grade after the removal of the bitumen and consists of a 100mm thick crushed rock layer placed over a geo-textile fabric with tree protection matting or rumble boards placed on top. See Appendix 7 for method of GPS installation and removal.

To successfully retain suitable trees, tree protection measures must be adopted including the following:

All conditions of the tree protection guidelines attached as Appendix 4 should be adopted and applied for the duration of the site redevelopment including demolition, bulk earthworks, excavation or installation of underground services or any construction related activity. This is to prevent damage to roots, buttress, trunk or limbs and to prevent soil compaction that may have an adverse impact on retained trees.

Existing soil grades must remain unaltered within any tree protection zone adopted on site. Trenching for installation of services or placement of fill in excess of 100mm depth must not occur within the recommended reduced TPZs of any retained trees contained within this report.

Further encroachment of the reduced TPZs must be based on the results of a non-destructive root investigation (NDRI) in consultation with the site arborist and relevant authorities and utilising root sensitive construction methods.

The installation of utility services for electricity, gas, sewer, water and telecommunications are to be located outside the TPZ of retained trees. If this requirement cannot be achieved, services are to be bored at a minimum of 600mm below existing soil grade to the top of the bore head. Entry and exit bore pits are to be located outside of the TPZ.

6. Re-evaluation of Moderate rated trees

An earlier assessment of trees and subsequent report was issued by Tree Logic for the Department of Education and Early Childhood Development in April 2013 at 29 Browns Road, Clayton (Ref 13_4880). A review of moderate arboricultural rated trees within the initial assessment was undertaken to identify any changes to tree condition since 2013. Trees with a Moderate arboricultural value are; 1, 3, 8, 14, 18, 20, 22, 23, 24, 25, 26, 28, 29, 30, 31, 32, 33 and 34.

Trees 14, 20, 23, 24, 29, 31, 32 and 33 had displayed either reduced health and/or structural condition since the 2013 assessment and subsequently their retention value has been downgraded from Moderate to Low.

Trees 14, 20 29, 32 and 33 had a reduction in health associated mostly with reduced vigour as indicated by crown dieback or reduced foliage density. The deciduous specimens typically displayed premature changes in foliage colour and early defoliation that could be indicative of environmental stress from dry soil conditions or being out competed by more vigorous trees for essential elements. It is likely that if these trees are retained in conjunction with the adjacent trees then tree health would further deteriorate into the short to medium term future.

Trees 23, 24, and 31 had displayed structural defects or deficiencies at the time of the initial assessment. Since then, their structural condition has become exacerbated and as a result there is an increased potential for structural failure. The development will increase the target value and frequency within the site and around the trees and this combined with an increase in failure potential will increase the risk the trees present within the new development.

Tree 8 is a maturing River Red Gum of Moderate arboricultural value located on the southern boundary. Its condition has not changed since the initial assessment, however mature River Red Gums have a propensity to shed limbs unexpectably and are appropriate trees for parks, reserves or large gardens, rather than medium to high density developments. Under the proposed design, the tree is expected to become problematic, requiring ongoing arboricultural input and design amendments if the tree is to be retained. Consideration could be given for its removal.

A review of the proposed design was undertaken to assess the impacts to trees of moderate arboricultural value located within the site.

All of the moderate rated trees within the subject site, except tree 34 are located within proposed building or road alignments or impacted to levels that would not be tolerated by the tree. Therefore, they would be unsustainable under the current design proposal.
Tree 34, a Lilly Pilly (*Acmena smithii*) was located along the western boundary that is sufficiently offset from the proposed building alignment. Although the tree is in fair condition and suitable to be retained, it is not an outstanding tree and is of moderate dimensions contributing a minor amount to the overall canopy cover. As the tree provides little in terms of amenity to the site (amenity refers to the trees biological, functional and aesthetic characteristics within an urban landscape context) the preferred landscape outcome would be to remove the tree and replace it with a species that is consistent with the proposed overall landscape plan.

Trees within the site of Low or No arboricultural value should not be a constraint on reasonable development within the site.

This report should be read in conjunction with the initial report supplied by Tree Logic Pty. Ltd in April, 2013.

7. Photographs

Figure 1: Shows the relative size, condition and location of tree 8, a Spotted Gum (*Corymbia maculata*). It is recommended that the northern wall of the north west townhouse be aligned at a minimum of 3.3 metres from the tree and the wall be constructed on pier and beam footing system.

Figure 2: Shows the relative size, condition and location of tree 9, a Spotted Gum. The proposed roadway is recommended to be 1.5 metres off the northern boundary and the area to the south west of the tree is to be offset and preserved for the duration of the construction works.

Figure 3: The arrow indicates tree 28 growing behind a second Bushy Sugar Gum (*Eucalyptus cladocalyx* 'Nana'). The adjacent tree is likely to have reduced root development in the subject site and the expected impact from the proposed development and tree condition is likely to be maintained under the current design proposal.

Figure 4: Shows the relative size, condition and location of the maturing trees 10 and 14. Design modifications are necessary to retain both trees as the building footprints are to encroach the TPZs to levels thatcould adversely impact upon tree condition.

Figure 5: The arrows indicates tree 30 located in the southern adjacent property. Long-term tree condition can be maintained if further encroachment beyond the calculated 11% does not occur. Minimising encroachment can be achieved by constructing the southern wall of the adjacent townhouse on pier and beam footing system and preserving the TPZ area within the rear setback of the townhouses during construction.

8. Conclusion

Thirty three (33) trees in total were assessed within the road reserve of Browns Road and the adjacent properties to the former Clayton Primary School at 29 Browns Road, Clayton. In addition all of the Moderate rated trees identified in the initial arboricultural assessment were re-assessed for any changes in their condition.

It is proposed to redevelop the site into high density housing, constructing a row of townhouses along the northern, southern, eastern and western boundaries. Two multi storey apartment blocks are to be constructed in the centre of the site with internal roadways for vehicular access and two separate car parks are to be constructed within.

A review of the design proposal was undertaken to assess the impacts to trees located within the Browns Road road reserve and adjoining properties, all of which must be considered for retention.

The trees located within the road reserve of Browns Road are the property of the Monash City Council and any intent to remove, lop or destroy the trees are subject to approval from Monash City Council.

Trees 1, 2, 3 and 4 located within the road reserve and trees 5, 6, 7, 16, 18, 19, 20, 21, 22, 23, 24, 25, 27, 29 and 33 are not expected to be impacted under the design proposal.

Trees 11, 12, 13, 15, 17, 26, 31 and 32 are to be impacted by less than 10% encroachment into their TPZs and are expected to tolerate the perceived impacts.

Trees 8, 9, 10 and 14 are to be impacted by more than 10% and reduction in tree health and or tree stability may result. Design amendments conjunction with root sensitive construction methods are recommended to maintain the condition of these trees.

Trees 28 and 30 are likely to tolerate encroachment greater than 10% providing no further encroachment occurs and the current growing conditions within the TPZ are preserved.

A review of the design proposal to assess the impacts to moderate rated trees located within the site was also undertaken. The review identified all moderate rated trees, except for tree 34 would be unsustainable as they are located within the construction foot print. Tree 34 was not singularly an outstanding tree and could be considered for removal and replaced within the proposed landscape design.

Trees of Low or No arboricultural value should not be a constraint on reasonable development within the site.

A review of the Moderate rated trees in the initial report found that a reduction in the health and/or structural condition of trees 14, 20, 23, 24, 29, 31, 32 and 33 had occurred and subsequently been downgraded to low arboricultural value.

Recommendations include:

- Design amendments are made to locate adjacent townhouses outside the reduced TPZs of trees 8, 10 and 14.
- Undertake exploratory investigation within the TPZ of tree 14 if initial design amendments cannot be achieved.
- Utilise pier and beam footings for the townhouse sections within the TPZ of trees 8, 10 and 30 and where the allocated TPZ is to be encroached.
- Where pier and beam footing system is utilised, it is recommended for the beam to be set above the natural soil grade after the removal of the top 100mm organic layer and the size of the footings are minimised as much as practical and dug by hand for the first 600mm depth to avoid damaging, severing or tearing roots greater than 50mmØ.
- Roots less than 50mmØ that are exposed are to cut with a sharp pair of secateurs, handsaw or loppers and covered with a moistened fabric until the hole is backfilled to avoid root desiccation.
- Realign the back of kerb, including drainage for northwest section of roadway to 1.5 metres from the northern boundary to minimise impacts to tree 9.
- Remove the existing bitumen in a manner that does not sever, tear or damage tree roots and the project arborist is to be on site during the removal of bitumen within the TPZs of retained trees (See Appendix 6).
- Erect TPZ fencing at the edge of the TPZ that extends into the subject site to preserve the growing environment within the TPZ.
- Install a GPS where TPZs extend into the subject site and will be temporarily accessed by pedestrian and vehicular traffic (See Appendix 7).
- Pruning recommendations are recommended on trees 12, 13, 17, 18, 19, 20, 21, 30, 31 and 32 and 33. All pruning works should be undertaken by a qualified arborist in accordance with AS4373 2007 *Pruning of amenity trees.*
- Once the building footprints of the ground floors are pegged or marked out, the site arborist is to reassess the need for additional pruning.

All conditions of the tree protection guidelines attached as Appendix 4 should be adopted and applied for the duration of the site redevelopment.

Existing soil grades must remain unaltered within any reduced tree protection zone adopted on site. Trenching for installation of services, utilities or footings or placement of fill in excess of 100mm depth must not occur within the recommended TPZ of any retained trees.

This report should be read in conjunction with the initial tree report issued by Tree Logic in April, 2013.

Under no circumstance shall this report be reproduced unless in full.

I am available to answer any questions arising from this report.

D. Phillips

David Phillips (Associate Deg. Env Hort)

Consultant Arborist –

0433 813 587

Appendix 1: Tree details: 29 Browns Road, Clayton.

DBH = Diameter at Breast Height (measured in centimetres at 1.4m above ground unless otherwise stated).
TPZ = Tree Protection Zone (metre radius). Radius distances measured in metres from the centre of the trunk.
For tree location and numbering refer Appendix 2. See Appendix 3 for Tree descriptors

Refer to following 3 pages

treelogic
Tree management for the urban forest
Tree Logic Pty Ltd Unit 4, 21 Eugene Terrace Ringwood Vic 3134 Ph 03 9870 7700 **treelogic.com.au**

Tree No	Common Name (Botanical Name)	Type	DBH (cm)	Height (m)	Width (m)	Age	Health	Structure	Form	Comment	Arb Rating	TPZ (m radius)	SRZ (m radius)	Red. TPZ	Distance to property boundary (m)	Works recommendation
14	Smooth-barked Apple (Angophora costata)	Australian native	70	13	18	Maturing	Fair	Fair	Symmetric	Lopped limbs on south side, cracking & lifting of adjacent bitumen.	Moderate	8.4	3.1	5.9		
15	Yellow Gum (Eucalyptus leucoxylon)	Victorian native	33	14	10	Maturing	Fair	Poor	Symmetric	Basal decay, branch to south rubbing on fence. Remove branch.	Low	4.6	2.5	3.2	2.5	Remove southern branch
16	Lemon-scented Gum (Corymbia citriodora)	Australian native	19	11	8	Semi-mature	Fair	Fair	Symmetric		Moderate	2.3	1.8	1.8	3.0	
17	Yellow Gum (Eucalyptus leucoxylon)	Victorian native	21,22,32	9	15	Maturing	Fair	Fair	Symmetric	Over-extended limbs, lopped branch to south.	Moderate	5.3	2.7	3.7	2.0	Prune for building clearance
18	Spotted Gum (Corymbia maculata)	Victorian native	30	17	11	Maturing	Fair	Fair	Symmetric		Moderate	3.6	2.3	2.5	3.0	Prune for building clearance
19	Lemon-scented Gum (Corymbia citriodora)	Australian native	25	15	12	Semi-mature	Fair	Fair	Symmetric		Moderate	3.0	2.2	2.2	3.0	Prune for building clearance
20	Spotted Gum (Corymbia maculata)	Victorian native	29	15	10	Semi-mature	Fair	Fair	Symmetric		Moderate	3.5	2.2	2.4	3.5	Prune for building clearance
21	Spotted Gum (Corymbia maculata)	Victorian native	32	15	9	Semi-mature	Fair	Fair	Symmetric		Moderate	3.8	2.3	2.7	3.5	Prune for building clearance
22	Spotted Gum (Corymbia maculata)	Victorian native	37	17	10	Semi-mature	Fair	Fair	Symmetric		Moderate	4.4	2.4	3.1	3.5	
23	Spotted Gum (Corymbia maculata)	Victorian native	25	15	10	Semi-mature	Fair	Fair	Symmetric		Moderate	3.0	2.2	2.2	3.5	
24	Spotted Gum (Corymbia maculata)	Victorian native	34	16	11	Semi-mature	Fair	Fair	Symmetric		Moderate	4.1	2.4	2.9	3.5	
25	Bracelet Honey-myrtle (Melaleuca armillaris)	Victorian native	18,10,12, 24	5	11	Maturing	Fair	Fair-poor	Symmetric		Low	4.1	2.3	2.8	3.0	

Tree No	Common Name (Botanical Name)	Type	DBH (cm)	Height (m)	Width (m)	Age	Health	Structure	Form	Comment	Arb Rating	TPZ (m radius)	SRZ (m radius)	Red. TPZ	Distance to property boundary (m)	Works recommendation
26	Lemon-scented Gum (Corymbia citriodora)	Australian native	25	8	10	Semi-mature	Fair	Fair-poor	Minor asymmetry-east		Moderate	3.0	2.1	2.1		
27	Lemon-scented Gum (Corymbia citriodora)	Australian native	18	5	6	Semi-mature	Fair	Fair-poor	Minor asymmetry-west	Small size	Low	2.2	1.8	1.8		
28	Sugar Gum (Eucalyptus cladocalyx)	Australian native	26,18,18	10	13	Maturing	Fair	Fair-poor	Symmetric	North limb rubbing on fence, Over-extended limb to east	Low	4.4	2.6	3.1		
29	Yellow Gum (Eucalyptus leucoxylon)	Victorian native	23	7	7	Semi-mature	Fair	Fair-poor	Asymmetric	Poor form	Low	2.8	2.0	2.0		
30	Bushy Sugar Gum (Eucalyptus cladocalyx 'Nana')	Australian native	32,30	12	14	Maturing	Fair	Fair-poor	Symmetric		Low	5.3	2.7	3.7		Prune for building clearance
31	Bushy Sugar Gum (Eucalyptus cladocalyx 'Nana')	Australian native	28,18	9	12	Maturing	Fair	Fair-poor	Symmetric		Low	4.0	2.5	2.8		Prune for building clearance
32	Desert Ash (Fraxinus angustifolia subsp. angustifolia)	Exotic deciduous	28	12	15	Semi-mature	Fair	Fair	Symmetric	Potential weed species.	Low	3.4	2.2	2.4		Prune for building clearance
33	Claret Ash (Fraxinus 'Raywood')	Exotic deciduous	40	12	15	Maturing	Fair	Fair-poor	Symmetric	Over-extended limbs to north, early leaf colour	Low	4.8	2.5	3.4		Prune for building clearance

Appendix 2: Tree location & numbers: 29 Browns Road, Clayton.

Refer to following page

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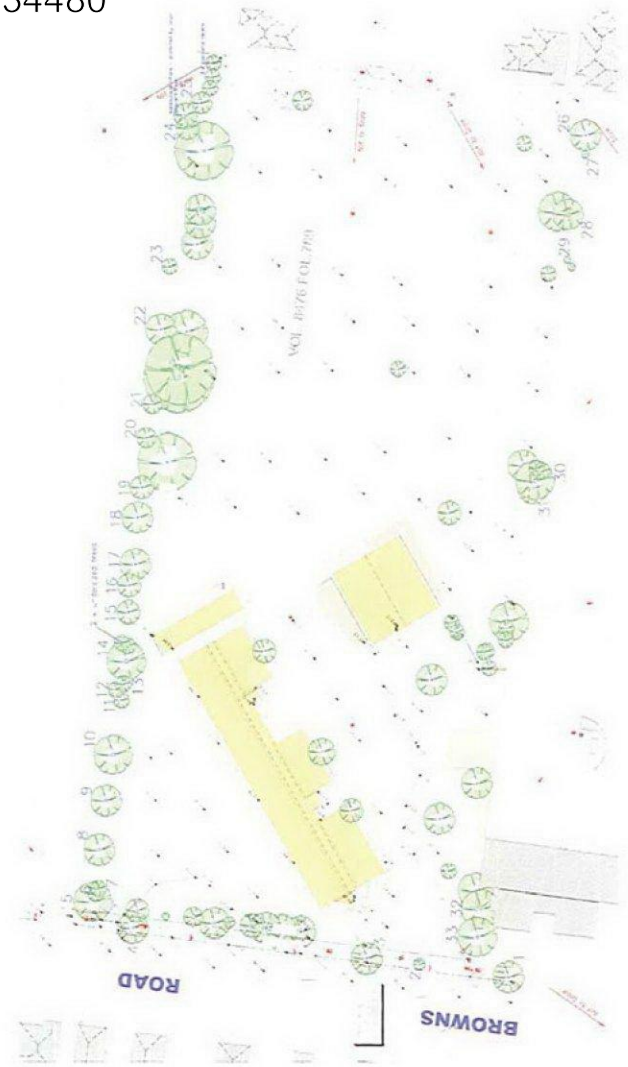


Appendix 3: Arboricultural Descriptors (August 2013)

Note that not all of the described tree descriptors may be used in a tree assessment and report. The assessment is undertaken with regard to contemporary arboricultural practices and consists of a visual inspection of external and above-ground tree parts.

Tree Condition

The assessment of tree condition evaluates factors of health and structure. The descriptors of health and structure attributed to a tree evaluate the individual specimen to what could be considered typical for that species growing in its location. For example, some species can display inherently poor branching architecture, such as multiple acute branch attachments with included bark. Whilst these structural defects may technically be considered arboriculturally poor, they are typical for the species and may not constitute an increased risk of failure. These trees may be assigned a structural rating of fair-poor (rather than poor) at the discretion of the author.

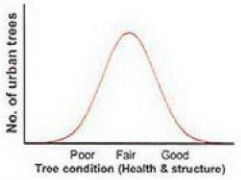


Diagram 1: Indicative normal distribution curve for tree condition

Diagram 1, provides an indicative distribution curve for tree condition to illustrate that within a normal tree population the majority of specimens are centrally located within the condition range (normal distribution curve). Furthermore, that those individual trees with an assessed condition approaching the outer ends of the spectrum occur less often.

Tree Name

Provides botanical name, (genus, species, variety and cultivar) according to accepted international code of taxonomic classification, and common name.

Tree Type

Describes the general geographic origin of the species and its type e.g. deciduous or evergreen.

Category	Description
Indigenous	Occurs naturally in the area or region of the subject site
Victorian native	Occurs naturally within some part of the State of Victoria (not exclusively) but is not indigenous
Australian native	Occurs naturally within Australia but is not a Victorian native or indigenous
Exotic deciduous	Occurs outside of Australia and typically sheds its leaves during winter
Exotic evergreen	Occurs outside of Australia and typically holds its leaves all year round
Exotic conifer	Occurs outside of Australia and is classified as a gymnosperm
Native conifer	Occurs naturally within Australia and is classified as a gymnosperm
Native Palm	Occurs naturally within Australia. Woody monocotyledon

Category	Description
Exotic Palm	Occurs outside of Australia. Woody monocotyledon

Height and Width

Indicates height and width of the individual tree; dimensions are expressed in metres. Crown heights are measured with a height meter where possible. Due to the topography of some sites and/or the density of vegetation it may not be possible to do this for every tree. Tree heights may be estimated in line with previous height meter readings in conjunction with author's experience. Crown widths are generally paced (estimated) at the widest axis or can be measured on two axes and averaged. In some instances the crown width can be measured on the four cardinal direction points (North, South, East and West).

Trunk diameters

The position where trunk diameters are captured may vary dependent on the requirements of the specific assessment. DBH is the typical trunk diameter captured as it relates to the allocation of tree protection distances. The basal trunk diameter assists in the allocation of a structural root zone. Some municipalities require trunk diameters be captured at different heights, with 1.0 m above grade being a common requirement. The specific planning schemes will be checked to ascertain requirements.

Diameter at Breast Height (DBH)

Indicates the trunk diameter (expressed in centimetres) of an individual tree measured at 1.4m above the existing ground level or where otherwise indicated, multiple leaders are measured individually. Plants with multiple leader habit may be measured at the base. The range of methods to suit particular trunk shapes, configurations and site conditions can be seen in Appendix A of Australian Standard *AS 4970-2009 Protection of trees on development sites*. Measurements undertaken with forestersØ tape or builders tape.

Basal trunk diameter

The basal dimension is the trunk diameter measured at the base of the trunk or main stem(s) immediately above the root buttress.

Health

Assesses various attributes to describe the overall health and vigour of the tree.

Category	Vigour/Extension growth	Decline symptoms/Deadwood /Dieback	Foliage density, colour, size, intactness	Pests and or disease
Good	Above typical	Negligible	Better than typical	Negligible
Fair	Typical	Minor or expected	Typical	Minor, within damage thresholds
Fair to Poor	Below typical	More than typical	Exhibiting deficiencies	Exceeds damage thresholds
Poor	Minimal	Excessive, large and/or prominent amount/size	Exhibiting severe deficiencies	Extreme and contributing to decline
Dead	N/A	N/A	N/A	N/A

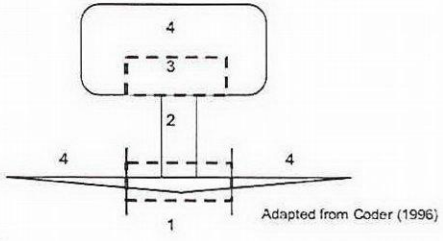
Structure

Assesses principal components of tree structure (Diagram 2).

Descriptor	Zone 1 - Root plate & lower stem	Zone 2 - Trunk	Zone 3 - Primary branch support	Zone 4 - Outer crown and roots
Good	No obvious damage, disease or decay; obvious basal flare / stable in ground	No obvious damage, disease or decay; well tapered	Well formed, attached, spaced and tapered	No obvious damage, disease, decay or structural defect
Fair	Minor damage or decay. Basal flare present.	Minor damage or decay	Typically formed, attached, spaced and tapered	Minor damage, disease or decay; minor branch end-weight or over-extension
Fair to Poor	Moderate damage or decay; minimal basal flare	Moderate damage or decay; approaching recognised thresholds	Weak, decayed or with acute branch attachments; previous branch failure evidence	Moderate damage, disease or decay; moderate branch end-weight or over-extension
Poor	Major damage, disease or decay; fungal fruiting bodies present. Excessive lean placing pressure on root plate	Major damage, disease or decay; exceeds recognised thresholds; fungal fruiting bodies present. Acute lean. Stump resprout	Decayed, cavities or has acute branch attachments with included bark; excessive compression flaring; failure likely	Major damage, disease or decay; fungal fruiting bodies present; major branch end-weight or over-extension
Very Poor	Excessive damage, disease or decay; unstable / loose in ground; altered exposure; failure probable	Excessive damage, disease or decay; cavities. Excessive lean. Stump resprout	Decayed, cavities or branch attachments with active split; failure imminent	Excessive damage, disease or decay; excessive branch end-weight or over-extension

Diagram 2: Tree structure zones

1. Root plate & lower stem
2. Trunk
3. Primary branch support
4. Outer crown & roots



Adapted from Coder (1996)

Structure ratings will also take into account
general branching architecture, stem taper, live crown ratio,
crown symmetry (bias or lean) and crown position such as tree being suppressed amongst more dominant trees.
The lowest or worst descriptor assigned to the tree in any column could generally be the overall rating assigned to the tree. The assessment for structure is limited to observations of external and above ground tree parts. It does not include any exploratory assessment of underground or internal tree parts unless this is requested as part of the investigation. Trees are assessed and the given a rating for a point in time. Generally, trees with a poor or very poor structure are beyond the benefit of practical arboricultural treatments.

The management of trees in the urban environment requires appropriate arboricultural input and consideration of risk. Risk potential will take into account the combination of likelihood of failure and impact, including the perceived importance of the target(s).

Life Stage

Relates to the physiological stage of the tree's life cycle.

Category	Description
Young	Sapling tree and/or recently planted. Approximately 5 or less years in location.
Semi-mature	Tree increasing in size and yet to achieve expected size in situation. Primary developmental stage.
Maturing	Specimen approaching expected size in situation, with reduced incremental growth
Over-mature	Tree is senescent and in decline. Significant decay generally present

Arboricultural Rating

Relates to the combination of tree condition factors, including health and structure (arboricultural merit), and also conveys an amenity value. Amenity relates to the trees biological, functional and aesthetic characteristics (Hitchmough 1994) within an urban landscape context.

Category	Description
High	Tree of high quality in good to fair condition. Generally a prominent arboricultural feature. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is highly desirable.
Moderate	Tree of moderate quality, in fair or better condition. Tree may have a condition, and or structural problem that will respond to arboricultural treatment. These trees have the potential to be a medium- to long-term component of the landscape if managed appropriately. Retention of these trees is generally desirable.
Low	Tree of low quality and/or little amenity value. Tree in poor health and/or with poor structure. Tree is not significant because of its size and/or age. These trees are easily replaceable. Tree (species) is functionally inappropriate to specific location and would be expected to be problematic if retained. Retention of such trees may be considered if not requiring a disproportionate expenditure of resources for a tree in its condition and location.
None	Tree has a severe structural defect and/or health problem that cannot be sustained with practical arboricultural techniques and the loss of tree would be expected in the short term. Tree whose retention would not be viable after the removal of adjacent trees (includes trees that have developed in close spaced groups and would not be expected to acclimatise to severe alterations to surrounding environment – removal of adjacent shelter trees). Tree has a detrimental effect on the environment, for example, the tree is a woody weed with potential to spread into waterways or natural areas.

Trees have many values, not all of which are considered when an arboricultural assessment is undertaken. However, individual trees or tree group features may be considered important community resources because of unique or noteworthy characteristics or values other than their age, dimensions, health or structural condition. Recognition of one or more of the following criterion is designed to highlight other considerations that may influence the future management of such trees.

Significance	Description
Horticultural Value/ Rarity	Outstanding horticultural or genetic value; could be an important source of propagating stock, including specimens that are particularly resistant to disease or exposure. Any tree of a species or variety that is rare.
Historic, Aboriginal Cultural or Heritage Value	Tree could have value as a remnant of a particular important historical period or a remnant of a site or activity no longer in action. Tree has a recognised association with historic aboriginal activities, including scar trees. Tree commemorates a particular occasion, including plantings by notable people, or having associations with an important event in local history.
Ecological Value	Tree could have value as habitat for indigenous wildlife, including providing breeding, foraging or roosting habitat, or is a component of a wildlife reserve. Remnant Indigenous vegetation that contribute to biological diversity

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Gooding, R.F., Ingram, J.B., Urban, J.R., Bloch, L.B., Steigerwaldt, W.M. Harris, R.W. and Allen, E.N. (2000) Guide for plant appraisal, 9th edition, International society of Arboriculture, USA

Pollard, A. H. (1974) Introductory statistics: a service course, Pergamon Press Australia, Australia.

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Appendix 4: Protection of retained trees

The following are guidelines that must be implemented to minimise the impact of the proposed construction works on the retained trees.

- The Tree Preservation Zone (TPZ) is fenced and clearly marked at all times. This fence should deter the placement of building materials, entry of heavy equipment and vehicles and also the entry of workers and/or the public into the TPZ. Australian Standard AS 4687 - 2007 Temporary fencing and hoardings, specifies appropriate fencing requirements. Existing perimeter fencing can be incorporated into the protective fencing. Shade cloth should be attached to reduce the movement of dust and other particulates into the TPZ. Signs identifying the TPZ are to be placed on the fencing.
- If the area within the TPZ is to be accessed during the construction phase then the area will need ground protection. Measures may include a permeable membrane, such as a geotextile, to cover the TPZ area beneath a 100 mm layer of crushed rock below rumble boards or tree protection matting.
- Contractors and site workers should receive written and verbal instruction as to the importance of tree protection and preservation within the site. Successful tree preservation occurs when there is a commitment from all relevant parties involved in designing, constructing and managing a development project. Members of the project team need to interact with each other to minimise the impacts to the trees, either through design decisions or construction practices.
- The consultant arborist is on-site to supervise excavation works around the existing trees where the TPZ will be encroached.
- There is no immediate requirement for mulching within the TPZ. There is benefit to maintaining existing site conditions within the TPZ and is more analogous to proposed completion conditions. Monitoring of the trees in-line with prevailing weather conditions will indicate if mulching will be required. The same approach is to be used in providing supplemental irrigation.
- No persons, vehicles or machinery to enter the TPZ without the consent of the consulting arborist or site manager.
- Any underground service installations within the allocated TPZ should be bored and utility authorities should common trench where possible.
- No fuel, oil dumps or chemicals shall be allowed in or stored on the TPZ and the servicing and re-fuelling of equipment and vehicles should be carried out away from the root zones.
- No storage of material, equipment or temporary building should take place over the root zone of any tree.
- Nothing whatsoever should be attached to any tree including temporary services wires, nails, screws or any other fixing device.
- Any pruning that is required must be carried out by trained and competent arborist who has a thorough knowledge of tree physiology and pruning methods and carry out pruning to the Australian Standard AS 4373 – 2007 '*Pruning of Amenity Trees*'.
- All root excavation should be carried out by hand digging or with the use of 'Air-Excavation' techniques, and roots should be severed by saw cutting or with a sharp axe and not with a Backhoe or any machinery or blunt instrument.

Appendix 5: Tree Protection Zones (TPZ)

The most important consideration for the successful retention of trees is to allow appropriate above and below ground space for the trees to continue to grow. This requires the allocation of tree protection zones for retained trees.

The Australian Standard AS 4970-2009 '*Protection of Trees on Development Sites*' has been used as a guide in the allocation of TPZs for the assessed trees. The TPZ for individual trees is calculated based on trunk diameter (DBH measured in centimetres), measured at 1.4 metres up from ground level. The radius of the TPZ is calculated by multiplying the trees DBH by 12.

This method provides a TPZ that addresses both the stability and growing requirements of a tree. TPZ distances are measured as a radius from the centre of the trunk at (or near) ground level. The maximum TPZ should be no more than 15m radius and the minimum TPZ should be no less than 2m radius.

Encroachment into the TPZ is permissible under certain circumstances though this is dependent on both site conditions and tree characteristics. Minor encroachment, up to 10% of the TPZ, is generally permissible provided encroachment is compensated for by recruitment of an equal area contiguous with the TPZ. Encroachment must also consider the crown of the tree and ensure that excessive pruning is not required that would cause the tree to become unbalanced or disfigured.

The 10% encroachment on one side equates to approximately a ⅓ reduction of the radial distance.

Examples of minor encroachment are provided in Diagram 1A &1B.

Encroachment greater than 10% is considered major encroachment under AS4970-2009 and is only permissible if it can be demonstrated that after such encroachment the tree would remain viable. Non-destructive root investigation (NDRI) may be required to investigate and identify the location of roots within the proposed area of encroachment.

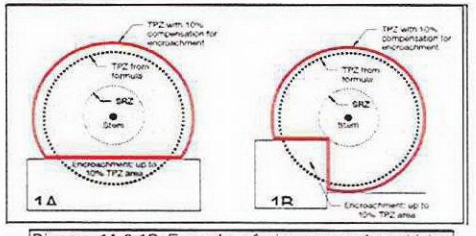

Diagram 1A & 1B: Examples of minor encroachment into a TPZ

Tree root growth is opportunistic and occurs where the essentials to life (primarily air and water) are present. Heterogeneous soil conditions, existing barriers, hard surfaces and buildings may have inhibited the development of a symmetrically radiating root system. Existing infrastructure around some trees may be within the TPZ or root plate radius. Where this has occurred, the roots of some trees may have grown in response to the site conditions and if existing hard surfaces and building alignments are utilised in new designs the impacts on trees should be minimal.

All TPZ measurements are provided in the tree assessment data in Appendix 1. More specific tree protection distances and other measures could be provided during the design phase of a development project. Appendix 4 provides tree protection guidelines that should be incorporated into design and management plans for retained trees.

The Structural Root Zone (SRZ) is the area in which the larger woody roots required for tree stability are found close to the trunk and which then generally taper rapidly. This is the minimum area recommended to maintain tree stability but does not reflect the area required to sustain tree health. The area between the reduced TPZ and the SRZ may only be encroached if root sensitive construction methods are adopted, based on results of a Non-destructive root investigation and if approved by the consulting arborist. No works are permitted within the SRZ radius as tree stability maybe compromised.

Appendix 6: Excavator orientation

1. The existing asphalt surface should be retained during construction to protect the tree roots from compaction and damage during construction by excavator, contractor and delivery vehicles.
2. If and when it is time to eventually lift the existing driveway, the excavator must operate in a radial fashion with the machine oriented to face the trunk of the tree at all times and operate by lifting and pulling away from the tree. Force must not be exerted laterally across the alignment of roots to avoid cracking or breaking roots closer to the tree. The excavator must be located beyond the nominated TPZ.
   Refer diagram 2 below.
3. A supervisor must be present to advise if any surface oriented roots are exposed and ensure no damage occurs to them.
4. Before installing the new surface the root zone must be covered in a geotextile material such as Bidum geo-fabric or Bodcell™.
5. Damage to paving from root activity is most likely to occur within 2m of the trunk base of a tree (Biddle, 1998; Coder, 1998; and Yau and Krause, 1996) and it is recommended that a minimum 2m clearance is provided from any tree to any hard paved surface.
   Design amendment should be considered to either provide greater clearance to the tree or engineer the concrete with reinforcing to withstand soil shrink/swell associated with the tree roots and root expansion.

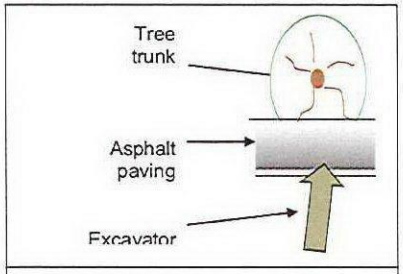

Diagram 2: Steps to minimise impacts of excavation within the TPZ.

6. Where there is potential for impact wounds to occur as a result of access, operation or slewing within close proximity to retained trees appropriate trunk and limb protection must be installed.
7. Mechanical impact damage to trunks and limbs that could result from the slewing action of plant and equipment or by construction traffic/ activity should be addressed by considering positioning of plant and machinery and operator caution to avoid the occurrence of such impact, and/or alternate traffic routes.
8. Where required, trunk protection can be achieved through the use of adequate padding secured around the trunk. Timber hoarding or palings, sufficient in length to cover the trunk, laid over rubber or similar padding wrapped around the trunk and fixed using non-invasive fixing device such as steel strapping is suitable.
   Attaching items to a trunk requiring invasive fittings such as screws, nails or bolts is not permitted.
9. Trunk protection material should not be maintained for prolonged periods and should be removed from the tree as soon as the threat ceases.
10. Crown Protection: see following points.
11. Work site set up and operation should be planned to avoid the need for pruning. Injurious contact between plant or machinery and the tree crown must be avoided whether during transit, traverse or operation within the site. Any pruning identified as being required to provide access or clearance for machinery or scaffolding erection, and general site access should be approved by the site arborist. Pruning must be undertaken in accordance with Australian Standards (AS 43732007 *Pruning of amenity trees*).
12. Where dust accumulation on foliage during demolition is likely, the site arborist should be consulted to determine if dust removal is required. Dust accumulation shall be controlled by application of water.
13. Root Protection: see following points.
14. Within the TPZ, the area close to the trunk that contains the major lateral roots and is associated with the stability of the tree is known as the structural root zone (SRZ). All roots

and soil in this area are deemed significant and no excavation is permitted. No excavation is to occur in the SRZ of any tree

15. If plant or machinery with bucket or blade type equipment is required for excavation abutting or near the edge of the TPZ, the bucket/ blade should be orientated to work radially from the trunk rather than across the root plate. This will avoid longitudinal root shattering towards the trunk.
16. Pruning of roots greater than 50mm in diameter at the edge of the TPZ must be undertaken using a sharp saw or secateurs or any other machinery specifically designed to prune tree roots. Any machinery not specifically designed to prune roots must not be used.
17. Exposed roots within a TPZ must not be allowed to desiccate. Exposed roots must be covered with pre-moistened thick hessian or jute matting and pinned. The covering must be kept moist until such time as the roots are permanently covered.

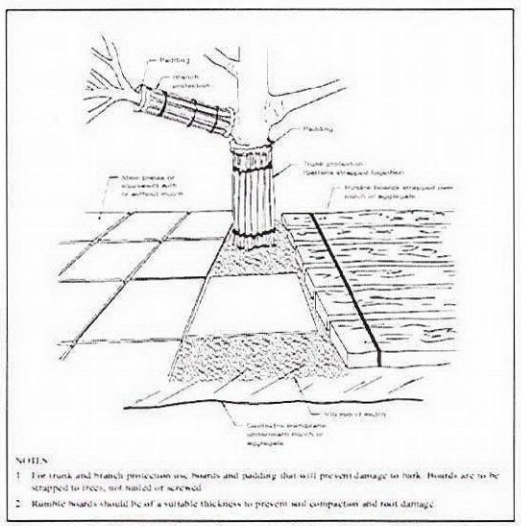

Diagram 1. Examples of appropriate Trunk, limb and root zone buffering protection.
Extract from Australian Standard (4970 2009) *Protection of Trees on development sites.*

Appendix 7: Ground Protection System (GPS).

The TPZ areas can be temporarily encroached if the area is protected. Measures may include a permeable membrane, such as a geotextile, to cover the TPZ area beneath a 100 mm layer of crushed rock below rumble boards or tree protection matting, such as Economat™ (See Diagram 3). This will allow temporary access.

Process for installation and removal of ground protection system (GPS).

- No need to remove organic matter layer. Close mow of all grass within area. If excavation is required to attain levels, no more than 100 mm in depth is to be removed.
- The entire area is to be covered with a geotextile fabric that will extend beyond the area by a distance to account for any crimping when a surface material is laid on top. Geotextile to be firmly anchored into the soil. The geo-fabric shall comprise Bidim U34 filter fabric or equivalent. Installed by hand.
- When installing the GPS, work from the existing hard surfaces towards the extremities, using a mini tracked excavator to transport the rock material. Excavator is to always work on installed GPS.
- When dismantling, work from the extremities back towards the existing hard surfaces. Using a mini tracked excavator. Excavator to always work on remaining GPS.
- Geotextile comes up last (by hand).
- Reinstate grass.

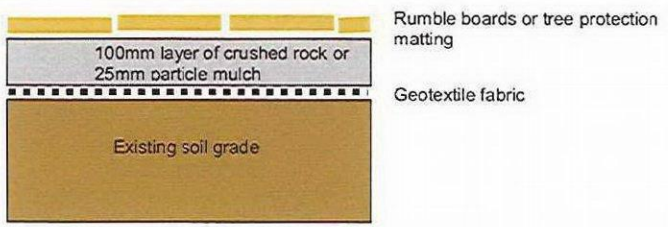

Diagram 3: Indicative ground protection system - adapted from AS4970 Clause 4.5.3 Ground protection

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To the writer's knowledge all facts, matter and all assumptions upon which the report proceeds have been stated within the body of the report and all opinion contained within the report will be fully researched and referenced and any such opinion not duly researched is based upon the writers experience and observations.

Appendix H: Development Summary

mecone

D19-334480

DEVELOPMENT SUMMARY

29 BROWNS ROAD, CLAYTON VIC

Apartments
Revision: **- 03**

LEVELS	UNITS PER FLOOR	NSA Residential (excluding Balcony)	BALCONY (sqm)	COMMON AREA /LOBBY (sqm)	RETAIL (sqm)	BOH / Loading / Plant (sqm)	GFA Carpark (sqm)	CARS TOTAL	1 BED	2 BED	3 BED	TOTAL
Basement Level							6780					
Ground Level	46	2929	990	413			Resident Cars	176	22	24	0	46
Level 1	46	2929	751	413			Visitor Cars	36	22	24	0	46
Level 2	42	2776	626	406					15	27	0	42
Level 3	40	1816	861.7	448					19	19	0	38
Total	**174**	**10450**	**3228.7**	**1680**	**0**	**0**	**6780**	**212**	**78**	**94**	**0**	**172**

Notes and Disclaimer:
1 This scheme has been produced without planning advice or preliminary meetings with the responsible authorities and as such may not comply with building or other statutory regulations. It represents a possible development that may be achieved with full consultation and liaison with state government and relevant authorities, however no warranty is given that the yield or layouts will be acceptable to the authorities or other interested parties. Hence Mushan presents this information as a possible solution only that is subject to council approval. **2** This scheme and schedule has been prepared for preliminary feasibility purposes only. the information herein is based on the limited information available at the time of preparation and is believed to be correct at the time of preparation however no warranty can be given that the yield or layouts will be acceptable to the authorities or other interested parties. Hence Mushan presents this information as a possible solution only that is subject to council approval. **3.** The layouts contained herein we prepared without structural or services advice hence no allowance has been made at this stage. **4** Apartment areas have been measured to the centreline of party and / or abounding walls. Areas do not allow for services or risers. GFA areas exclude balcony areas. **5** Change to the layouts and associated figures will be made during the development of the project hence recipients must rely on their own enquiries to satisfy themselves in all aspects. **6** Site coverage does not include terraces and carpark entrances.

D19-334480

DEVELOPMENT SUMMARY

29 BROWNS ROAD, CLAYTON VIC

Townhouses
Revision: **04**

	TOWHOUSE TYPE	No.	NSA Residential (excluding Balcony)	BALCONY (sqm)	COMMON AREA /LOBBY (sqm)	RETAIL (sqm)	BOH / Loading / Plant (sqm)	COURTYARD (sqm)	CARS TOTAL	2BED	3 BED + STUDY	4 BED	TOTAL
	2 Storey	50	8447	468				2036	82	18	22	10	50
	3 Storey	24	3978	210				432	32	16	0	8	24
								Visitor Cars	15				
Total		**74**	**12425**	**678**	**0**	**0**	**0**	**2468**	**129**	**34**	**22**	**18**	**74**

Notes and Disclaimer:
1 This scheme has been produced without planning advice or preliminary meetings with the responsible authorities and as such may not comply with building or other statutory regulations. It represents a possible development that may be achieved with full consultation and liaison with state government and relevant authorities, however no warranty is given that the yield or layouts will be acceptable to the authorities or other interested parties. Hence Mushan presents this information as a possible solution only that is subject to council approval. **2** This scheme and schedule has been prepared for preliminary feasibility purposes only. the information herein is based on the limited information available at the time of preparation and is believed to be correct at the time of preparation however no warranty can be given that the yield or layouts will be acceptable to the authorities or other interested parties. Hence Mushan presents this information as a possible solution only that is subject to council approval. **3.** The layouts contained herein we prepared without structural or services advice hence no allowance has been made at this stage. **4** Apartment areas have been measured to the centreline of party and / or abounding walls. Areas do not allow for services or risers. GFA areas exclude balcony areas. **5** Change to the layouts and associated figures will be made during the development of the project hence recipients must rely on their own enquiries to satisfy themselves in all aspects. **6** Site coverage does not include terraces and carpark entrances.

Revisions
04 - REVISED FOR DEVELOPMENT PLAN AMENDMENT