

APPENDIX A RETAIL SUSTAINABILITY ASSESSMENT

A woman wearing a straw hat and a backpack is walking through a busy outdoor market. The scene is bathed in the warm, golden light of a sunset, with trees and market stalls visible in the background. The woman is looking off to the side with a slight smile.

URBIS

EGLINTON DISTRICT CENTRE RETAIL SUSTAINABILITY ASSESSMENT

PREPARED FOR
EGLINTON ESTATES

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INTRODUCTION

BACKGROUND & PURPOSE

INTRODUCTION

BACKGROUND

Eglinton is located in Perth's fast-growing north west growth corridor. A district structure planning process commenced more than a decade ago and identified the need for a mix of activity centres to accommodate future population growth planned in the Alkimos and Eglinton area.

A district centre was proposed for Eglinton within the Eglinton Estates land holdings. Whilst structure planning was undertaken in 2011 and 2012, the site is currently vacant.

Against this backdrop, the State Government METRONET project is being implemented and includes construction of the Butler to Yanchep rail extension. As part of this project, a train station within the Eglinton District Centre is expected to be completed around 2021.

Eglinton Estates commenced activity centre planning for the district centre to integrate with the rail extension.

PURPOSE

This retail and commercial needs and sustainability assessment (RSA) forms part of the Eglinton Activity Centre Plan. In accordance with State Planning Policy 4.2 Activity Centres for Perth and Peel, this RSA assesses the sustainable future provision of floorspace.

The key requirements of the research were to:

- Determine the potential scale, mix and timing of development (retail and ancillary non-residential uses) within the Eglinton District Centre; and
- Advise on the appropriate location of the potential range of uses, layout of the town centre and required land area to accommodate these uses.

Focus was afforded to a range of retail, commercial and community uses in line with the expected role of the district centre within the wider region's centre hierarchy. Importantly, this RSA assumes that higher order centres will progress their development in line with published activity centre plans and district structure plans.

This RSA is complemented by a Local Employment Strategy which determines the potential employment contribution of the Eglinton District Centre and the strategies to enhance employment and diversity outcomes.

INTRODUCTION

APPROACH

This RSA has been informed by input from a multi-disciplinary project team and Urbis retail economists and commercial advisors.

The RSA includes consideration of:

- Definition of the trade area that would be served by the Eglinton District Centre and estimates of the size of the retail market, including resident forecasts, demographic profiling and retail expenditure forecasts by product group;
- A review of existing and planned activity centres and assessment of implications for the scale and timing of development at the Eglinton District Centre;
- Assessment of the need and demand for retail and non-retail uses, including:
 - A review the scale / mix of uses and development timeline of district centres in Perth with comparable location, market and property attributes;
 - Forecast demand for retail floorspace and supportable allocation of demand to the district centre;
 - The capacity of the market to support major retail tenants, having regard to sustainable rates of supply and appropriate allocation of demand to the district centre;
 - Required market thresholds to support non-retail uses; and
- Analysis of the sustainable scale and mix of development, including staging.

The RSA includes four key sections illustrated to the right.



SECTION ONE

TRADE AREA DEFINITION

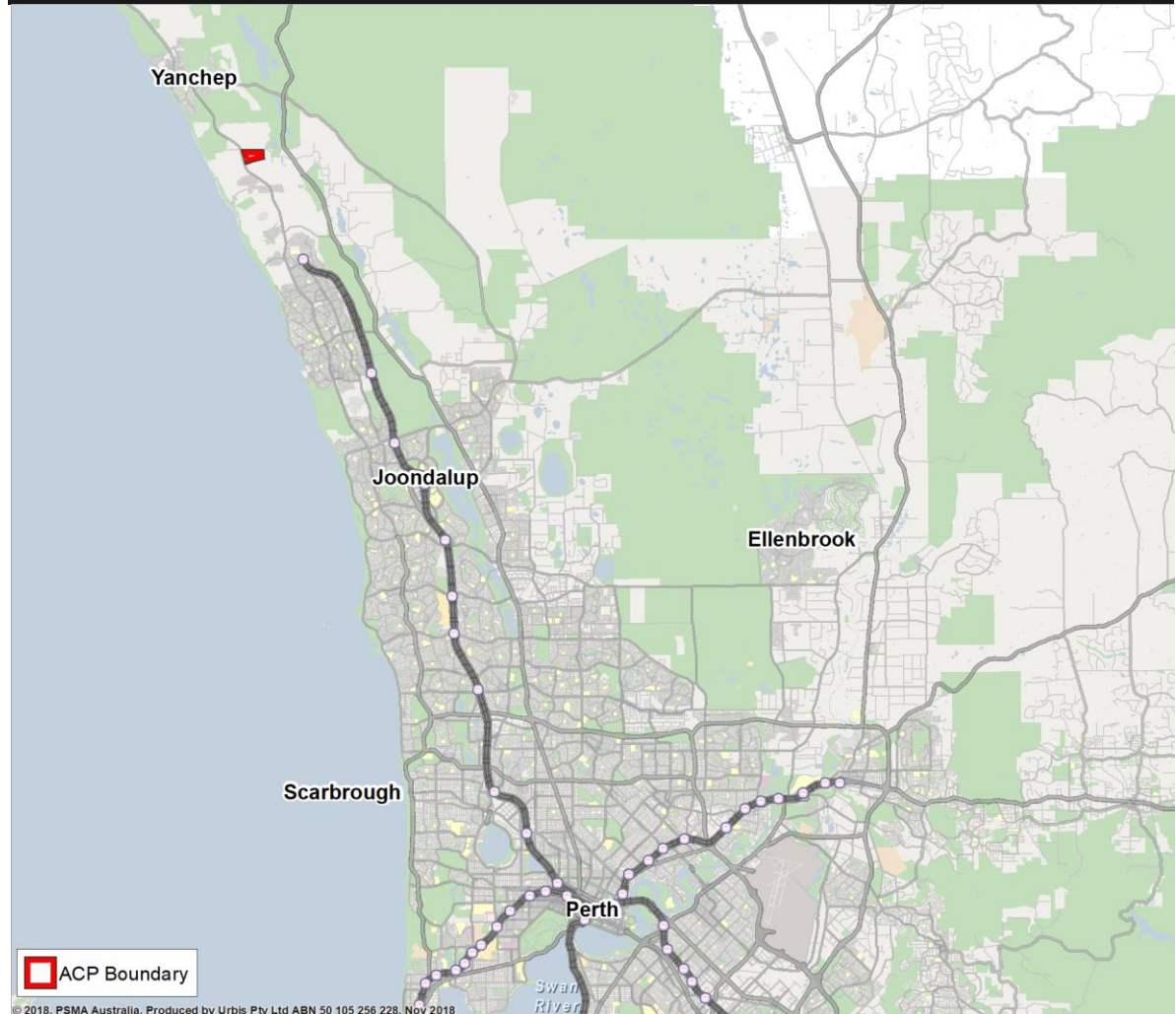
1.1 REGIONAL CONTEXT

THE NORTH WEST CORRIDOR

KEY FINDINGS

- Rapid population growth has transformed Perth into a global city which is home to more than two million people and globally recognised within the top ten most liveable cities in the world. The city has benefited from a wave of migration as result of lifestyle and employment opportunities.
- The North West Corridor – defined by the City of Joondalup and City of Wanneroo boundaries – has been central to accommodating Perth's growth over the past three decades and today is home to more than 350,000 people and 180,000 workers.
- Against this backdrop, the State Government predicts that Perth is set to develop into a city of 3.5 million residents by 2050 and central to the future growth outlook is the role of the North West Corridor. The number of residents and workers in the corridor is expected to double to 740,300 and 376,000 respectively.
- This predicted growth has led to the need to develop a network of economic precincts to connect people to quality and appropriate employment, health care, education, and social, cultural and recreational facilities.
- The Eglinton District Centre is proposed to primarily support future growth within Eglinton and be supported by higher order centres in Alkimos and Yanchep.

REGIONAL CONTEXT

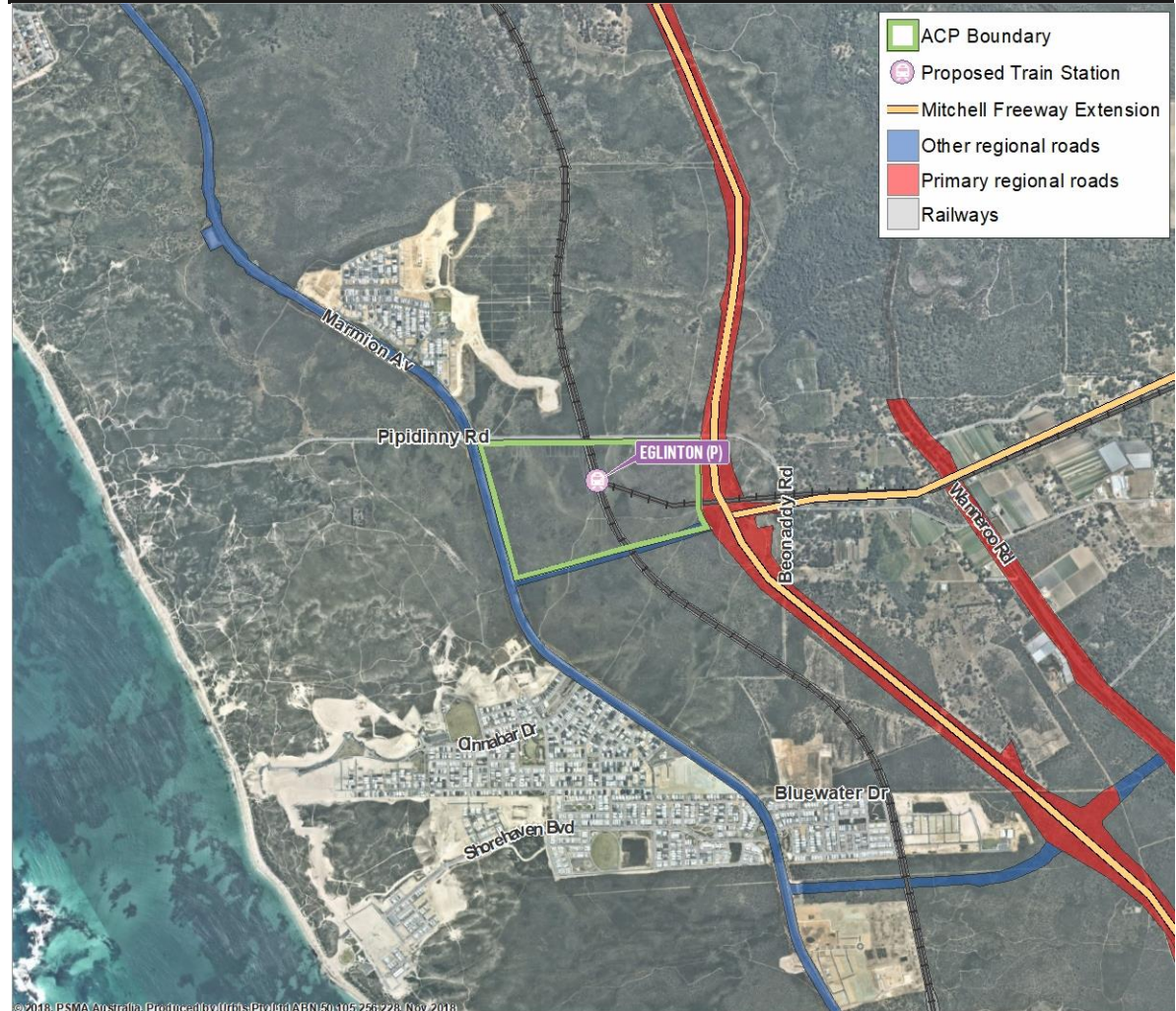


ALKIMOS – EGLINTON

KEY FINDINGS

- The Alkimos – Eglinton District Structure Plan represented a step-change for the City of Wanneroo and State Government. When the DSP was being developed a decade ago, an ambitious 60% employment self sufficiency (ESS) target was adopted and continues to be championed throughout developments in the area.
- However much has changed over the past decade. Technology is reshaping the way we work, live, shop and socialise more so than the DSP had envisaged. The shifting landscape means that a significant portion of jobs that exist today will no longer exist in 20 years' time. A greater understanding of these trends has therefore informed local structure planning across the DSP area and the role of different employment areas now has been better defined.
- Significant changes between the DSP and LSPs include:
 - Significant growth of neighbourhood / local centre floorspace is expected to support three times more employment within these lower order centres than originally envisaged;
 - The Alkimos Secondary Centre is expected to be home to a greater scale and mix of shop retail, large format retailers, office accommodation, medical services, education and light industrial uses, as well as higher density residential; and
 - The proposed Service Commercial Activity Corridor has undergone significant modification reflecting issues relevant to viability and industry growth projections, the evolving nature of activity centres and industrial areas and site constraints.

EGLINTON DISTRICT CENTRE BOUNDARY

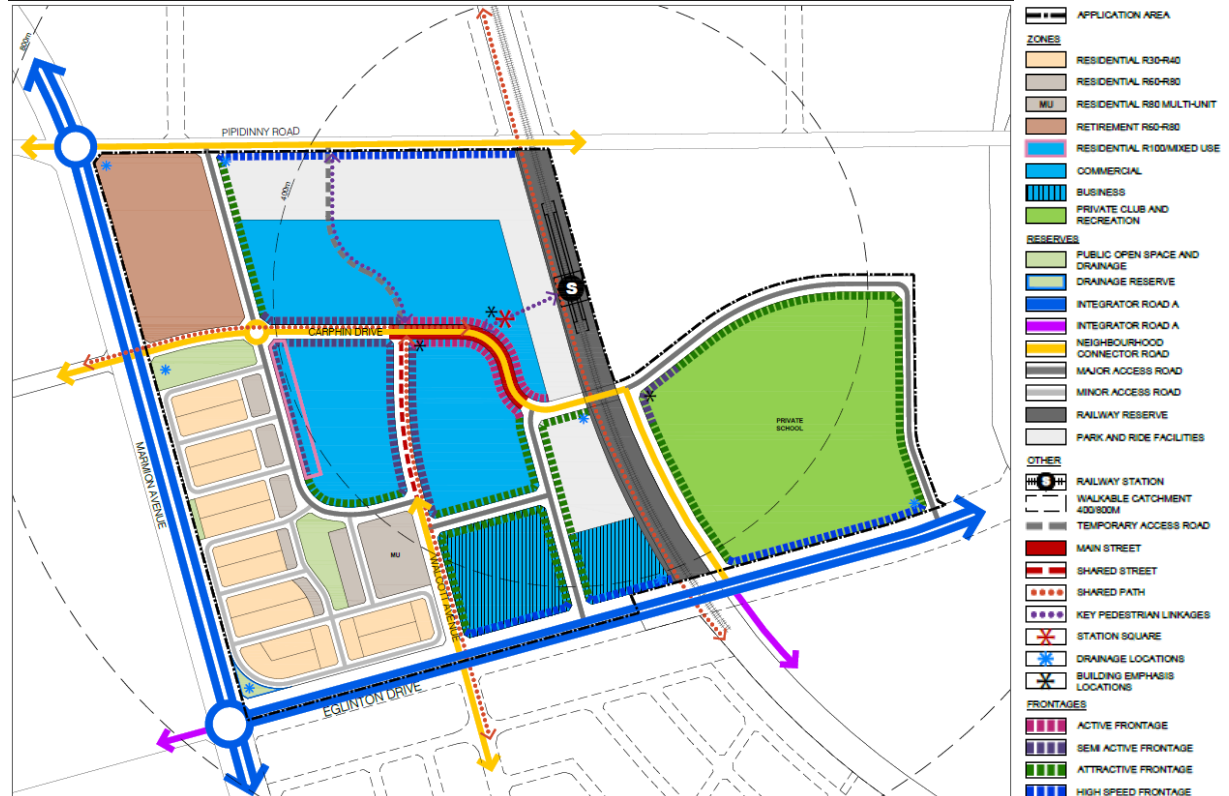


EGLINTON DISTRICT CENTRE OVERVIEW

KEY FINDINGS

- The Eglinton Local Structure Plan (LSP) (2012) established a hierarchy of activity centres consistent with the Alkimos – Eglinton District Structure Plan. Central to the Eglinton LSP was the identification of the Eglinton District Centre around a future train station located between Marmion Avenue and the future Mitchell Freeway extension.
- Initial land use assessments informed the scale of proposed land uses within the Eglinton District Centre, with the LSP noting a projected floorspace of 38,163 square metres (sq. m) by 2036.
- Whilst these previous studies informed the activity centre planning, this RSA has sought to test the proposed scale and mix of land uses based on a more current understanding of the centre hierarchy and consumer / market patterns.
- Based on input from this RSA, and other planning considerations, an activity centre boundary was identified. The boundary is defined by Marmion Avenue, Pipidinnny Road, the railway reservation, extends around a proposed K-12 private school site and Eglinton Drive.
- This RSA has also informed the mix and scale of uses proposed within the ACP together with the preferred street network and design as is illustrated to the right.
- The retail component is expected to form the core of the activity centre and include linkages to Marmion Avenue and the Eglinton train station.

PROPOSED LAND USES, EGLINTON DISTRICT CENTRE



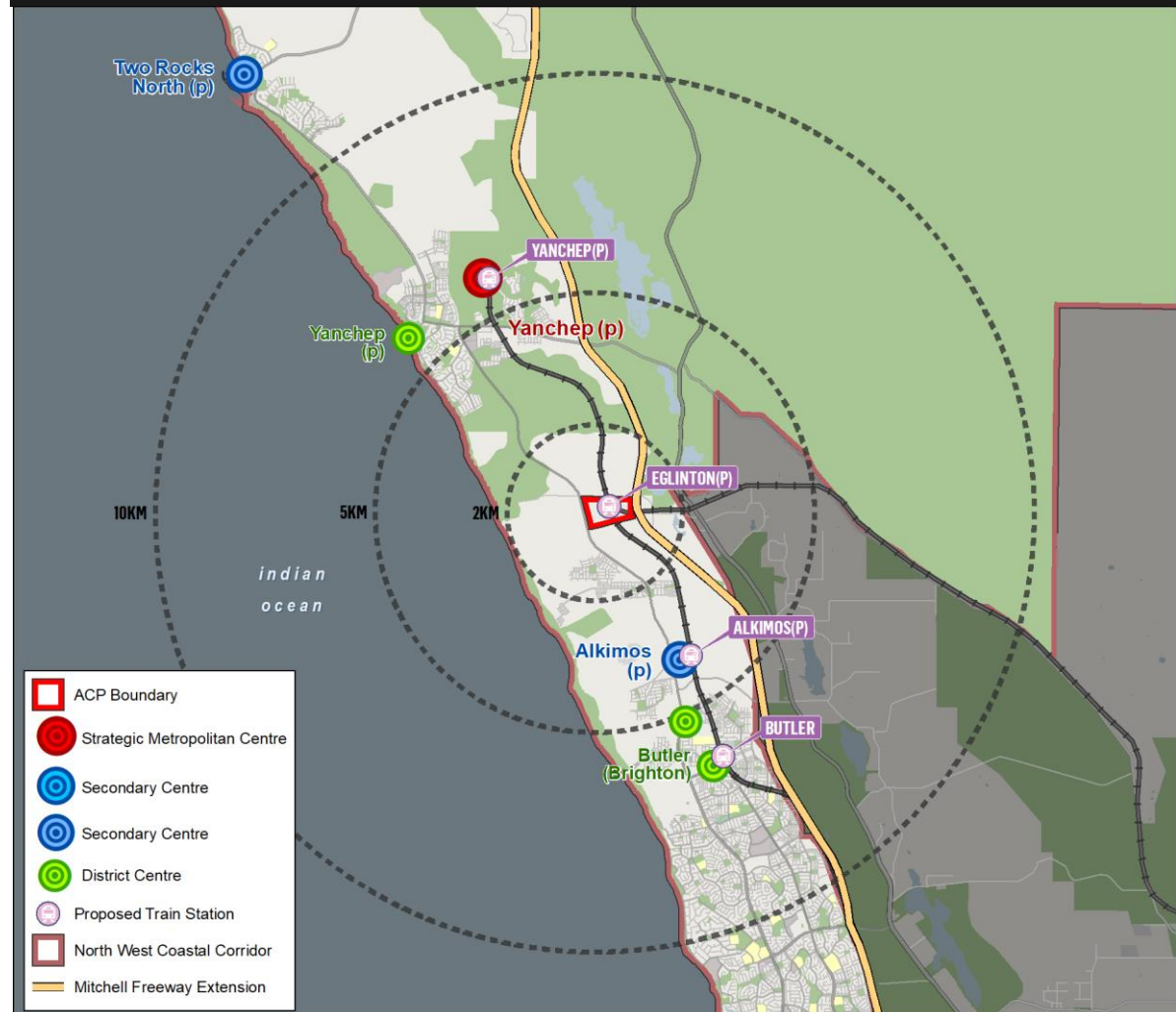
1.2 SUPPLY CONSIDERATIONS

ACTIVITY CENTRE HIERARCHY

KEY FINDINGS

- The north-west sub-region is characterised by a number of higher and lower order centres which were identified through district structure planning and more detailed local structure planning.
- The core centres of relevance to the development potential at the Eglinton District Centre are summarised below.
 - **Alkimos Secondary Centre:** The Alkimos Activity Centre Plan was endorsed in mid-2018 and presents the land use planning framework to guide the development of a significant mixed use centre with more than 120,000 sq. m of non-residential floorspace at build-out. A significant first stage development is expected to be completed within the next five years.
 - **Yanchep Strategic Metropolitan Centre:** In 2018, the Yanchep City Centre Activity Centre Plan was endorsed. The activity centre plan area covers 106 hectares and adopts a floorspace target of 458,867 sq. m, including 71,800 sq. m of retail floorspace. A significant first stage development is assumed to occur by 2025.
- As noted in Section 4.2, this RSA explored the potential floorspace scale, mix and timing at Eglinton through the lens of what is sustainable across the broader region. This RSA therefore does not depart from the planned floorspace levels and roles of higher order centres in the corridor.

ACTIVITY CENTRE HIERARCHY, NORTH-WEST SUB-REGION



EXISTING AND PLANNED RETAIL SUPPLY

KEY FINDINGS

- A range of lower order centres were assessed given the Eglinton District Centre will be staged and its role will initially function similar to a neighbourhood centre in the initial years.
- There are a range of existing centres with convenience offerings which are expected to complement future higher order centres and a range of identified but undeveloped local and neighbourhood centres.
- Existing floorspace estimates were informed by the Property Council of Australia database, development applications and the Department of Planning, Lands and Heritage's Land Use and Employment Survey. Future floorspace was informed by structure plans.
- The table to the right notes the relevant existing and planned activity centres in the North-West Sub-Region. Only local / neighbourhood centres within a 6km radius are illustrated in the table given these centres have overlapping catchment areas with the Eglinton District Centre.
- In Section 4.2, this RSA demonstrates that the Eglinton District Centre will not undermine the sustainability of these lower and higher order centres, with the catchment expected to support the viability of all centres over the assessment period.

EXISTING AND PLANNED CENTRES, NORTH-WEST SUB-REGION

	Distance* (km)	Supermarket Floorspace (sq. m)	Planned Shop Retail Floorspace (sq. m)	Total Planned Floorspace (sq. m)
Yanchep Strategic Metropolitan Centre	5.0		72,000	460,000
Alkimos Secondary Centre	3.5		65,000	142,000
Two Rocks Secondary Centre	12.5		44,000	131,000
Butler District Centre <i>(existing floorspace)</i>	5.0	4,600	22,500 11,680	77,000
Yanchep District Centre	6.8		11,700	24,000
Eglinton Coastal Node	2.0		4,000	n.a.
The Village at Shorehaven	2.0		4,000	n.a.
Allara Neighbourhood Centre	2.2		4,000	n.a.
Alkimos Coastal Node	2.5		1,500	n.a.
Gateway Alkimos <i>(existing floorspace)</i>	3.0	1,400	5,000	n.a.
Trinity Village <i>(existing floorspace)</i>	4.0	3,500	5,500	n.a.
Yanchep Central <i>(existing floorspace)</i>	6.0	4,000	4,700	n.a.

Source: Urbis, Property Council, DPLH

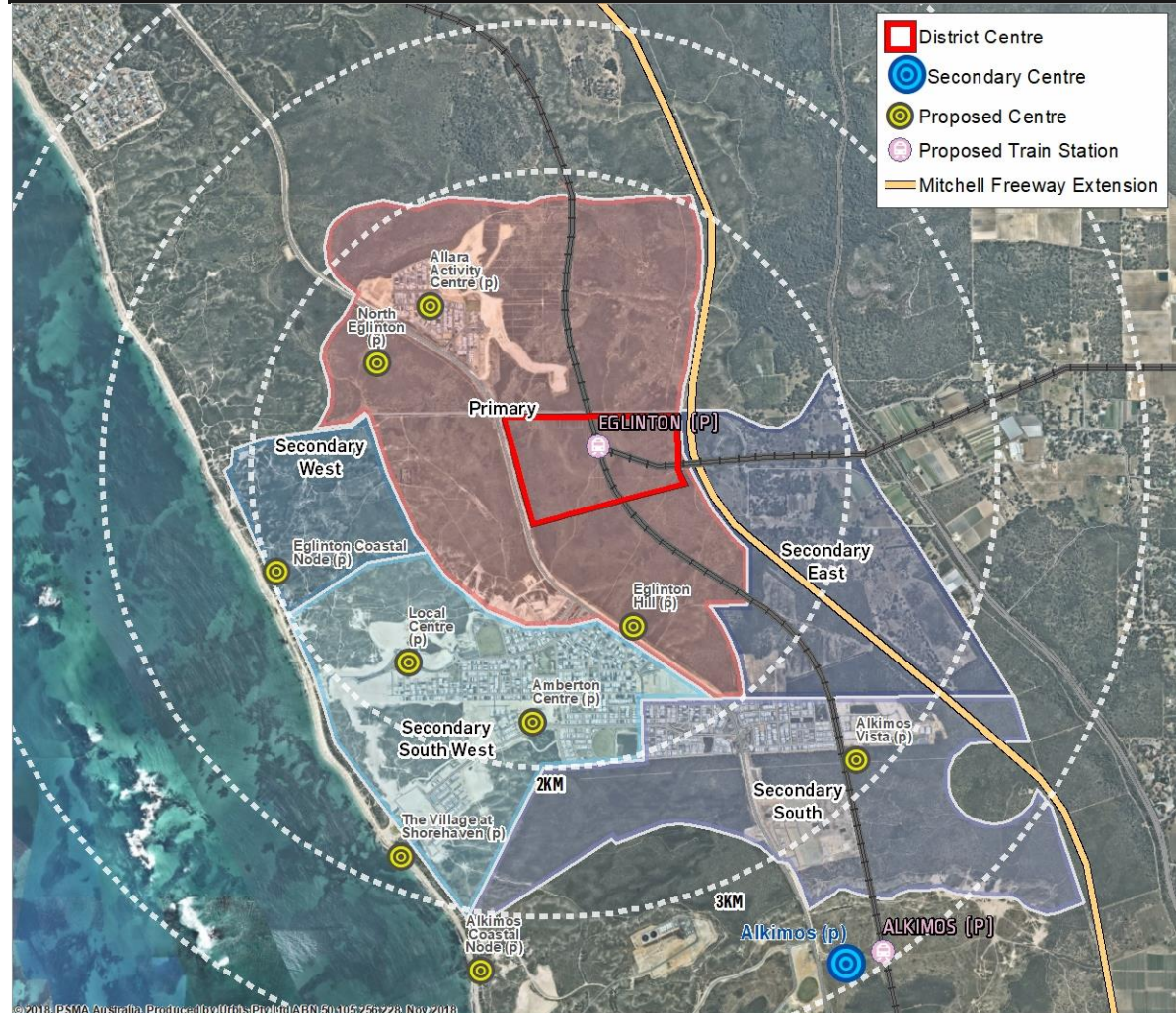
1.3 DEFINED TRADE AREA

TRADE AREA DEFINITION

KEY FINDINGS

- A trade area has been defined for the Eglinton District Centre taking into account the following characteristics.
 - The geography of the region which will result in a relatively captive market for retailing between the coastline and future Mitchell Freeway extension.
 - The future pattern of urban development and planned road network which will generate good access and exposure to the Eglinton District Centre site.
 - The planned network of competing activity centres in the region which will limit the extent of the catchment, most notably:
 - Alkimos Secondary Centre approximately 3.5 km south; and
 - Yanchep Strategic Metropolitan Centre, approximately 5 km north.
- The Eglinton District Centre is also expected to capture a share of its business from outside the trade area (~10%-15%), which will be supported by the site's convenient and accessible positioning on Marmion Avenue and the potential for visitation to be enhanced by future rail and road linkages.

TRADE AREA



SECTION TWO

TRADE AREA

ATTRIBUTES

2.1 POPULATION OUTLOOK

RESIDENTIAL DEVELOPMENT CONTEXT

KEY FINDINGS

- The trade area and surrounding region is defined by numerous master planned communities underway and planned.
- The master planned communities of Shorehaven, Amberton, Alkimos Beach and Trinity are well-established.
- Alkimos Vista (LandCorp / Lend Lease) and East of the Beach (Urban Quarter) launched in 2018.
- The timing of the LandCorp development sites that are progressing structure planning (i.e. Alkimos Coastal Node, Alkimos City Centre and South Yanchep) is unknown and dependent on current / future joint venture arrangements.
- Eglinton Hill is likely to come to market in 2020, with a subdivision plan expected to be approved in 2019.
- Eglinton Estates, at the time of writing, was marketing two lots west of the district centre which could lead to development earlier than envisaged.
- In summary, the Eglinton District Centre will benefit from continued strong population growth in the catchment for at least 15 years. The timing of future developments and market conditions will however impact on the staging of the centre.

CURRENT AND FUTURE RESIDENTIAL ESTATES



TRADE AREA POPULATION

KEY FINDINGS

- The forecasts for the trade area have been derived using top-down and bottom-up approaches.
- The top-down approach takes into account the broader population trends for Perth; the North West Region (City of Wanneroo and City of Joondalup), and North West Sub-Region, and the share of future population growth that can be captured by each region and the defined trade area.
- The bottom-up approach aggregates small area information for projected population and dwelling capacity for key developments in the trade area. This task was supported by a review of land sale rates and forecasts; as well as expected development timeframes informed by the Urban Land Development Outlook and .id Consulting. (.id Consulting prepare small area forecasts which are more detailed than estimates published for the City of Wanneroo.)
- The trade area population is forecast to increase from just over 6,000 people to almost 30,000 people by 2030.
- By 2040, the trade area is expected to reach its full development capacity and support a population in the order of 42,000 people. This population includes 17,500 people in the Eglinton District Centre's core 'primary' market.
- This level of growth assumed in the trade area is broadly consistent with forecasts published for the City of Wanneroo.

POPULATION PROJECTIONS, 2018-40

Region	2018	2020	2025	2030	2035	2040
North-West Corridor	364,700	376,300	419,000	473,200	526,500	574,900
North-West Sub-Region	29,880	39,100	74,190	121,420	170,360	216,410
Eglinton Trade Area	6,060	8,540	18,600	29,710	39,310	42,130
<i>Primary</i>	1,120	1,900	5,230	10,970	15,920	17,470
<i>Secondary East</i>	40	40	400	690	940	1,210
<i>Secondary South</i>	1,080	1,380	2,530	4,580	7,280	7,580
<i>Secondary South West</i>	3,780	5,180	10,280	11,280	11,280	11,280
<i>Secondary West</i>	40	40	160	2,190	3,890	4,590

Source: Urbis, SAFi, DPLH

POPULATION BUILD-OUT PROFILE, EGLINTON DISTRICT CENTRE TRADE AREA, 2018-40,

Region	2018	2020	2025	2030	2035	2040
Primary	6%	11%	30%	63%	91%	100%
Secondary East	3%	3%	33%	57%	78%	100%
Secondary South	14%	18%	33%	60%	96%	100%
Secondary South West	34%	46%	91%	100%	100%	100%
Secondary West	1%	1%	3%	48%	85%	100%
Trade Area	14%	20%	44%	71%	93%	100%

Source: Urbis, SAFi, DPLH

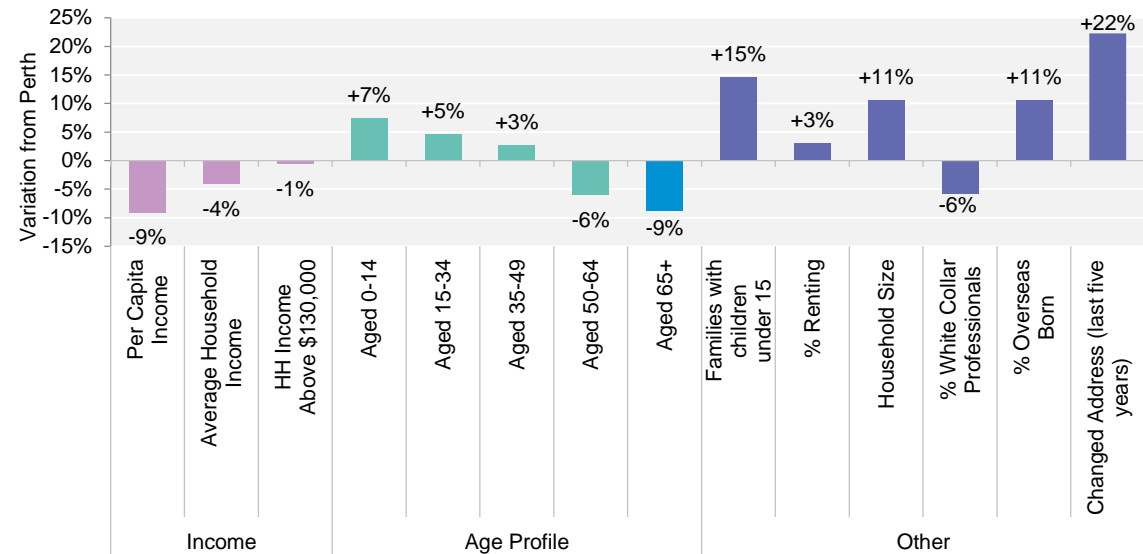
2.2 RESIDENT CHARACTERISTICS

DEMOGRAPHIC & SOCIO-ECONOMIC CHARACTERISTICS

KEY FINDINGS

- As an indicator of likely future spending rates in the trade area, the analysis has considered the demographic profile of areas supporting significant greenfield development.
- The North-West Sub-Region is characterised as an emerging growth area with an above average proportion of families with young children (+15% points above Perth). The average household income is 4% below the Perth average. However, incomes tend to be higher and above the Perth average in areas west of Marmion Avenue and near the coastline.

DEMOGRAPHIC & SOCIO-ECONOMIC CHARACTERISTICS, NORTH-WEST SUB-REGION, 2016



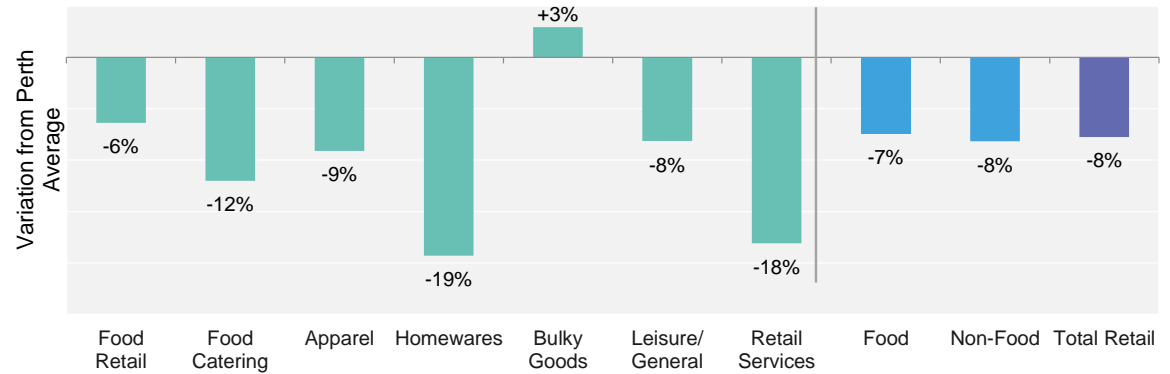
Source: ABS; Urbis

SPENDING CHARACTERISTICS

KEY FINDINGS

- A review of MarketInfo expenditure profiles for the sub-region revealed that future spending rates are likely to be moderately lower than the Perth average, especially for more discretionary spending such as food catering (i.e. cafes, restaurants) and homewares.
- As the catchment establishes over the coming decades, expenditure patterns are expected to change somewhat to reflect a more diverse demographic and likely translate into a greater portion of spending on discretionary items.

SPENDING CHARACTERISTICS, NORTH-WEST SUB-REGION, 2016



Source: ABS; MarketInfo; Urbis

SECTION THREE

CENTRE MIX AND SCALE CONSIDERATIONS

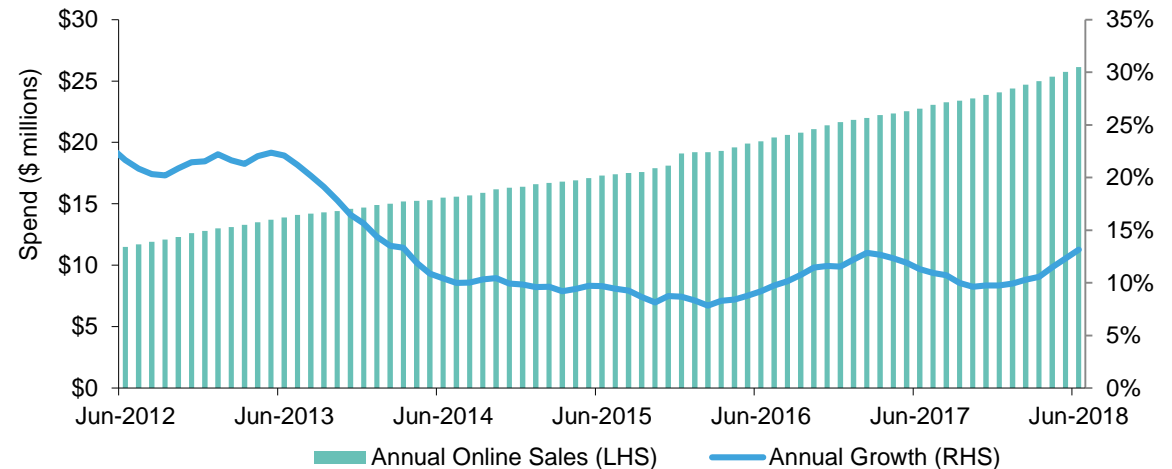
3.1 CENTRE TRENDS

ONLINE SHOPPING

KEY FINDINGS

- Online retail is becoming more convenient and ubiquitous through streamlining of browsing, transaction and fulfilment aspects. This, along with the growth in mobile platforms, will mean that online retail becomes increasingly ubiquitous, allowing customers to shop 'anytime, anywhere'.
- With online retail channels offering more seamless transactions and more convenient fulfilment, physical retail will offer more in terms of in-store experience, and customer service to create a point of difference, or complimentary experience. Stores will become more like experiences, allowing customers to view and try products, and ask questions of staff.
- With the advancement of Internet-of-Things (IoT) technology, companies now have the opportunity to develop new business models by directly interacting with their customers through smart replenishment systems. Some manufacturers have developed subscription models whereby customers receive products in regular time intervals to lock in the customer relationship and thereby bypass retailers.
- Urbis estimates that over the last four years, online retail has shaved around 0.4% p.a. growth off bricks and mortar retailers (after adjusting for in-store fulfilments). The greatest impact of online continues to be for physical comparison goods such as Apparel (-1.4% p.a.), Leisure / General (-0.8% p.a.) and Homewares, including small electronics (-1.1% p.a.). The impact on product groups including Food Retail (-0.1% p.a.), Food Catering (-0.3% p.a.) and Retail Services (0%) has been much lower.
- Suburban district centres however are typically more immune to online shopping trends given a higher weighting of food and service categories.

ONLINE SPENDING, AUSTRALIA, 2012-18



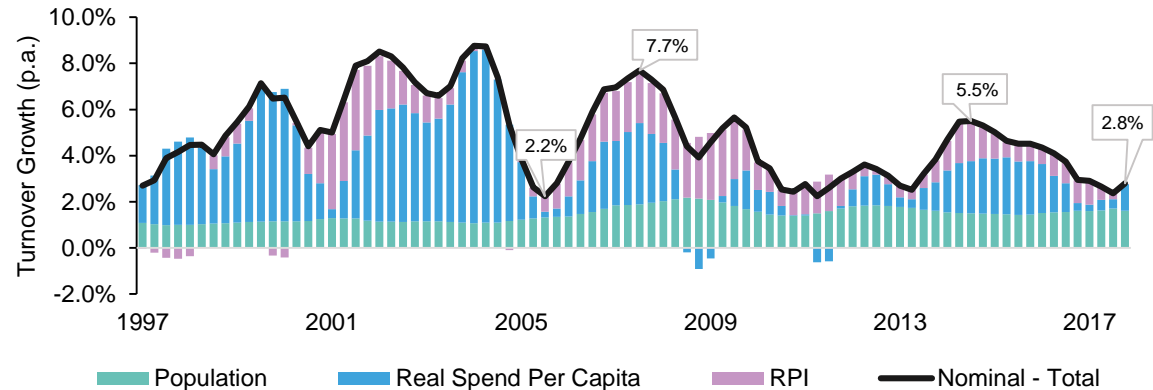
Source: Urbis, NAB

RETAIL SPENDING

KEY FINDINGS

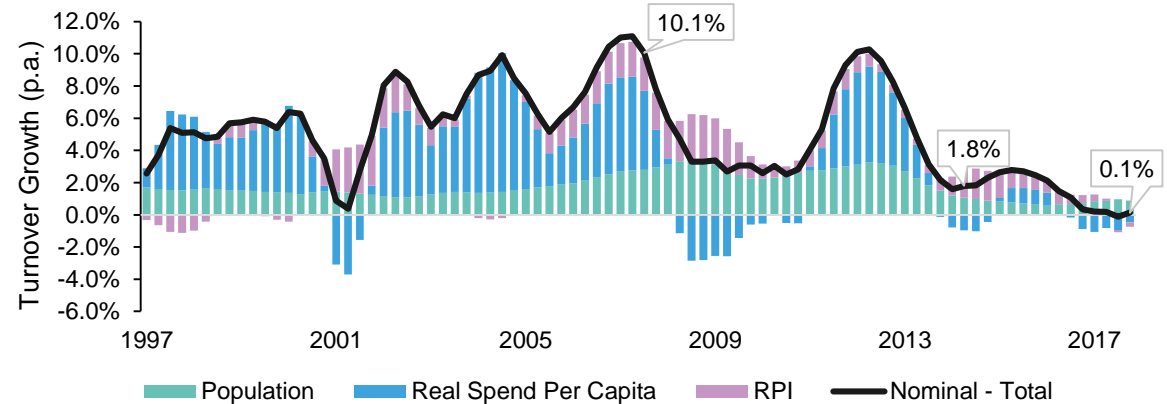
- Low wage growth, persistently high underemployment and changing work patterns are influencing retail expenditure growth trends across Australia.
- In Western Australia, low economic growth conditions translated into minimal retail turnover growth over the 2013 to 2018 period.
- Whilst retail growth conditions in Western Australia are expected to improve, sustained growth in excess of 6% per annum is not considered likely.
- For the Eglinton District Centre, population growth rather than increased household incomes will be the key driver of demand and the staging of the centre.

RETAIL TURNOVER GROWTH, AUSTRALIA, 1997-2018



Source: Urbis, ABS

RETAIL TURNOVER GROWTH, WESTERN AUSTRALIA, 1997-2018



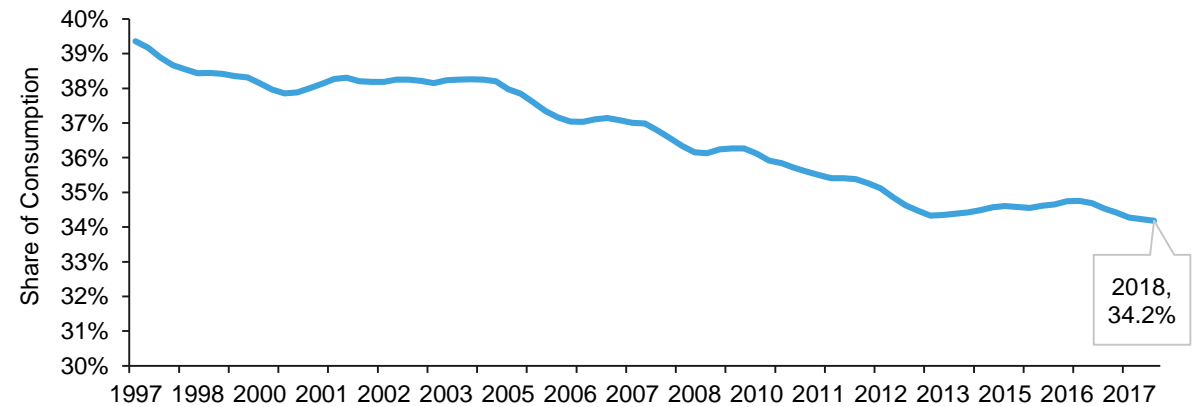
Source: Urbis, ABS

RETAIL SPENDING

KEY FINDINGS

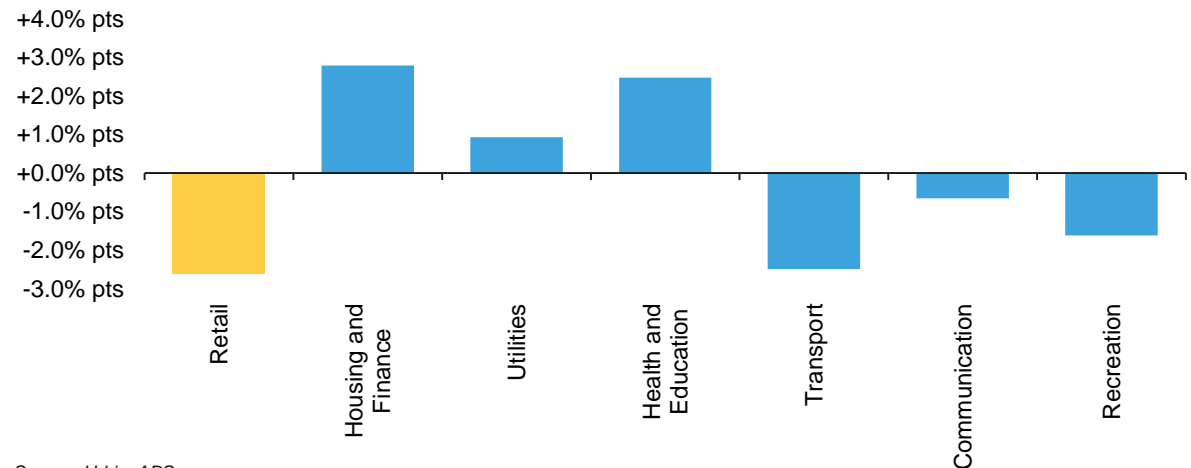
- Retail declined as a share of household consumption from approximately 40% to 34.2% as of 2018.
- Increased spending on non-retail categories, such as education, healthcare and utilities, is diverting household spending from retail goods. This is exacerbated by deflation in non-food retail goods, driven by increased trade and retail competition.
- As a result, centres are changing their tenancy mix and offering to cater to non-retail uses such as health and wellbeing and education uses.
- The ability for the Eglinton District Centre to cater for non-retail uses will however be challenged by its proximity to higher order centres such as Alkimos and Yanchep.

RETAIL SPENDING SHARE OF HOUSEHOLD CONSUMPTION, AUSTRALIA, 1997-2018



Source: Urbis, ABS

CHANGING SHARE OF HOUSEHOLD CONSUMPTION, AUSTRALIA, 2008-18



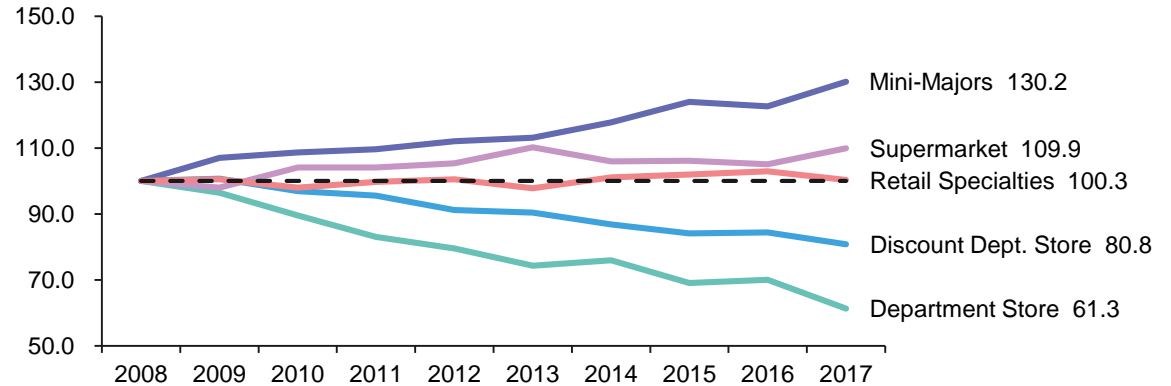
Source: Urbis, ABS

CENTRE COMPOSITION

KEY FINDINGS

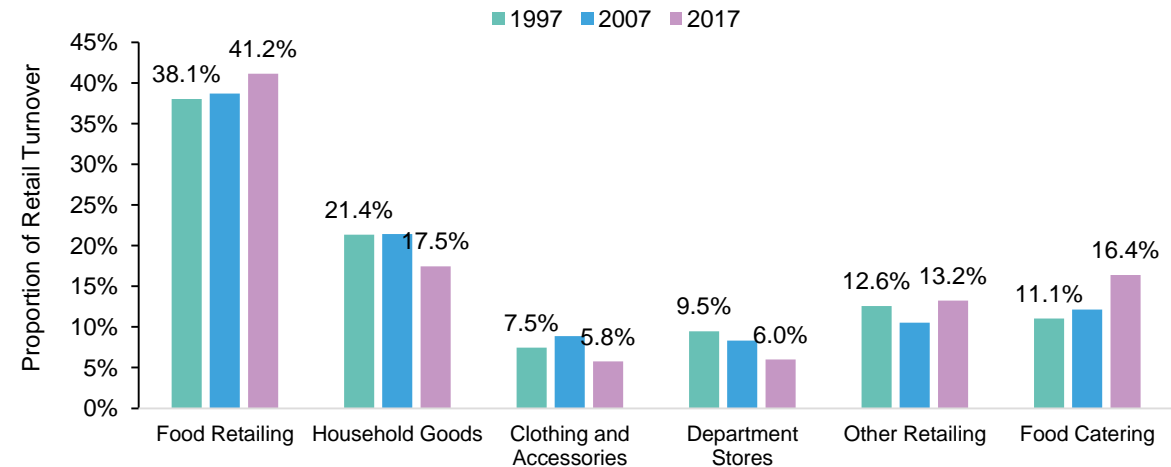
- The traditional expansion mix is changing. Food and beverage is becoming a much more significant aspect, especially food dining.
- Another significant growth area is health and wellness. The majority of centres surveyed by Urbis increased H&W over the past three years.
- Department stores (including discount department stores) have faced structural headwinds at a global level for some time, especially in the United States where department store closures have been significant in the last few years. In Australia, department store closures have been much more resilient to-date, with only limited impact from store closures and space handbacks. There is nonetheless a risk as to whether a DDS will be a viable use in new district centres.
- The Eglinton Activity Centre Plan should be flexible to enable other uses to be pursued if a DDS and associated retail floorspace is not considered viable in the future.

RETAIL TURNOVER BY STORE TYPE, AUSTRALIA, 2008-17



Source: Urbis

RETAIL TURNOVER SHARES BY CATEGORY, WESTERN AUSTRALIA



Source: Urbis, ABS

CENTRE COMPOSITION

KEY FINDINGS

- Centres are a rapidly evolving sector and key driver of this change is consumers – a consumer who, through the power of technology, has become far more discerning and value-conscious. Customer have expectations for immediacy but they are also have a greater emphasis on experiences.
- Responses to threats posed by online shopping and changing consumer patterns are shifting the focus of retail centres to mixed use centres, driven by a variety of uses and experiences, rather than narrow, purpose-driven shopping trips. Stores are becoming more like experiences and services and including new uses and services (e.g. household service bookings, co-working spaces, education and learning hubs and health and medical faculties).
- Out-of-centre retailers are adopting smaller floorplate and pop-up uses with large experiential offerings and fulfillment centres.
- Customers are demanding a seamless experience and self service options for 24/7 'just in time' consumption options. This will see the ongoing development of self service opportunities in stores, which may support longer retail hours due to reduced labour costs and the ongoing development of afterhours delivery platforms (e.g. after hours delivery services and/or drones).
- The ensure the success of the Eglinton District Centre, the regulatory framework should enable a mix of temporary uses and experiences.

EXAMPLES OF NEW CENTRE USES



3.2 DISTRICT CENTRE MIX & ROLE

INTENDED DISTRICT CENTRE ROLE

KEY FINDINGS

- This RSA has been informed by State Planning Policy 4.2 Activity Centres in Perth and Peel. Particular focus was afforded to the illustrated characteristics of centres within the hierarchy.
- The table to the right summarises the identified role, characteristics and targets for district centres in Perth and Peel.
- As per Section 2.1, the trade area of the Eglinton District Centre is expected to be within the mid-to-upper range identified by SPP 4.2 which notionally suggests that the district centre could support an above average provision of non-residential floorspace.

DISTRICT CENTRE FUNCTIONS, CHARACTERISTICS AND PERFORMANCE TARGETS

Typical Characteristic	Description
Main Role / Function	District centres have a greater focus on servicing the daily and weekly needs of residents. Their relatively smaller scale catchment (than higher order centres) enables them to have a greater local community focus and provide services, facilities and job opportunities that reflect the particular needs of their catchments.
Transport Connectivity and Accessibility	Focal point for bus network.
Typical Retail Types	<ul style="list-style-type: none"> • Discount department stores • Supermarkets • Convenience goods • Small scale comparison shopping • Personnel services • Some specialty shops
Typical Office Development	<ul style="list-style-type: none"> • District level office development • Local professional services
Future Indicative Service Population (Trade) Area	20,000 to 50,000 persons

Source: SPP 4.2

DISTRICT CENTRES IN PERTH

KEY FINDINGS

- The proposed scale and composition of commercial uses at the Eglinton District Centre was assessed in the context of evidence of the development within other district centres in Perth.
- For district centres with at least 3,000 sq.m of shop retail uses, the average provision of shop floorspace is around 12,000 sq.m. A further 10,000 sq.m is supported in other commercial floorspace.
- On average, district centres are situated 6.8 km from their closest strategic metropolitan centre, and 3.5 km from the closest secondary centre. There is little correlation between these distances and the amount of shop and other commercial floorspace supported in district centres.

FLOORSPACE DISTRIBUTION, DISTRICT CENTRES, PERTH



* Other Retail; Entert. / Rec / Cultural; Office / Business; Health / Welfare / Comm.; Service Industry
 Source : Urbis

DISTRICT CENTRES IN PERTH

KEY FINDINGS

- There are 12 established district centres serviced by a train station. These centres support an above average provision of commercial uses (+5,000 sq.m), although in terms of shop uses the train station has limited influence on the scale of floorspace supportable.
- Whilst this analysis suggests that the train station could enable an above average level of non-shop retail floorspace at the Eglinton District Centre, the higher order Alkimos and Yanchep centres are also expected to leverage their locations within train station precincts.

DISTRICT CENTRE ATTRIBUTES, PERTH, 2015

	Land Area (ha)	Shop Retail (sq. m)	Other Floorspace (sq. m)	Total Floorspace (sq. m)
>35,000 sq. m	23.7	16,600	22,420	39,020
25,000-35,000 sq. m	35.6	15,780	12,520	28,300
15,000-25,000 sq. m	13.3	12,250	7,500	19,750
<15,000 sq. m	7.0	8,760	4,100	12,860
All Centres	15.9	12,270	9,820	22,090
<i>With train station</i>	<i>23.5</i>	<i>10,960</i>	<i>15,110</i>	<i>26,070</i>
<i>With DDS</i>	<i>15.1</i>	<i>17,190</i>	<i>5,800</i>	<i>22,990</i>
<i>With >20,000 sq. m Shop Retail</i>	<i>22.3</i>	<i>24,630</i>	<i>6,840</i>	<i>31,470</i>

* Excludes proposed and emerging centres

Source: Urbis, DPLH

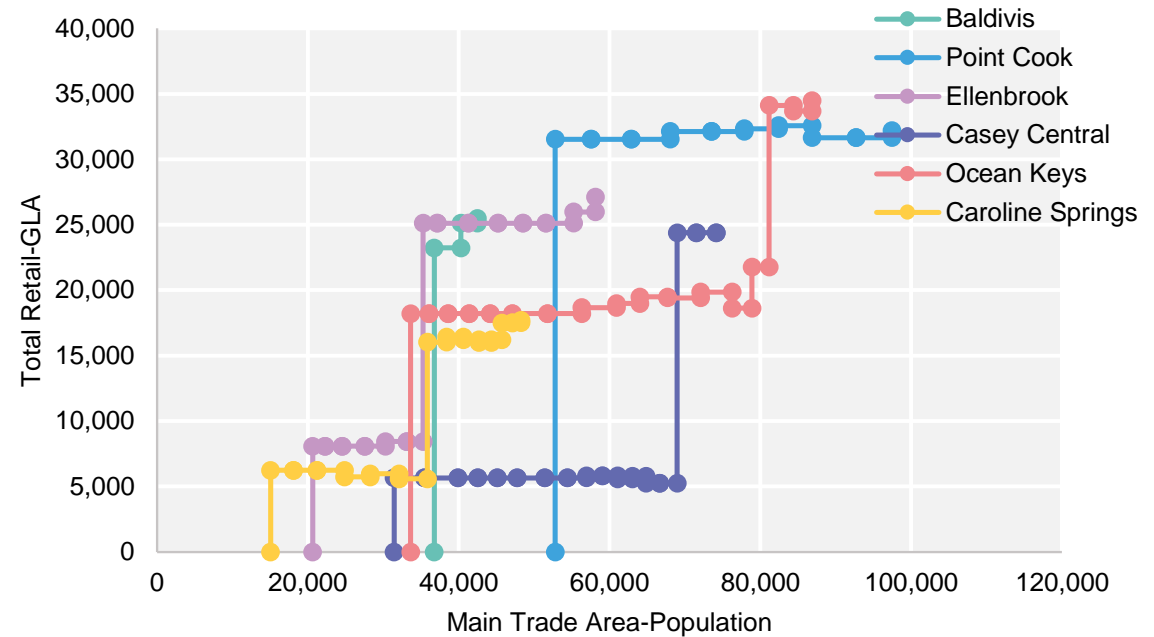
3.3 STAGING

DEVELOPMENT STAGING

KEY FINDINGS

- The chart adjacent outlines the development profile of select case study centres for the Eglinton District Centre. This analysis has informed the analysis of sustainable timing and scale of retail uses at Eglinton.
- It should be noted that the case studies refer to single entity properties and therefore exclude retail floorspace external to these centres within each activity centre.
- In general, the case study assessment identified that centres undertake an initial expansion to a convenience-based role with a supermarket offering and subsequently expand when the trade area population is approximately 40,000 residents.
- This suggests that a significant expansion of the Eglinton District Centre to its 'build out' level may not occur until at least 2035.

CENTRE EXPANSION CASE STUDIES



Source : Urbis

SECTION FOUR

DEVELOPMENT

POTENTIAL

4.1 FLOORSPACE POTENTIAL

TRADE AREA SPENDING PROJECTIONS

KEY FINDINGS

- The retail spending market has been estimated using MarketInfo, a micro-simulation model developed by MDS Market Data Systems Pty Ltd. Growth rates are based on historical trends and our expectation of spending patterns over the medium to long term based on the retail trends review undertaken in Section 3.
- By 2040, trade area retail expenditure is forecast to reach \$729 million. The food retail category is forecast to account for 44% of this retail expenditure, which will be a key segment for supermarkets and other food retail tenants at the Eglinton District Centre.
- The following sections explore the potential for the Eglinton activity centre to capture the trade area expenditure. These assessments are based on market share projections which reflect the level of competition expected in the trade area and wider corridor.

RETAIL SPENDING PROJECTIONS, TRADE AREA (\$ MILLIONS)

	Food Retail	Food Catering	Apparel	Home-ware	Leisure/General	Retail Services	Total Retail	Annual Growth	=	Pop Growth	+ Per Cap Spend Growth
2018	36	8	7	5	9	2	77				
2020	52	12	10	7	13	4	111	20.5%		18.7%	0.6%
2025	120	29	24	16	31	8	260	18.6%		16.9%	1.0%
2030	202	52	41	29	54	15	447	11.4%		9.8%	1.0%
2035	282	76	59	42	77	21	634	7.3%		5.8%	1.0%
2040	318	91	68	49	90	24	729	2.8%		1.4%	1.0%

Source: ABS; MarketInfo; Urbis

DISCOUNT DEPARTMENT STORE (DDS) CAPACITY

KEY FINDINGS

- By 2040 the North West Sub-Region is forecast to support some \$125 million in DDS turnover (excluding inflation).
- The forecast allows for future demand by trade area residents, as well as some additional business from outside the trade area.
- The expected DDS turnover could support between 5-6 stores by 2040.
- A DDS is unlikely to be considered for the Eglinton site until at least 2035. After this year, the store will also likely face considerable competition from DDSs at other locations (Alkimos, Yanchep) which could influence its turnover potential and the prospects of securing an operator for the site.

DDS CAPACITY ASSESSMENT, NORTH-WEST SUB-REGION

	Unit	2020	2025	2030	2035	2040
Population	No.	58,600	93,700	131,800	170,600	208,800
DSTM* Spending	\$M	309.8	530.8	799.0	1,105.4	1,441.8
DDS Share of DSTM	%	13%	13%	13%	13%	12%
	\$M	41.7	64.5	87.8	109.8	129.4
<u>NW Sub-Region</u>						
Share of Total DDS Spending	%	80%	80%	80%	80%	80%
	\$M	33.3	51.6	70.2	87.8	103.5
Allowance for Turnover from Beyond TA	%	10%	10%	10%	10%	10%
	\$M	3.7	5.7	7.8	9.8	11.5
Allowance for Turnover from non-DSTM categories	%	8%	8%	8%	8%	8%
	\$M	3.2	5.0	6.8	8.5	10.0
Total DDS Turnover	\$M	40.3	62.3	84.8	106.1	125.0
Total DDS Turnover (inflated)	\$M	40.7	64.5	90.0	115.4	139.5
<u>Supportable Floorspace</u>						
Supportable Avg. Trading Rate**	\$ psq.m	3,131	3,210	3,291	3,374	3,460
Supportable Floorspace	sq.m	12,855	19,417	25,768	31,432	36,145
<u>Supportable Stores</u>						
@ 6,500 sq.m per store	no.	2.0	3.0	4.0	4.8	5.6
<u>Supportable Floorspace - TA</u>						
Share of NW Sub-Region	%	9%	13%	17%	18%	17%
Share of NW Sub-Region	sq.m	1,180	2,595	4,268	5,643	6,043

* Department Store Type Merchandise

Source : Urbis

SUPERMARKET CAPACITY

KEY FINDINGS

- The table adjacent outlines a supermarket capacity assessment for the trade area.
- Based on the overall trade area capacity, the Eglinton District Centre could comfortably support a full-line supermarket (e.g. Coles / Woolworths of approximately 4,000 sq.m) and a smaller format supermarket (e.g. Aldi 1,600 sq.m) by around 2024.
- By 2030, a second full line supermarket could be sustained.
- This assessment is based on our current understanding of the competing locations of other full-line supermarkets in the trade area.

SUPERMARKET CAPACITY ASSESSMENT, TRADE AREA

	Unit	2020	2025	2030	2035	2040
Population	No.	8,540	18,600	29,710	39,310	42,130
F&G* Spending	\$M	45.1	104.1	175.9	245.4	277.2
Supermarket Share of F&G	%	75%	75%	75%	75%	75%
	\$M	33.9	78.1	131.9	184.0	207.9
<u>Eglinton Trade Area</u>						
TA Share of	%	59%	62%	64%	64%	65%
Supermarket Spending	\$M	20.1	48.0	84.2	117.6	134.1
Allowance for Turnover	%	10%	10%	10%	10%	10%
from Beyond TA	\$M	2.2	5.3	9.4	13.1	14.9
Allowance for Turnover	%	5%	5%	5%	5%	5%
from non-F&G categories	\$M	1.2	2.8	4.9	6.9	7.8
Total Supermarket Turnover	\$M	23.5	56.2	98.4	137.6	156.8
Total Supermarket Turnover (inflated)	\$M	24.2	62.4	117.7	177.2	217.6
<u>Supportable Floorspace</u>						
Supportable Avg. Trading Rate**	\$ psq.m	10,605	10,873	11,148	11,429	11,718
Supportable Floorspace	sq.m	2,218	5,169	8,830	12,038	13,385

* Food and Grocery

** Constant dollars

Source : Urbis

FLOORSPACE RECOMMENDATIONS

KEY FINDINGS

- The adjacent table outlines the recommended composition and timing for retail and other uses in the Eglinton District Centre.
- The analysis indicates that the Eglinton District Centre can sustain around 27,000 sq.m of shopping centre floorspace when the trade area population capacity is reached. This floorspace would be based around one DDS and three supermarket anchors.
- A further 29,000 sq.m could be sustained in bulky goods and other non-retail uses.
- Total community, commercial and retail floorspace amounts to around 55,000 sq.m.

SUPPORTABLE FLOORSPACE AND STAGING, EGLINTON DISTRICT CENTRE

<u>Retail Uses</u>	2025	2030	2035	2040
DDS	0	0	5,000	5,000
Supermarket	<u>5,600</u>	<u>9,600</u>	<u>9,600</u>	<u>9,600</u>
- Coles / Woolworths	4,000	8,000	8,000	8,000
- Aldi	1,600	1,600	1,600	1,600
Mini Majors	500	1,000	2,000	2,000
Specialty Shops	3,000	4,000	7,000	7,000
External	<u>1,500</u>	<u>2,500</u>	<u>3,000</u>	<u>3,500</u>
Total Retail	10,600	17,100	26,600	27,100
<u>Other Uses</u>				
Bulky Goods	<u>2,700</u>	<u>4,600</u>	<u>6,200</u>	<u>8,000</u>
- Hardware	1,300	2,200	3,000	3,900
- Furniture	400	700	900	1,200
- Automotive Accessories	400	700	900	1,200
- Other	600	1,000	1,400	1,700
Non-Retail	<u>6,900</u>	<u>11,400</u>	<u>15,900</u>	<u>20,000</u>
- Church / Community Uses	900	1,500	2,100	2,600
- Libraries	300	600	800	1,000
- Pub / Tavern	300	600	800	1,000
- Sporting Facilities	600	900	1,300	1,700
- Medical Centre	800	1,300	1,800	2,200
- Gyms	900	1,400	2,000	2,500
- Cinemas / Other Entertainment	300	600	800	1,000
- Child Care	400	700	1,000	1,300
- Motor Vehicle Services	400	600	800	1,000
- Real Estate / Finance / Insurance :	900	1,400	2,000	2,500
- Retail / Trade Services	1,000	1,700	2,300	3,000
- Travel Agency	<u>100</u>	<u>100</u>	<u>200</u>	<u>200</u>
Total Other	9,600	16,000	22,100	28,000
Total Activity Centre	20,200	33,100	48,700	55,100

Source : Urbis

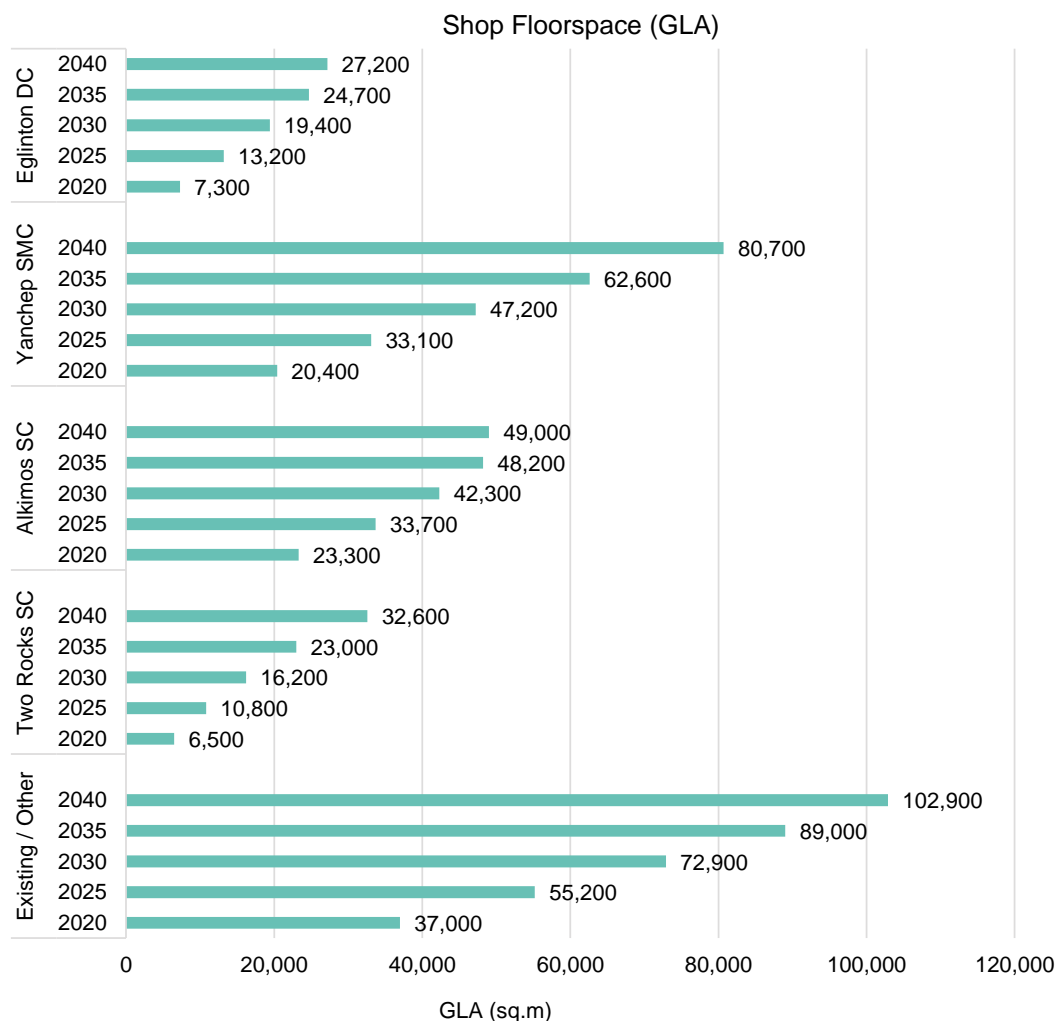
4.2 RETAIL SUSTAINABILITY ASSESSMENT

CENTRE HIERARCHY CONSIDERATIONS

KEY FINDINGS

- In line with SPP 4.2, this RSA assessed the potential loss of services in the wider area. In order to ensure there was no potential loss of services and the identified centre hierarchy was not undermined, the proposed development staging and timing of the Eglinton District Centre was assessed in the context of the balance of demand available to other activity centres in the region.
- In other words, the methodology explicitly explored retail demand across the wider region and adopted market shares for the Eglinton activity centre which are premised on future retail growth being achieved in other existing and planned centres.
- This analysis shows the following.
 - Alkimos can achieve a sizeable first stage development within the 2020-2025 period, including several supermarkets and at least one DDS.
 - The progressive development of Yanchep SMC would also not be affected by the Eglinton development. Within the period to 2040 the centre could include 80,000 sq.m of shop floorspace.
 - The inclusion of two major supermarkets and an Aldi-sized store at Eglinton, whilst also including an appropriate allocation of demand to Alkimos and Yanchep, around 4,000 sq.m of supermarket floorspace could be supported elsewhere in the Eglinton trade area.
- A turnover impact assessment was not undertaken given the early stage of development of competitive centres and given this assessment does not propose any changes that would undermine the planned / existing hierarchy. Further, a retail impact assessment is not a requirement of an RSA as per SPP 4.2.

SHOP FLOORSPACE PROJECTIONS BY CENTRE



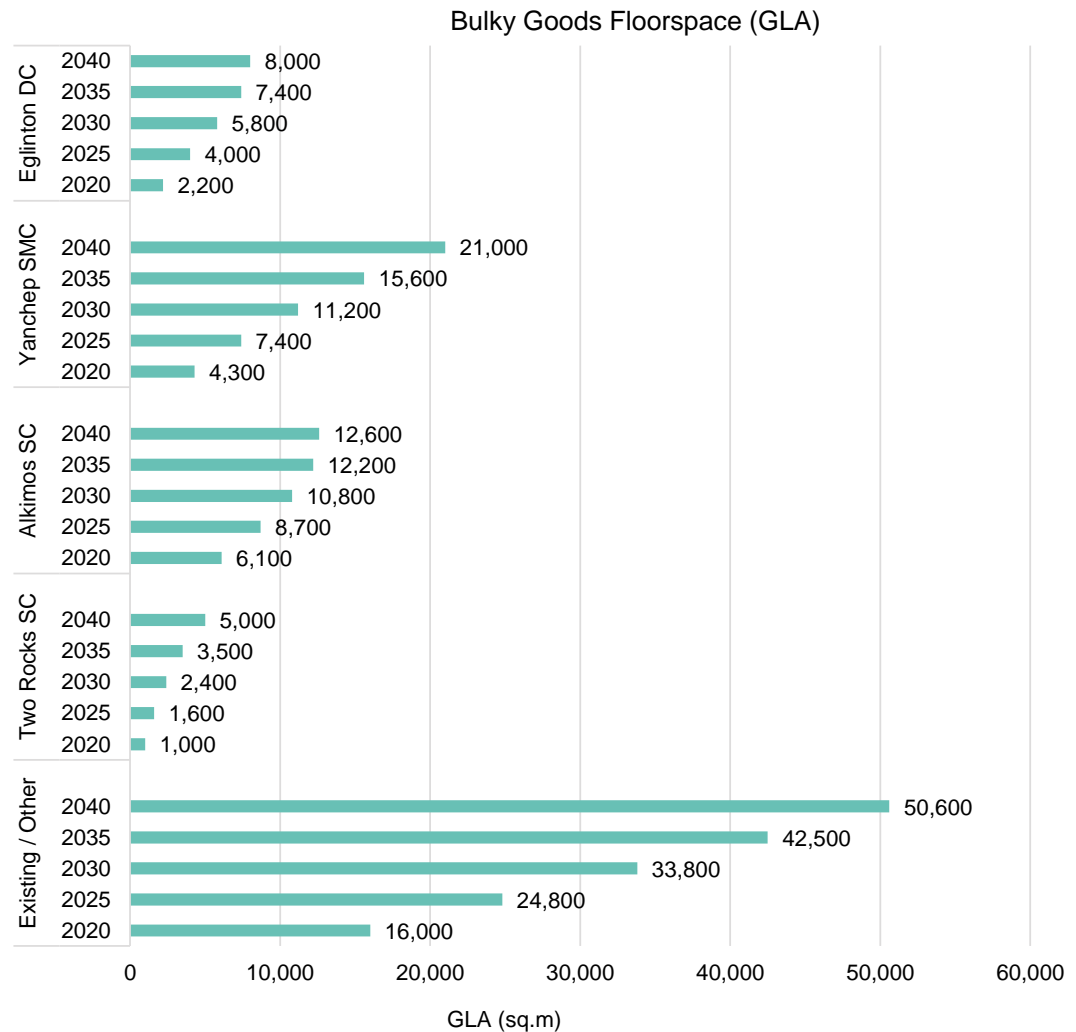
Source : Urbis

CENTRE HIERARCHY CONSIDERATIONS

KEY FINDINGS

- The analysis indicates there is limited potential for bulky goods floorspace within the Eglinton District Centre
- As per typical location / development trends across Perth, the majority of this type of use is provided outside of activity centres (i.e. more than 70%). Within the region, close to half of the future bulky goods floorspace demand has been allocated to SMCs, Secondary Centres and District Centres.
- Of the bulky goods demand allocated to activity centres, the majority would be captured by Yanchep and Alkimos. Again the higher order role of these centres is supported in the context of the allocation of bulky goods floorspace demand to Eglinton.

BULKY GOODS FLOORSPACE PROJECTIONS BY CENTRE

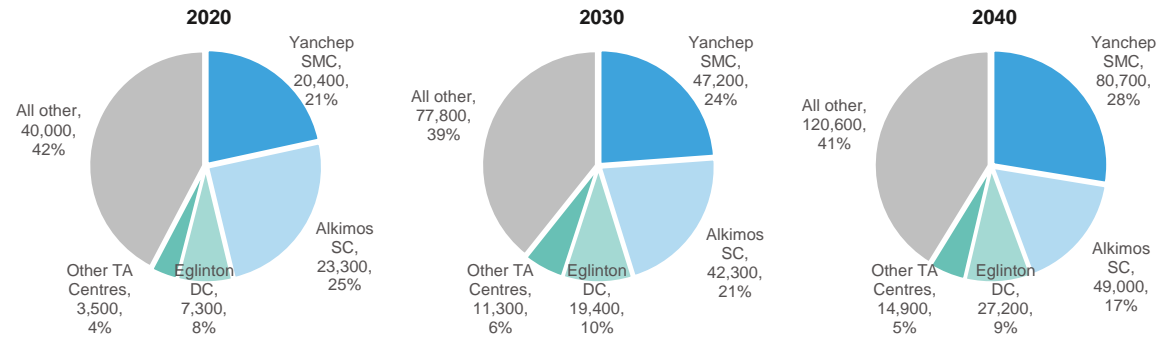


CENTRE HIERARCHY CONSIDERATIONS

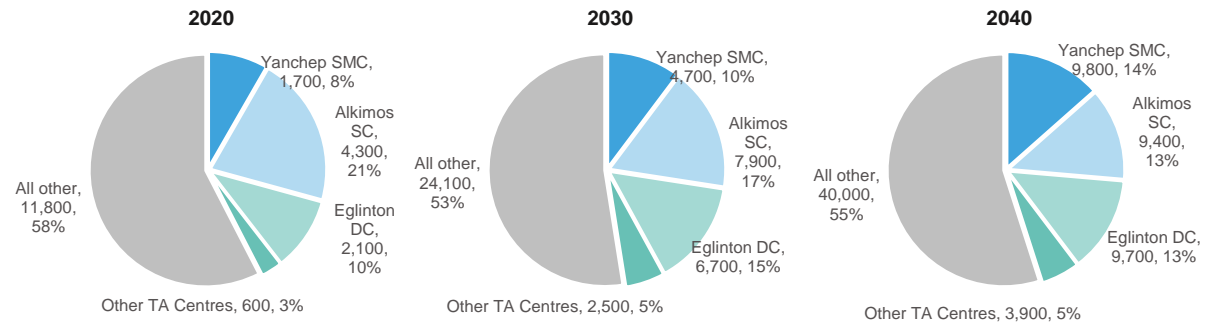
KEY FINDINGS

- The allocation of shop and bulky floorspace to key locations, including other centres in the trade area, is shown in the charts to the right.
- In 2040, the Eglinton District Centre could accommodate around 9% of the total shop floorspace requirement of the North West Sub-Region. A further 5% of floorspace could be supported in other designated smaller centres within the Eglinton trade area.
- The Eglinton District Centre could include approximately 13% of the region's supermarket floorspace. Around 3,900 sq.m would be available for development elsewhere in the trade area.

ALLOCATION OF SHOP RETAIL FLOORSPACE BY CENTRE



ALLOCATION OF SUPERMARKET FLOORSPACE DEMAND BY CENTRE



APPENDIX

CENTRE ROLES AND FLOORSPACE MIX IN PERTH

SUMMARY OF AVERAGE FLOORSPACE MIX BY CENTRE DESIGNATION, PERTH, 2015

	Strategic Metropolitan Centres			Secondary Centres			District Centres			Other Locations
No. Centres	10			19			48			
Indicative trade area population	150,000-300,000			up to 150,000			20,000-50,000			
<u>Typical Uses</u>										
Type	• Full range of economic and community services			• Essential services to their catchment			• Services and facilities with a local community focus			
Office	• Major offices, state government agencies			• Major offices, professional and service businesses			• District level office development, local professional services			
Retail	• Department store/s, DDSs, supermarkets, full range of speciality shops			• Department store/s, DDSs, supermarkets, speciality shops			• DDSs, supermarkets, convenience goods, small scale comparison shopping, personal services, some specialty shops			
<u>Commercial Floorspace*</u>	<u>Average</u>	<u>% Perth**</u>	<u>Max</u>	<u>Average</u>	<u>% Perth**</u>	<u>Max</u>	<u>Average</u>	<u>% Perth**</u>	<u>Max</u>	<u>% Perth**</u>
Shop / Retail	71,300	17%	98,700	35,100	16%	55,700	11,700	17%	29,400	50%
Other Retail	12,100	8%	30,600	6,800	8%	31,900	1,000	4%	15,400	80%
Entert. / Rec / Cultural	21,300	9%	55,300	7,500	6%	14,800	2,100	5%	9,400	80%
Office / Business	39,400	6%	61,600	21,900	5%	130,100	5,400	4%	24,200	85%
Health / Welfare / Comm.	40,900	5%	225,400	5,500	1%	19,000	800	1%	5,100	93%
Service Industry	<u>6,400</u>	<u>2%</u>	<u>23,900</u>	<u>2,500</u>	<u>1%</u>	<u>9,400</u>	<u>1,000</u>	<u>2%</u>	13,100	<u>95%</u>
Total Commercial	191,400	7%	495,500	79,300	6%	260,900	22,000	5%		82%
<u>Outer Suburban</u>										
Shop / Retail	64,200	22%	98,600	27,600	19%	44,300	15,700	19%	29,400	40%
Other Retail	4,800	5%	7,500	7,400	14%	31,900	1,000	7%	15,400	75%
Other	<u>158,000</u>	<u>26%</u>	<u>342,800</u>	<u>22,100</u>	<u>7%</u>	<u>41,300</u>	<u>5,200</u>	<u>4%</u>	13,000	<u>63%</u>
Total Commercial	227,000	23%	448,900	57,100	11%	117,500	21,900	9%		57%

* Excludes proposed and emerging centres

** Excludes CBD

Source : PLUS, Urbis

DISTRICT CENTRE CASE STUDIES

BALDIVIS



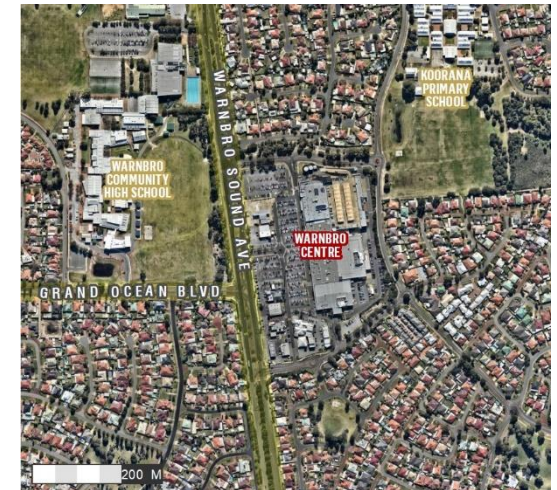
	LUES Year			% Total (2017)
	2002	2008	2017	
Baldivis				
Population (MTA)	8,000	16,000	42,000	
Population (TTA)	60,000	85,000	133,000	
PLUC Category Floorspace:				
Shop / Retail	0	6,600	29,400	63%
Other Retail	100	200	3,800	8%
Entert / Rec / Cultral	0	0	4,400	9%
Office / Business	0	1,800	5,800	12%
Health / Welfare / Comm.	400	400	900	2%
Services	0	100	1,400	3%
Other	0	200	1,000	2%
Total	500	9,300	46,600	100%

CURRAMBINE



	LUES Year			% Total (2017)
	2002	2008	2017	
Currumbine				
Population (TTA)	33,000	36,000	40,000	
PLUC Category Floorspace:				
Shop / Retail	6,500	6,500	18,200	60%
Other Retail	0	300	200	1%
Entert / Rec / Cultral	3,100	1,500	6,300	21%
Office / Business	500	800	3,400	11%
Health / Welfare / Comm.	100	100	2,100	7%
Services	100	0	0	0%
Other	300	100	0	0%
Total	10,600	9,200	30,200	

WARNBRO



	LUES Year			% Total (2017)
	2002	2008	2017	
Warnbro				
Population (TTA)	54,000	71,000	103,000	
PLUC Category Floorspace:				
Shop / Retail	12,200	13,400	21,000	88%
Other Retail	600	500	700	3%
Entert / Rec / Cultral	0	0	600	3%
Office / Business	800	800	1,000	4%
Health / Welfare / Comm.	100	100	200	1%
Services	300	200	200	1%
Other	200	1,000	100	0%
Total	14,100	16,100	23,800	

This report is dated March 2019 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Pty Ltd's (Urbis) opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of Eglinton Estates (Instructing Party) for the purpose of a activity centre planning (Purpose) and not for any other purpose or use. Urbis expressly disclaims any liability to the Instructing Party who relies or purports to rely on this report for any purpose other than the Purpose and to any party other than the Instructing Party who relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

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Project code	PA1523
Report number	Draft v3

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APPENDIX B TRANSPORT ASSESSMENT

Eglinton Estates Pty Ltd
Eglinton Activity Centre Plan
Transport Assessment

262620-00

Issue | 26 March 2019

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 262620-00

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ARUP

Document Verification

ARUP

Job title		Eglinton Activity Centre Plan		Job number 262620-00	
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Revision	Date	Filename	181221 Eglinton ACP Transport Assessment_DRAFT.docx		
Draft 1	21 Dec 2018	Description	First draft		
			Prepared by	Checked by	Approved by
		Name			
		Signature			
Issue	4 Feb 2019	Filename	1810204 Eglinton ACP Transport Assessment final.DOCX		
		Description	Incorporates feedback received from the project team.		
			Prepared by	Checked by	Approved by
		Name	Danya Mullins	Ryan Falconer	Ryan Falconer
		Signature			
Revision 1	26 Mar 2019	Filename	190326 Eglinton ACP Transport Assessment final rev1		
		Description	Updated figure 2 and 13 with revised structure plan.		
			Prepared by	Checked by	Approved by
		Name	Stephen Loughnan	Danya Mullins	Danya Mullins
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document



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Appendices

Appendix A

MRWA Regional Operations Model volume plots 2021 and 2031

Appendix B

Trip Generation

Appendix C

Aimsun modelling outputs

Executive Summary

Arup was appointed by Eglinton Estates Pty Ltd as part of a multidisciplinary design team to prepare an activity centre plan for the proposed Eglinton Centre in the City of Wanneroo. Eglinton activity centre will be centred on the proposed Eglinton Station on the proposed rail extension from Butler to Yanchep. Arup has delivered transport planning advice which has culminated in the preparation of a Transport Assessment. This Transport Assessment has been prepared in line with the Western Australian Planning Commission's Guidelines for Transport Assessments and State Planning Policy 4.2 'Activity Centres for Perth and Peel'.

The planning framework for the development of the activity centre plan has been established through a number of planning documents including the North-West Sub-Regional Planning Framework (2018), Alkimos Eglinton District Structure Plan (2016) and the Eglinton Local Structure Plan No. 82 (2012).

The Eglinton Activity Centre is bounded by Marmion Avenue in the west, Pipidinny Road to the north, proposed Michell Freeway extension to the east and proposed Eglinton Drive to the south. The region is undergoing rapid change through greenfield development that is presently centred on Marmion Avenue and the coastline to the west. There are numerous major transport infrastructure developments planned to support the proposed development including the extension of the rail line to Yanchep (by 2021), duplication of Marmion Avenue to a four lane cross section and extension of the Mitchell Freeway from Hester Avenue to Yanchep Beach Road (by 2031). Eglinton Drive, to the south of the Eglinton Activity Centre will be an important east-west connection as it connects to the freeway via an interchange. At this time, Pipidinny Road will be severed to the west of the freeway.

Through consultation, Main Roads Western Australia has indicated a preference for all intersections of the centre with Marmion Avenue to be controlled by roundabouts. These roundabouts have a significant footprint as Marmion Avenue will be a four-lane divided road.

Eglinton Station will have a bus interchange, park and ride and kiss and ride facilities located on the western side of the station. A total of 400 park and ride bays are proposed but with long term plans for an additional 600 bays. The timeframe for the expansion is not confirmed. The design of the station, bus station and parking facilities are not yet complete.

Eglinton Drive and Carphin Drive (the activity centre's main street), will have grade separated crossings with the rail line.

The centre is proposed to comprise 55,000sqm of community, commercial and retail floor space at full build out. The development is planned to be staged with Stage 1 expected to take place around year 2025 and full build out reached by 2040.

Arup has undertaken modelling using the software platform Aimsun. The purpose of the modelling was to identify peak hour and daily forecast volumes for the

proposed activity centre road network/ Eglinton Drive and Marmion Avenue and to understand resultant levels of service of key intersections and road midblocks.

While stage 1 and ultimate development is not expected to occur until year 2025 and 2040 respectively, in order to be consistent with metropolitan-wide strategic modelling, stage 1 development traffic was assumed at year 2021 and ultimate at year 2031.

A key input to the model was volume plots and sub areas matrices from the MRWA Regional Operations Model (ROM). The ROM forecast traffic volumes for Marmion Avenue and Eglinton Drive formed the cordon for the model. Both AM and PM peak hours were assessed for a typical weekday.

Key results from the modelling are as follows:

- The internal and external network at years 2021 are forecast to operate well within capacity however, the intersections on Marmion Avenue are showing early signs of capacity issues
- Traffic volumes along Eglinton Drive will require it to be duplicated between the freeway interchange and Marmion Avenue
- The three roundabouts on Marmion Avenue to the west of Eglinton Activity Centre are operating at capacity and will experience significant congestion and delay on all approaches at year 2031. There will be limited gaps in the traffic stream on Marmion Avenue (due to the absence of signalised intersections) for traffic on side streets at roundabout-controlled intersections to access Marmion Avenue. Testing of the intersections operating under signal control (instead of roundabout control) was undertaken and led to increased delays to movements on Marmion Avenue however reduced delays to traffic on side street approaches to Marmion Avenue
- Forecast traffic volumes on Marmion Avenue at year 2031 are extremely high as aligned with ROM24 and two lanes in each direction is insufficient for the forecast volumes. The proposed volumes would require a six lane cross section. Arup is unaware of any plans for a six lane cross section on Marmion Avenue in the current planning outlook
- Pipidiny Road east of Marmion Avenue is likely to require turning pockets to access the District Centre at two key locations (providing access to Eglinton Station)
- The roundabout on Eglinton Drive at the proposed Neighbourhood Connector (east of the railway line) is likely to operate at capacity. Again volumes on Eglinton Drive within the ROM24 model at year 2031 are significantly higher than those identified under the DSP and therefore it is recommended that the ROM is reviewed before making recommendations on any need for further capacity enhancement and/ or appropriateness of a roundabout in this location
- The possible expansion of PnR bays from 400 to 1,000 bays will exacerbate issues on the external road network. Further examination is needed in partnership with the PTA in order to best locate these additional bays so that they result in volumes that are commensurate with the street classification

within the centre. PTA's plans were still being developed at the time of preparation of this Transport Assessment.

The modelling for Eglinton has built in a number of conservatisms which means that the internal link volumes depicted in the Aimsun modelling are considered to be worst-case. These conservatisms are namely:

- 20% contingency factor on the trip generation to allow for flexibility in land use planning
- Expected stage 1 build out at year 2025 has been applied to the 2021 network
- Expected ultimate build out at year 2035-2040 has been applied to the 2031 network
- The road network depicted in the model is coarse and there will be a series of secondary streets within the centre that means that traffic volumes will be distributed over a finer-grained network.

Importantly the volumes on the external network as forecast within the MRWA ROM 24 model, as an input to this modelling, are escalated for Eglinton Drive and Marmion Avenue and have highlighted strategic capacity issues. This is not an issue for the proponents of the activity to solve.

It is recommended that MRWA (in consultation with the City of Wanneroo) undertake a review of the ROM model in this region to better understand the volumes, function and form of this part of the network. This may include a need for DPLH to review the demographic forecasts for the corridor, which are an input to the ROM model.

Planning for Eglinton Station including the PnR bays in terms of their location and access arrangements are being refined. It is recommended that this planning sees sufficient distribution of bays and resultant link volumes that are in line with the planned street classification.

Subsequent detailed planning of the centre will establish further details for the movement network including street cross sections, pedestrian crossings, access and layout of off street car parking, provisions for on street parking and service vehicle access. It is recommended that a parking and servicing strategy is developed through detailed design.

Glossary

The following terms and acronyms are used throughout this report:

CoW	City of Wanneroo
DPLH	Department of Planning, Lands and Heritage
DSP	Alkimos Eglinton District Structure Plan
KnR	Kiss and ride bays
LSP	Eglinton Local Structure Plan
MRWA	Main Roads Western Australia
PnR	Park and ride bays
ROM	MRWA Regional Operations Model
WAPC	Western Australian Planning Commission

1 Introduction

Arup was appointed as part of a multidisciplinary design team to prepare an activity centre structure plan for Eglinton. Eglinton activity centre will be centred on the proposed Eglinton Station on the proposed rail extension from Butler to Yanchep. Arup has prepared this Transport Assessment for the activity centre in line with the Western Australian Planning Commission's (WAPC's) Guidelines for Transport Assessments and State Planning Policy 4.2 'Activity Centres for Perth and Peel'.

The scope of the Transport Assessment has included consultation with relevant planning authorities regarding the timing and function of planned transport infrastructure, preparation of a mesoscopic model (Aimsun) and input to the proposed movement network design throughout the centre.

1.1 Project overview

The planning of the Alkimos- Eglinton region has been espoused in the approved Alkimos Eglinton District Structure Plan (2016) and Eglinton Local Structure Plan No. 82 (2012). These documents set the framework for regional transport infrastructure including the freeway extension and upgrades to Marmion Avenue. The Eglinton Activity Centre is bounded by Marmion Avenue in the west, Pipidiny Road to the north, proposed Mitchell Freeway extension to the east and proposed Eglinton Drive to the south. The activity centre is shown in Figure 1.

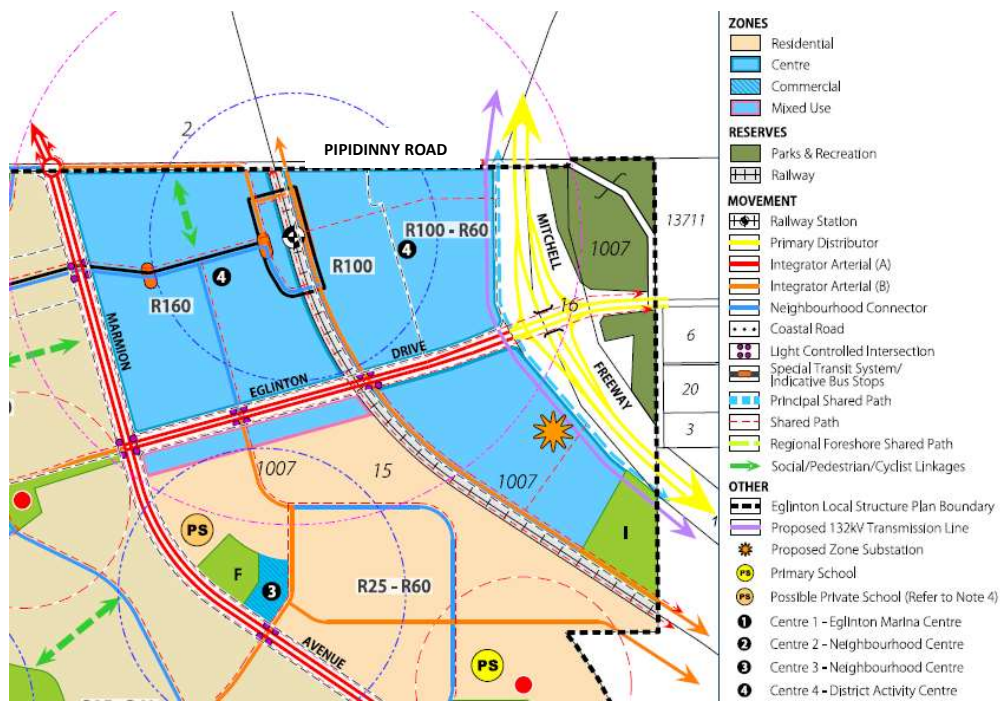


Figure 1 Eglinton Activity Centre (Source: Eglinton Local Structure Plan No. 82, Nov 2012)

The site is undeveloped and the extension of the metropolitan rail network, planned to be operational in late 2021, will transform the area. The site is undulating with very steep pockets in some locations. The proposed structure plan layout has responded to this topography as well as integrating with the planned regional transport infrastructure.

Consultation with Main Roads Western Australia (MRWA) has identified that planning and design is underway for the extension of the Mitchell Freeway from Hester Avenue to Yanchep Beach Road. This extension will be operational by year 2031. Significantly for the Eglinton Activity Centre, Eglinton Drive (the southern boundary of the centre) is planned to connect to the freeway at a full interchange. Pipidiny Road will be severed by the freeway and the primary east-west connection in the area will be via Eglinton Drive.

Eglinton Station is planned as one of three new rail stations on the rail extension of the line to Yanchep. The station will be an unstaffed station with initial

provision of 400 park and ride (PnR) bays with a possible long term expansion to 1,000 bays. The station will also have a kiss and ride (KnR) area and bus interchange.

The transport principles adopted for the preparation of the activity centre plan are as follows:

- Consistency with the regional road network established under the District Structure Plan (DSP) and Local Structure Plan (LSP)
- Minimise access points to Marmion Avenue
- A staged development approach that responds to the timing of the planned external transport network upgrades and allows for the station to be accessed by bus and private vehicle
- Integrates development with surrounding development at Eglinton Hill (to the south) and Allara (to the north)
- Provides a network of streets that supports walking, cycling, public transport and private vehicle trips.

1.2 Proposed concept (ultimate)

The timing of full build out of the structure plan will be driven by market demand. The development of the station within the centre at 2021 will be an early impetus for development. The activity centre plan at full build out is shown in Figure 2.

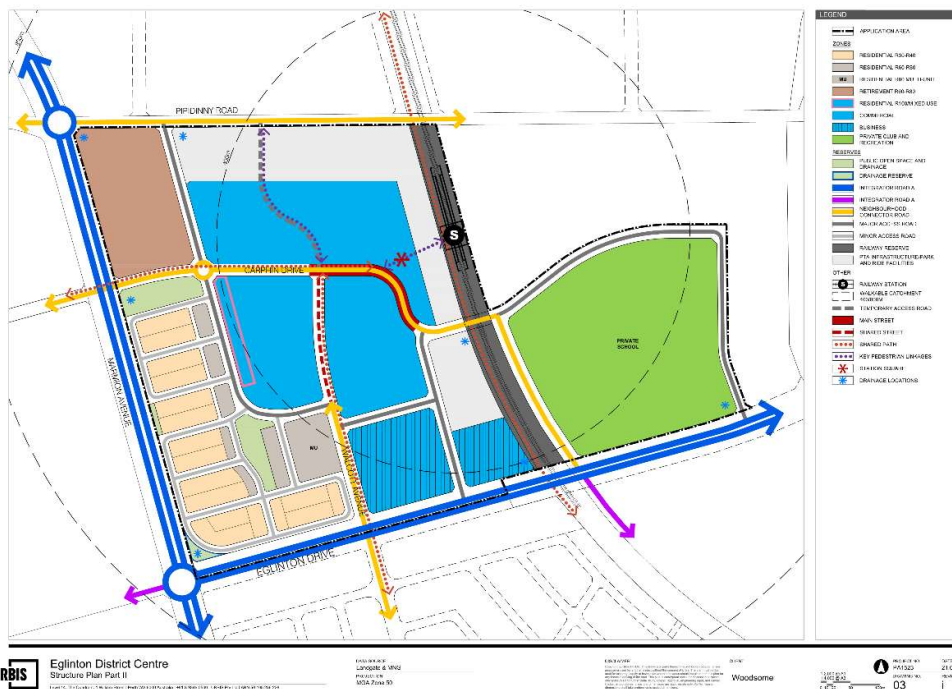


Figure 2 Eglinton Activity Centre (ultimate development)

The proposed land use yields at full build out are shown in Table 1. A further breakdown of the land use is provided in Section 4.

Table 1 Ultimate Development Yields

Use	2021	2031	Unit
Residential	50	589	Dwellings
Education	420	1,220	Students
Bulky goods	2,700	8,000	Square metres
Retail	10,600	27,000	Square metres
Non-retail	6,900	20,000	Square metres

While full build out is unlikely to occur prior to 2031, the following timeframes have been adopted for this assessment:

- Opening year: 2021
- Full build out (ultimate): 2031

The ultimate development is expected to occur around 2035 – 2040 and therefore the ultimate development scenario is considered to be conservative.

2 Policy and planning context

2.1 State policy and strategy

2.1.1 Perth and Peel@3.5million (2018)

Previous transport planning for the Perth and Peel regions has been guided by various strategic land use plans, including the ‘Stephenson-Hepburn Plan’, ‘Corridor Plan for Perth’, ‘Metroplan’, ‘Network City’ and ‘Directions 2031 and Beyond’.

In March 2018, the State Government released the final Perth and Peel@3.5million suite of documents and the supporting sub-regional planning framework documents. Following consultation responses, the framework plans are intended to define the urban form over the next 30 years allowing for a population of 3.5 million people in Perth and Peel nominally by 2050.

2.1.2 North-West Sub-Regional Planning Framework (2018)

The sub-regional planning framework, put together by the Department of Planning, Lands and Heritage (DPLH) and the Western Australian Planning Commission (WAPC) in 2018, intends to guide growth in the north-west sub-region by establishing an integrated planning framework for land use and infrastructure.

The framework notes that the region’s coastal lifestyle and relative affordability have resulted in it being one of the fastest growing areas in Australia over the past decade. This growth is expected to continue through to 2050, due to the significant supply of undeveloped Urban and Urban Deferred zoned land available. A key focus of the framework is encouraging higher densities in currently undeveloped lands zoned for urban use, which includes much of the land in Eglinton. In particular, such land located in close proximity to existing or future rail is identified as a priority for higher density.

Eglinton East is identified as a site with specific matters requiring further planning investigation as part of the strategic reconsideration of land use in the sub-region. These include:

- Employment – identification. Confirmation of land for employment-generating activities
- Land use transition/ interface with Parks and Recreation reserve and Bush Forever areas
- Proposed Whiteman – Yanchep Highway
- Access to regional road network
- Bushfire risk.

The framework proposes a high-frequency transit corridor Alkimos – Eglinton deviating along the coast to supplement the future rail line connecting the areas. This is shown in Figure 3.

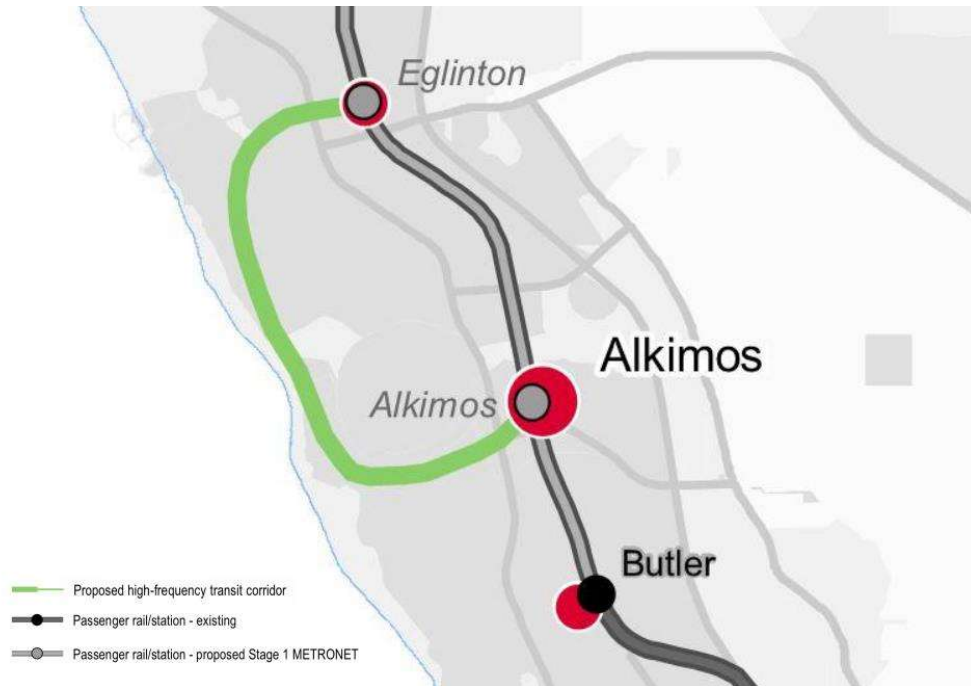


Figure 3 High-frequency Alkimos-Eglinton transit corridor

The framework proposes a new north-south primary distributor road connecting to Eglinton, called Whiteman Yanchep Highway. It is to connect the North-West sub-region to the North-East and Central sub-regions and broader regional road network in the medium term (2022-2031). This is shown in Figure 4. It also notes the Mitchell Freeway extension to Alkimos/ Eglinton is proposed for the medium term.

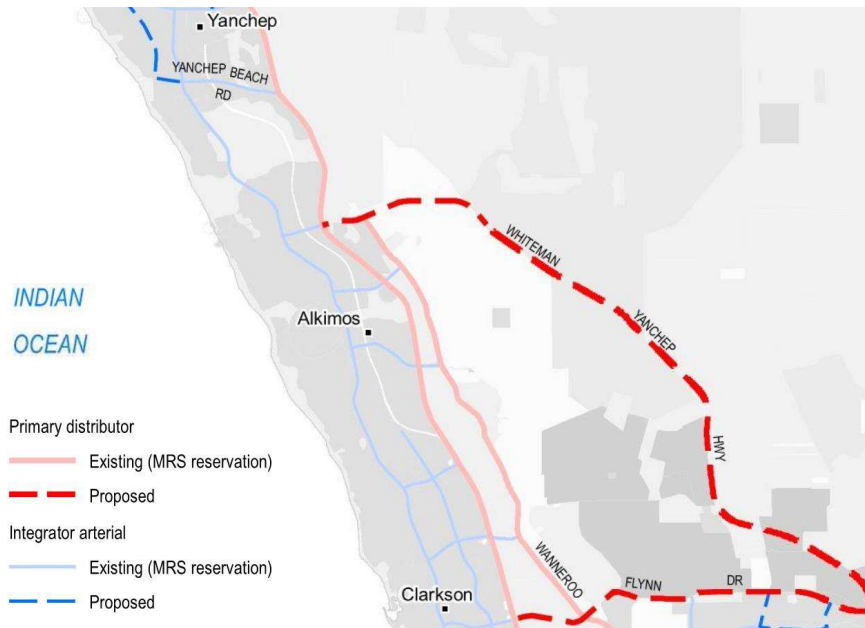


Figure 4 Proposed Whiteman Yanchep Highway

Principal shared paths are noted as being required to run along major transportation reserves in the sub-region, with more detailed arrangements for active transport in precincts to occur through district and local structure plans.

2.1.3 State Planning Policy 4.2 - Activity Centres for Perth and Peel (2010)

The ‘State Planning Policy 4.2 Activity Centres for Perth and Peel’ consolidates the concepts presented in ‘Directions 2031’. The main purpose of the policy is to specify the broad requirements for the planning and development of new activity centres and the redevelopment and renewal of existing centres in Perth and Peel.

The Policy reinforces that activity centres should act as community focal points providing an extensive range of services, facilities and activities.

Eglinton is identified as an emerging district centre in the policy. The functions, typical characteristics and performance targets specific to district centres are shown in Table 2.

Table 2 District Centre functions, characteristics and performance targets (SPP 4.2, 2010)

Main role/ function	<ul style="list-style-type: none"> • Focus on servicing the daily needs of residents • Relatively smaller scale catchment enables greater local community focus and provision of services, facilities and job opportunities that reflect the particular needs of their catchments
Transport connectivity and accessibility	<ul style="list-style-type: none"> • Focal point for bus network
Typical retail types	<ul style="list-style-type: none"> • Discount supermarket stores • Supermarkets • Convenience goods • Small scale comparison shopping • Personal services • Some specialty shops
Typical office development	<ul style="list-style-type: none"> • District level office development • Local professional services
Future indicative service population area	<ul style="list-style-type: none"> • 20,000-50,000 persons
Walkable catchment for residential density target	<ul style="list-style-type: none"> • 400m
Residential density target per gross hectare	<ul style="list-style-type: none"> • Minimum: 20 • Desirable: 30

2.1.4 METRONET

The Joondalup railway line is set to be extended to Yanchep as part of the State Governments METRONET program. The project is referred to as the Yanchep Rail Extension (YRE). The project includes 13.8km of new dual passenger railway from Butler Station to the Yanchep town centre, and the accompanying 14km of shared paths to connect the stations. Construction is set to begin in 2019.



Figure 5 Yanchep rail extension (METRONET, 2018)

2.2 Local policy and strategy

2.2.1 Local Planning Policy 3.8: Marmion Avenue Arterial Road Access (2012, reviewed 2017)

Local Planning Policy (LPP) 3.8 was prepared in accordance with Section 8.11 of the City of Wanneroo (CoW) District Planning Scheme No. 2, which denotes much of the Eglinton area as a Special Control Area. It details acceptable types and locations for vehicle access points, provisional standards for cycling infrastructure and operational procedures for all new planning proposals. Figure 6 shows the policy's spatial plan, showing its application area, road hierarchy and rail network, key vehicular access points, ultimate target operating speed zones, and centre locations (cropped to display the Eglinton area).

The plan depicts that full access intersections on Marmion Avenue will be signalised rather than under roundabout control. Presently the intersection of Marmion Avenue/ Pipidinny Road is under roundabout control. It is also noted that the north-south road located east of the railway line is shown as a Neighbourhood Connector. Pipidinny Road which will be severed in the east, will also be a Neighbourhood Connector.

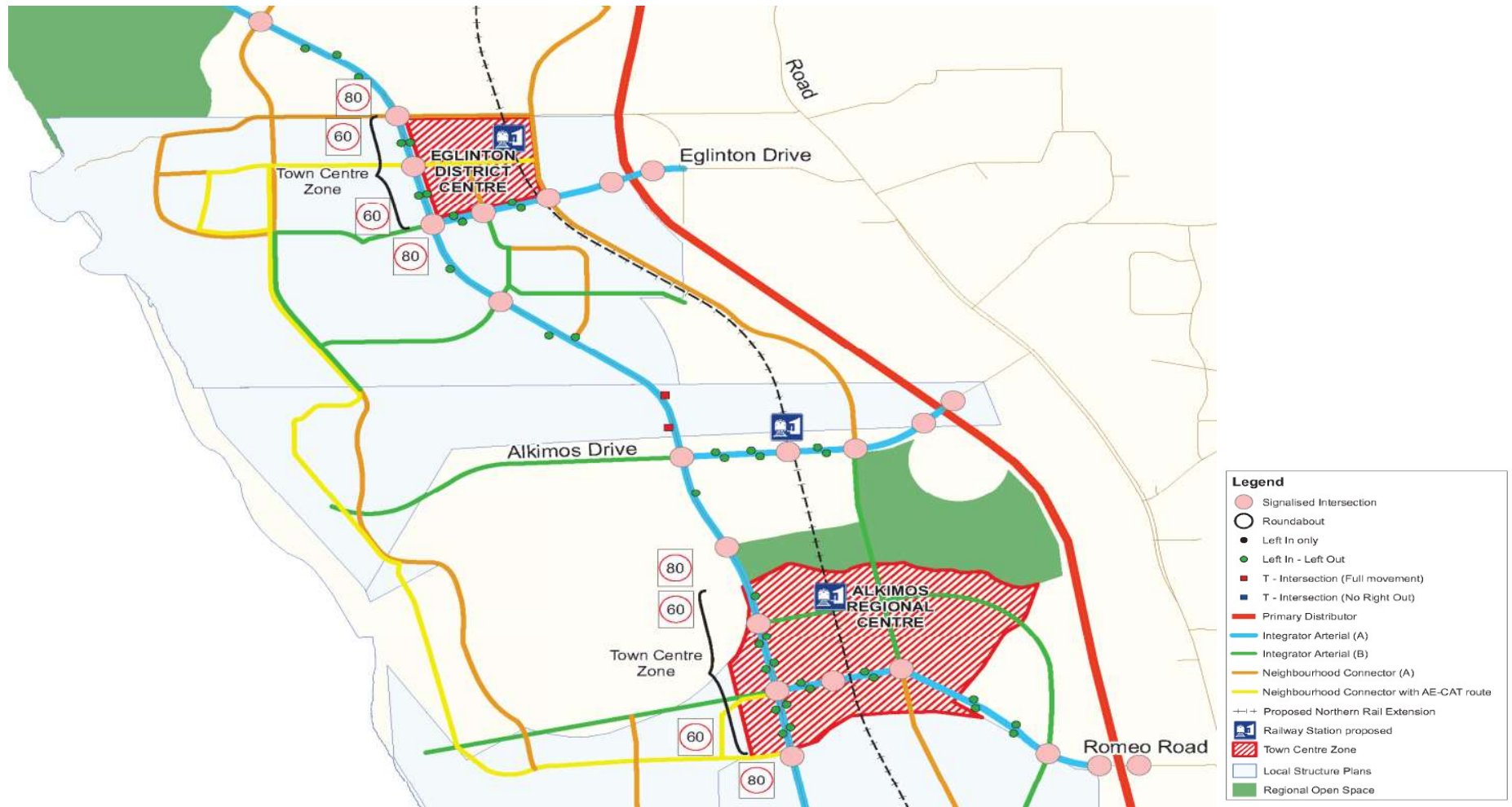


Figure 6 LPP 3.8 spatial plan (City of Wanneroo, 2012, reviewed 2017)

2.2.2 Alkimos Eglinton District Structure Plan (2016)

The Alkimos Eglinton District Structure Plan (DSP) (refer to Figure 7) was prepared to facilitate and enable the development of the district to provide for the growth of the North-West corridor, addressing land supply demand and employment creation. It is intended to guide subsequent levels of more detailed planning, subdivision and development. Some key takeaways from the DSP include:

- The creation of the Eglinton District Activity Centre
- The development of the Eglinton Marina (connected to the Eglinton Activity Centre via a secondary transit service)
- Marmion Avenue and Eglinton Drive as other regional roads
- Connecting the future rail stations to the three coastal villages and adjoining residential precincts
- Providing for localised employment opportunities
- Incorporating two major east/ west social/ pedestrian/ cycle linkages
- Housing a new community of 57,000 people in around 23,000 dwellings.

The strategic nature of the plan means that details such as intersection controls are not depicted.

2.2.3 Eglinton Local Structure Plan No. 82 (2012)

The Eglinton Local Structure Plan (LSP) was informed by the Alkimos Eglinton DSP and guides the development and subdivision of Eglinton for the expected future 16,000 residents across 7,400 dwellings. The LSP map is shown in Figure 8. Key transport features include:

- Marmion Avenue and Eglinton Drive as Integrator Arterials
- Full freeway access at Eglinton Drive
- Special transit route/ bus route on Carphin Avenue (the centre's main street) extending from Eglinton Marina
- Signalised intersections for access to the Eglinton Activity centre at Marmion Avenue and Eglinton Drive with the exception of the intersection of Marmion Avenue/ Pipidiny Road
- A series of shared paths in the north-south and east-west directions and access to the Principal Shared Path (PSP) on the Mitchell Freeway.

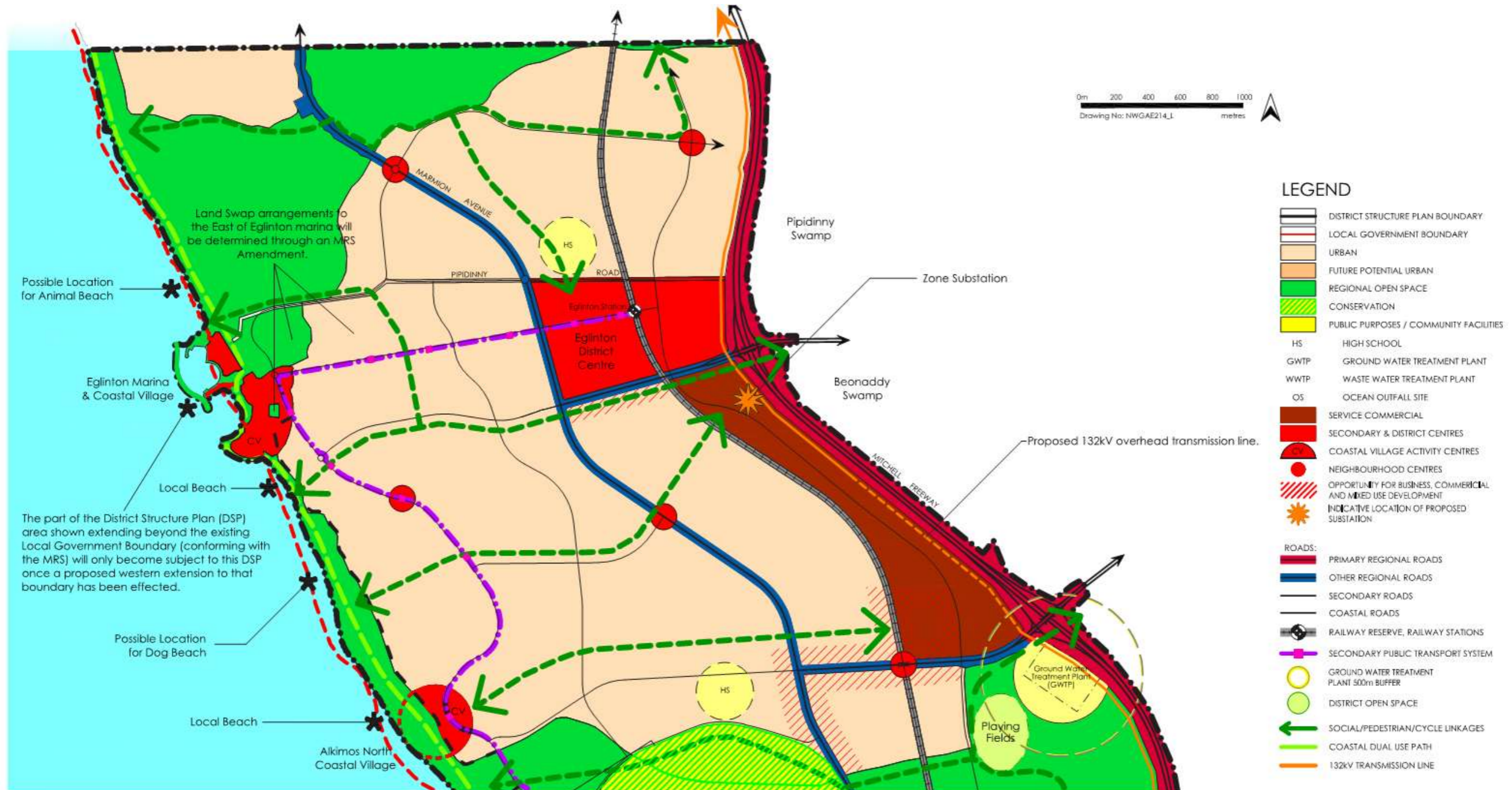


Figure 7 Alkimos Eglington District Structure Plan Map – crop (City of Wanneroo, 2016)



Figure 8 Eglinton Local Structure Plan map (Eglinton Escapes, Oceanscapes Alliance: 2012)

2.2.4 City of Wanneroo Pathways Policy (2016)

The CoW Pathways Policy was put together in 2016 to promote active transport through an improved walking and cycling environment, brought about by a safe and accessible pathway network. The document sets requirements for the CoW for path types, depending on roads. It classifies roads according to the typologies shown in Table 3.

Table 3 Road typologies from CoW Pathways Policy

Primary distributor	Roads designed for the movement of inter-regional and/ or cross-town/ city traffic, e.g. freeways, highways, and main roads.
District distributor	Roads designed for high-capacity traffic movements between industrial, commercial, and residential areas.
Local distributor	Roads designed for the movement of traffic within local areas and connect access roads to higher order distributors
Access street	A road that is less than 200m in length which does not have any continuing pedestrian access or egress beyond the closed end, and is therefore deemed to be a safe pedestrian and cycling street not requiring the provision of a path.
Bicycle boulevard	Residential streets designed to prioritise cycling, typically with speeds less than 30km/h and vehicle volumes less than 200 vehicles/day.

Table 4 shows the pedestrian and cycling facilities required for different road typologies with different characteristics in the CoW.

Table 4 Pedestrian and cyclist facility provision (CoW Pathways Policy, 2016)

Road	Characteristics			Facility required	
	Speed (km/h)	VPD	Attractors	Pedestrian	Cyclist
Cul-de-sac, laneways <200m	< 30	< 300	Residential properties	No pathway required	No pathway required
Access street	< 30	< 3,000	Residential properties	1.5m pedestrian path ⁴	Bicycle boulevard
Access street	< 50	< 3,000	Within 400m of schools, train stations & activity centres	2.5m shared path min.	
Access street	< 50	< 3,000	Residential properties	1.5m pedestrian path ⁴	No bicycle facilities required
Local distributor, neighbourhood connector B	< 50	< 3,000	Residential properties, activity centres, train stations	2.5m shared path	1.5m (1.8m abutting parking) red asphalt cycle lanes
Local distributor, neighbourhood connector A	< 50	< 7,000	Residential properties, activity centres, train stations	2.5m shared path and 1.5m pedestrian path ⁴	1.5m kerb-separated cycle lanes; or 1.5m red asphalt cycle lanes (1.8m abutting parking); or 3m red asphalt shared path
District distributor, integrator B	50 – 60	7,000 – 10,000	Activity centres, schools, train stations	1.5m pedestrian path ⁴	3m separated red asphalt cycle path; or 1.8-2m kerb separated 1-way cycle lane; or Use of parallel local access road/ service streets to create a continuous cycle facility
District distributor, integrator A	50 – 60	7,000 – 10,000	Activity centres, schools, train stations	1.5m pedestrian path ⁴	3m separated red asphalt cycle path; or 1.8-2m kerb separated 1-way cycle lane; or Use of parallel local access road/ service streets to create a continuous cycle facility
Primary distributor	≥ 80	> 20,000	Inter- and intra-regional centres	2m pedestrian path	Minimum 3m separated red asphalt cycle path

3 Transport context

3.1 Active transport

The active transport network in the Eglinton area is currently extremely limited due to low levels of development. Active transport in the area is limited to the network of footpaths in the existing developments, including parts of Amberton and Shorehaven.

3.2 Public transport

3.2.1 Existing rail network

The Joondalup railway line currently terminates at the northern end at Butler Station. Rail services on the Joondalup line currently operate with a frequency of six services per hour (in each direction) during the peak periods of 7am to 9am and 3pm to 5pm (excluding those services that do not reach Butler Station). During the inter-peak periods, there are approximately four services per hour in each direction. The approximate hours of operation of the Joondalup line services on weekdays are 5:30am to 12:00am.

3.2.2 Existing bus network

The bus network between Butler and Yanchep is currently limited due to the relatively low build-out north of the existing train station at Butler. Only two routes serve the Eglinton area; 490 and 491 which operate on Marmion Avenue. These are shown in Figure 9.



Figure 9 Existing bus network in the Eglinton area (Transperth Network Maps, accessed August 2018)

A summary of the frequency of these services is shown in Table 5.

Table 5 Existing bus services in Eglinton area

Bus service	Route	Peak services per hour	Inter-peak services per hour
490	Southbound and northbound from Butler Station to the Two Rocks terminus	3 services per hour (AM) and 3-4 services per hour (PM) in peak direction	1 service per hour in each direction
491	Southbound and northbound between Butler Station and Yanchep Station	3 services per hour (AM) and 3 services per hour (PM) in peak direction	1 service per hour in each direction

3.3 Road network

The road network in the Eglington area is currently relatively limited. It consists primarily of a network of local access roads and Marmion Avenue, a 'Distributor A' type road under Main Roads WA's functional road hierarchy. The existing road hierarchy is shown in Figure 10.

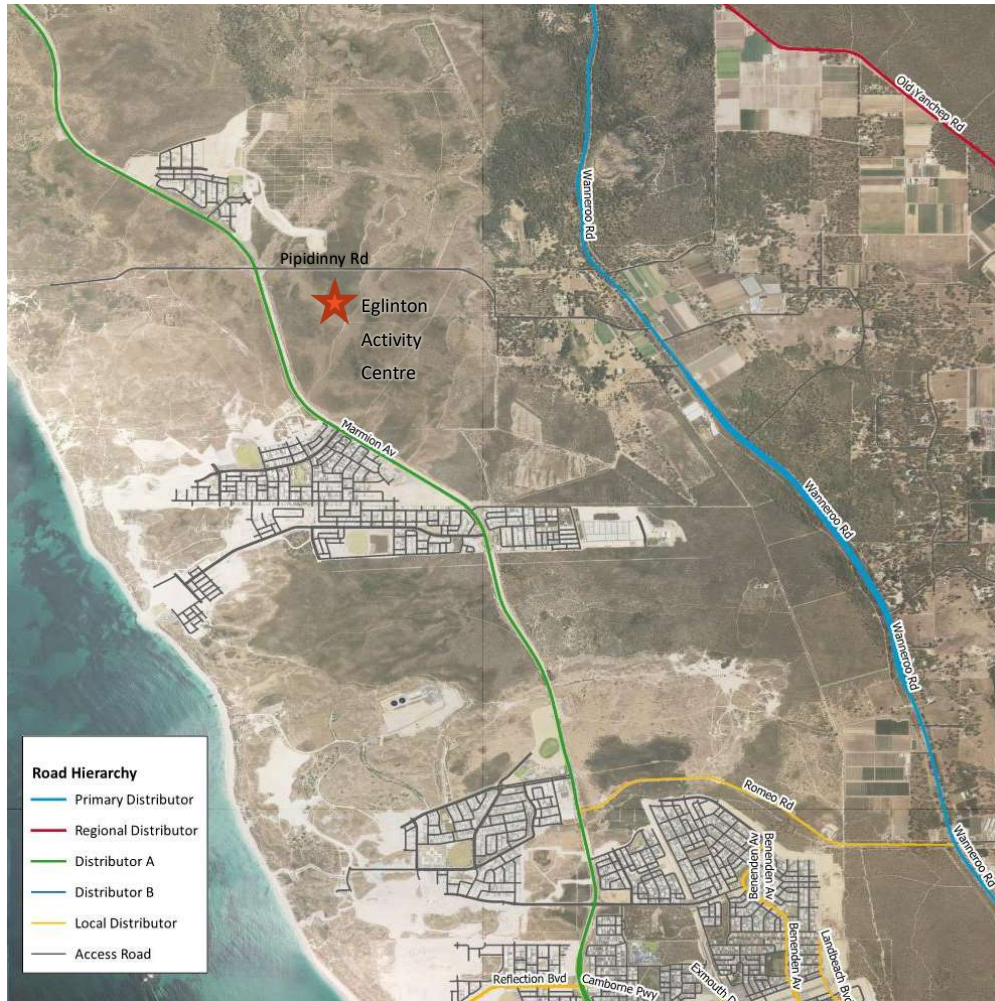


Figure 10 Eglington road hierarchy

As shown, limited east-west permeability exists between Wanneroo Road and the Eglington area. The only connections currently are Pipidiny Road (local access road to the north) and Romeo Road, a local distributor to the south.

Table 6 shows the existing traffic flows along Marmion Avenue and Wanneroo Road in the vicinity of the Eglington area.

Pipidiny Road is classified as an Access Road in the Main Roads WA Functional Road Hierarchy. The signposted speed limit is 110km/h.

Table 6 Main Roads WA traffic information

Road name	Count location	AAWDT	% heavy vehicles	Count year
Wanneroo Road	N of Romeo Rd	10,002	14.8	2015/16
Marmion Avenue	N of Romeo Rd	19,010	9.0	2015/16
Pipidinny Road*	E of Marmion Avenue	330	-	2009

Notes: * sourced from the City of Wanneroo

The extension of the Mitchell Freeway to Yanchep Beach Road has been reserved under the Metropolitan Region Scheme (MRS). The reserve allows for a full interchange at Eglinton Drive. MRWA is progressing the design of the extension and it is understood that the interchange will be signalised rather than a dog-bone configuration.

4 Development Proposal

4.1 Land use yields

The land use yields developed by URBIS in the Eglinton Activity Centre Residential Yields Plan and Eglinton Activity Centre Total Supportable Floorspace documents have been used. This information is depicted in Figure 11 to Figure 13. The centre will comprise a mix of retail, civic, bulky goods, education (a school (kindergarten to year 12) and residential uses.

The activity centre plan is shown in Figure 13. The development is to be staged from years 2025 to 2040 however timing will be dependent on market demand.

TOTAL SUPPORTABLE FLOORSPACE



- The adjacent table outlines the recommended composition and timing for retail and other uses in the Eglinton District Centre.
- The analysis indicates that Eglinton can sustain around 27,000 sq.m of shopping centre floorspace when the trade area population capacity is reached. This floorspace would be based around one DDS and three supermarket anchors.
- A further 29,000 sq.m could be sustained in bulky goods and other non-retail uses.
- Total community, commercial and retail floorspace amounts to around 55,000 sq.m.

SUPPORTABLE FLOORSPACE AND STAGING

	2025	2030	2035	2040
Retail Uses				
DDS	0	0	5,000	5,000
Supermarket	5,000	9,600	9,600	9,600
- Coles / Woolworths	4,000	8,000	8,000	8,000
- Aldi	1,600	1,600	1,600	1,600
Mini Majors	500	1,000	2,000	2,000
Specialty Shops	3,000	4,000	7,000	7,000
External	1,500	2,500	3,000	3,500
Total Retail	10,600	17,100	26,600	27,100
Other Uses				
Bulky Goods	2,700	4,600	5,200	8,000
- Hardware	1,300	2,200	3,000	3,900
- Furniture	400	700	900	1,200
- Automotive Accessories	400	700	900	1,200
- Other	600	1,000	1,400	1,700
Non-Retail	9,300	11,400	15,900	20,000
- Church / Community Uses	900	1,500	2,100	2,600
- Libraries	300	600	800	1,000
- Pub / Tavern	300	600	800	1,000
- Sporting Facilities	600	900	1,300	1,700
- Medical Centre	800	1,300	1,800	2,200
- Gyms	900	1,400	2,000	2,500
- Cinemas / Other Entertainment	300	600	800	1,000
- Child Care	400	700	1,000	1,300
- Motor Vehicle Services	400	600	800	1,000
- Real Estate / Finance / Insurance	900	1,400	2,000	2,500
- Retail / Trade Services	1,000	1,700	2,300	3,000
- Travel Agency	100	100	200	200
Total Other	9,600	16,000	22,100	28,000
Total Activity Centre	20,200	33,100	48,700	55,100

Source: URBIS

Figure 11 Total supportable floorspace yields (URBIS)

RESIDENTIAL YIELD

DEVELOPMENT CELL	AREA	AVE LOT SIZE / DWELLINGS PER GROSS AREA	YIELD
1	34,266m ²	22	75
2	3,713m ²	300m ²	12
3	2,557m ²	300m ²	8
4	2,557m ²	300m ²	8
5	1,330m ²	150m ²	8
6	1,330m ²	150m ²	8
7	2,933m ²	300m ²	9
8	2,933m ²	300m ²	9
9	2,557m ²	300m ²	8
10	2,557m ²	300m ²	8
11	1,350m ²	150m ²	9
12	1,164m ²	300m ²	4
13	2,537m ²	300m ²	8
14	2,537m ²	300m ²	8
15	1,164m ²	300m ²	4
16	12,862m ²	n/a*	75 - 107
17	4,827m ²	300m ²	16
18	5,481m ²	300m ²	18
19	928m ²	150m ²	6
20	5,177m ²	300m ²	17
21	1,164m ²	300m ²	4
22	110,194m ²	15	165
23	46,776m ²	15	70
TOTAL			557 - 589

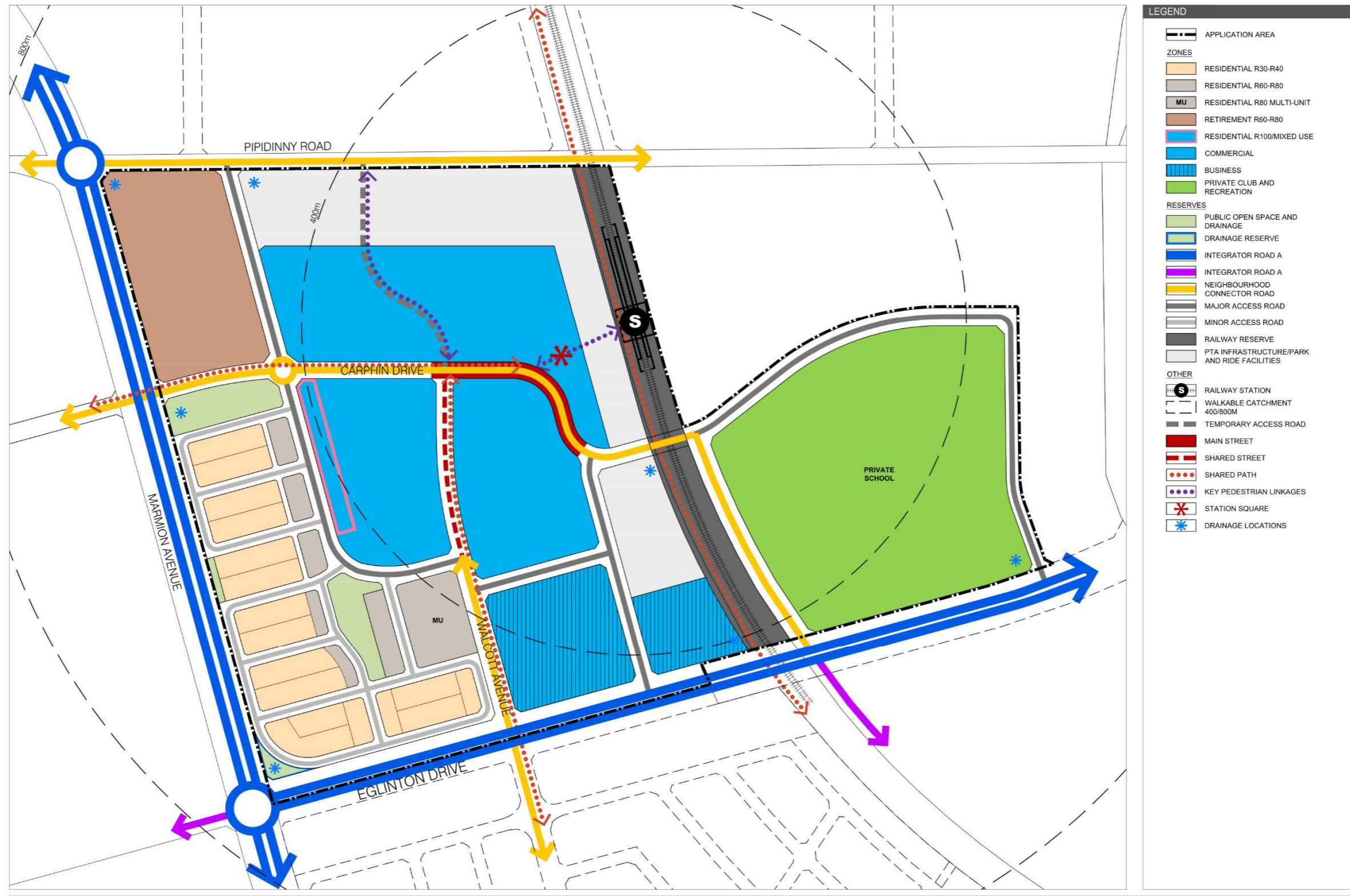
* Yields calculated based upon table 4 of the R-Codes. Lowest yield assumes 0.7 plot ratio (R60) whereas highest yield assumes the maximum permitted plot ratio of 1 under R80. 120m² unit size assumed for both scenarios.

Figure 12 Residential yields (URBIS 2018)

The following supplementary yields in Table 7 have been provided by URBIS for within the study area to ensure the accuracy of the trip generation process.

Table 7 - Supplementary yields

Land Use	Year	Yield	Unit
School (K-6)	2025	420	Students
School (K-12)	2040	1220	Students
Residential (Cells 2 -21 in Figure 13)	2025	50	Dwellings



LEGEND	
	APPLICATION AREA
ZONES	
	RESIDENTIAL R30-R40
	RESIDENTIAL R60-R80
	RESIDENTIAL R80 MULTI-UNIT
	RETIREMENT R60-R80
	RESIDENTIAL R100/MIXED USE
	COMMERCIAL
	BUSINESS
	PRIVATE CLUB AND RECREATION
RESERVES	
	PUBLIC OPEN SPACE AND DRAINAGE
	DRAINAGE RESERVE
	INTEGRATOR ROAD A
	INTEGRATOR ROAD A
	NEIGHBOURHOOD CONNECTOR ROAD
	MAJOR ACCESS ROAD
	MINOR ACCESS ROAD
	RAILWAY RESERVE
	PTA INFRASTRUCTURE/PARK AND RIDE FACILITIES
OTHER	
	RAILWAY STATION
	WALKABLE CATCHMENT 400/800M
	TEMPORARY ACCESS ROAD
	MAIN STREET
	SHARED STREET
	SHARED PATH
	KEY PEDESTRIAN LINKAGES
	STATION SQUARE
	DRAINAGE LOCATIONS

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Structure Plan Part II
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DATA SOURCE
Landgate & MNG
PROJECTION
MGA Zone 50

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CLIENT
Woodsome

PROJECT NO. PA1523
DRAWING NO. 03
DATE 21.03.19
REVISION i

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1:4,000 @ A3
0 10 20 50 100m

Figure 13 Eglington Activity Centre Plan (Urbis, March 2019)

5 Network Assessment

5.1 Introduction and objectives

Arup has undertaken modelling using the software platform Aimsun. The purpose of the modelling was to identify peak hour and daily forecast volumes for the proposed activity centre road network/ Eglinton Drive and Marmion Avenue and to understand resultant levels of service of key intersections and road midblocks.

Static intersection modelling has also been undertaken for key intersections where the results of the Aimsun modelling indicated lower levels of service.

While stage 1 and ultimate development is not expected to occur until year 2025 and 2040 respectively, in order to be consistent with strategic modelling, stage 1 development traffic has been assumed at year 2021 and ultimate at year 2031. The MRWA ROM forecast volumes plots are shown in Appendix A.

5.2 Approach

A mesoscopic Aimsun model was coded of the Eglinton Activity Centre network and surrounding major roads, and model scenarios were developed for AM and PM peaks in years 2021 and 2031. A key input to the model was volume plots and sub areas matrices from the MRWA Regional Operations Model (ROM). The ROM forecast traffic volumes for Marmion Avenue and Eglinton Drive formed the cordon for the model. The volumes for the activity centre within the ROM sub area matrices were zeroed and replaced by the traffic generated for the land uses now proposed within the Eglinton activity centre structure plan.

The matrix development process and assumptions used to estimate traffic flows are depicted in Figure 14.

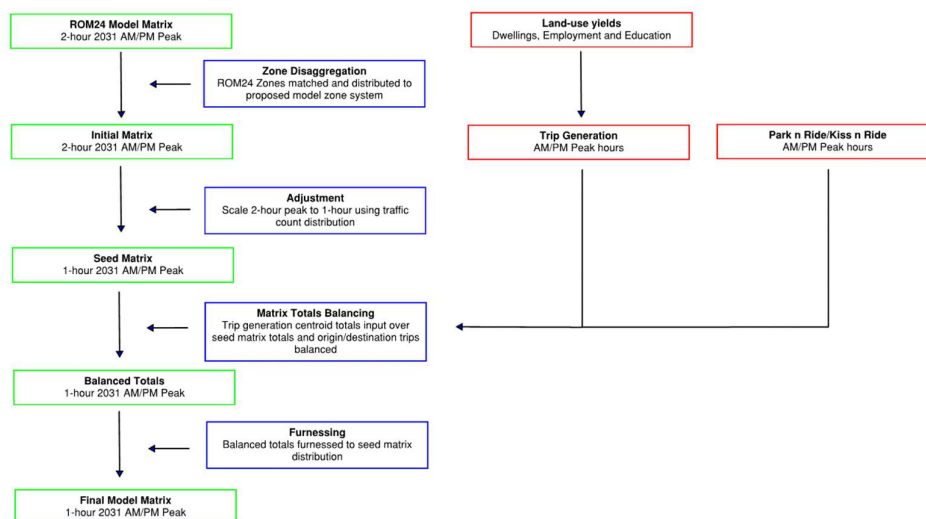


Figure 14 – Matrix estimation process

5.3 Trip generation and attraction

The adopted trip generation rates have been sourced from the *Transport Impact Assessment guidelines (Department of Planning 2016)*. These were applied to the land use yield forecasts (as per Section 4.1).

Table 1: Typical land use vehicle trip rates

LAND USE	UNIT	AM peak hour trip rate			PM peak hour trip rate		
		In	Out	Total	In	Out	Total
Residential	Dwellings	0.2	0.6	0.8	0.5	0.3	0.8
School	Pupils	0.5	0.5	1.0	0.5	0.5	1.0
Commercial	100m ² GFA	1.6	0.4	2.0	0.4	1.6	2.0
Retail (Food) ^a	100m ² GFA	2.0	0.5	2.5	5.0	5.0	10.0
Retail (Non-food) ^b	100m ² GFA	1.0	0.25	1.25	2.0	2.0	4.0
Industrial	100m ² GFA	0.8	0.2	1.0	0.2	0.8	1.0

GFA = gross floor area

a – These rates should be applied to retail developments/ shopping centres that have a significant food retail component.

b – The trip rates for both food and non-food retail stores can vary significantly depending upon a number of issues including type of goods sold, location and size. Caution should be used in applying these rates arbitrarily.

Figure 15 – Typical land use vehicle trip rates (*Department of Planning 2016*)

For areas where further detail has been provided for land use, the following sources have been used:

- Trip generation rates for assessment of development proposals (*Department of Planning, Transport and Infrastructure 2014*)
- Guide to Traffic Generating Developments (*RTA 2002*)
- Parking Generation 4th Edition (*Institute of Transport Engineers 2010*).

Appendix B contains the resultant AM and PM peak trip generation of the activity centre in years 2021 and 2031 for residential and education and non-residential uses; respectively. Table 8 depicts a summary of the trip generation within the District Centre by land use category. Detailed breakdowns of the peak hour trip generation by land use for years 2021 and 2031 are provided in Appendix B.

Table 8 - Trip generation by land use

Year	2021 Peak Hour Trips		2031 Peak Hour Trips	
	AM	PM	AM	PM
Peak				
Retail	293	770	891	2143
Bulky Goods	116	116	319	319
Commercial	43	43	127	127
Education	420	420	1220	1220
Residential	40	40	433	433

5.4 Trip distribution

The trip generation for Eglinton Activity Centre was dispersed on the network utilising the matrix distributions within ROM24 provided by Main Roads WA. Table 9 summarises the traffic distributions:

Table 9 - District Centre traffic distribution of origin and destination trips

Year	2021		2031	
	AM Peak	PM Peak	AM Peak	PM Peak
North	27%	29%	26%	27%
East	1%	1%	1%	1%
South	40%	40%	44%	48%
West	32%	30%	28%	24%

5.5 Bus routes

The proposed bus routes and frequencies were coded into the AM and PM peaks of the 2021 and 2031 models in accordance with Section 7 of this report.

5.6 Station Park and Ride (PnR)/ Kiss and Ride (KnR)

Eglinton Station's proposed location is within the District Centre, therefore the PnR and KnR traffic demands were included in the models.

The following assumptions have been applied to forecast the trip generation of the station.

- Station will be operational in year 2021
- Parking provision at 2021 is 400 bays, with 50% of total daily arrivals occurring in the AM peak hour and 50% of departures in the PM peak. The station's trip generation is assumed to be very pronounced during peaks
- Parking provision at 2031 is 400 bays, with 50% of daily arrivals occurring in the AM peak hour and 50% of departures in the PM peak
- All KnR trips are circular trips
- Using the Butler Station existing mode shares, KnR trips were estimated relative to PnR demand

Table 10 displays the distribution of trips that has been assumed for the PnR and KnR for year 2031. This distribution has been determined using the seed matrix distribution from ROM. For the year 2021 network, the distribution for freeway north and south have been attributed to Marmion Avenue north and south respectively.

The project definition plan for Eglinton Station indicates that there is a possible long term extension of the PnR capacity from 400 to 1,000 bays. The timing for

this is unknown but it has been considered as part of this assessment as a sensitivity test.

Table 10 - Arrival and departures splits (year 2031)

Arrival/Depart	% Split AM Peak	% Split PM Peak
Marmion North	24%	24%
Freeway North	2%	3%
East	1%	1%
Freeway South	9%	16%
Marmion South	36%	32%
Eglinton West	28%	24%

5.7 Network assumptions

Figure 16 and Figure 17 depict the assumptions made in relation to the road network connectivity and attributes for the Eglinton Activity Centre within the 2021 and 2031 models:

- Road geometry
- Speed limits
- Road classifications.

The freeway has not been extended in the 2021 network and therefore Pipidiny is the primary east-west connection. While Eglinton Drive rail bridge will be constructed as part of the YRE, Eglinton Drive will not be constructed east of the proposed north-south road east of the rail alignment.

The signposted speed limit on Pipidiny Road is assumed to be reduced to 70km/h by 2021, commensurate with its role in providing access to Eglinton Station in year 2021. In 2031, Pipidiny Road will be a local access street and it is assumed that the cross section will have been upgraded to include provisions for active transport, kerbing and some channelization (eg some right turn pockets at key locations). A signposted speed limit of 50km/h is considered appropriate for year 2031.



Figure 16 – 2021 network assumptions

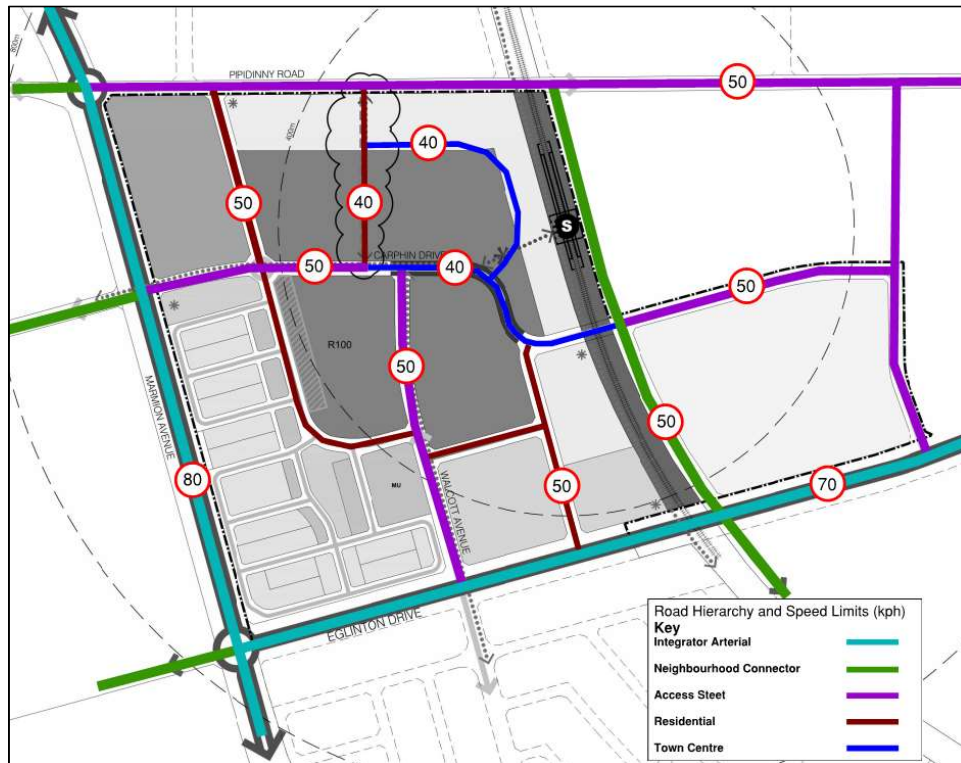


Figure 17 – 2031 network assumptions

5.8 Forecast daily network volumes

In order to review and refine the proposed road network classification within the Eglinton Activity Centre, the resultant peak hour trips on the network have been factored into daily trips. Generally it is assumed that each peak hour comprises 10% of daily traffic volumes. The exceptions to this was school trips which are assumed to be predominantly within the AM and PM peaks when pick-up and drop-off occurs. For the purpose of scaling up to daily volumes, the totals for the AM (approx. 600 trips) and PM (approx. 400 trips) peak were removed and added to the scaled daily total.

6 Road network performance results

Full modelling results are provided in Appendix C.

6.1 2021 model

The road network in 2021 is limited and reflects the planned staging of the centre and the fact that the freeway is not planned to be extended to Eglinton Drive at this stage. Eglinton Drive would be constructed as a single carriageway (two lanes). Marmion Avenue has been assumed to have been constructed to its ultimate configuration of a divided carriageway with two lanes in each direction. Roundabout controls have been assumed at key intersections as advised by MRWA.

The road network depicted in the model is shown in Figure 18. The proposed main street, Carphin Drive, is only constructed in part and will not connect to Marmion Avenue.

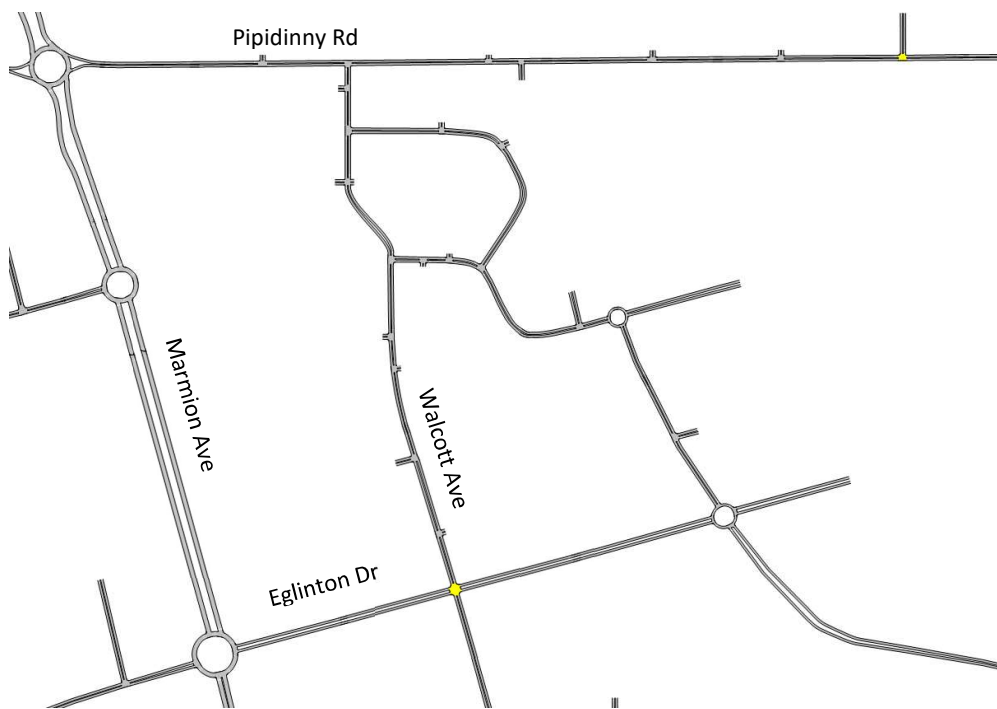


Figure 18 – Adopted 2021 road network

6.1.1 AM peak hour

The forecast volume to capacity (V/C) ratio of the network is shown in Figure 19. The network is expected to operate well within capacity. The roundabouts on Marmion Avenue are starting to experience some capacity issues. Within the district centre, the streets with the highest V/C ratio are those that provide access to the PnR bays and the school.

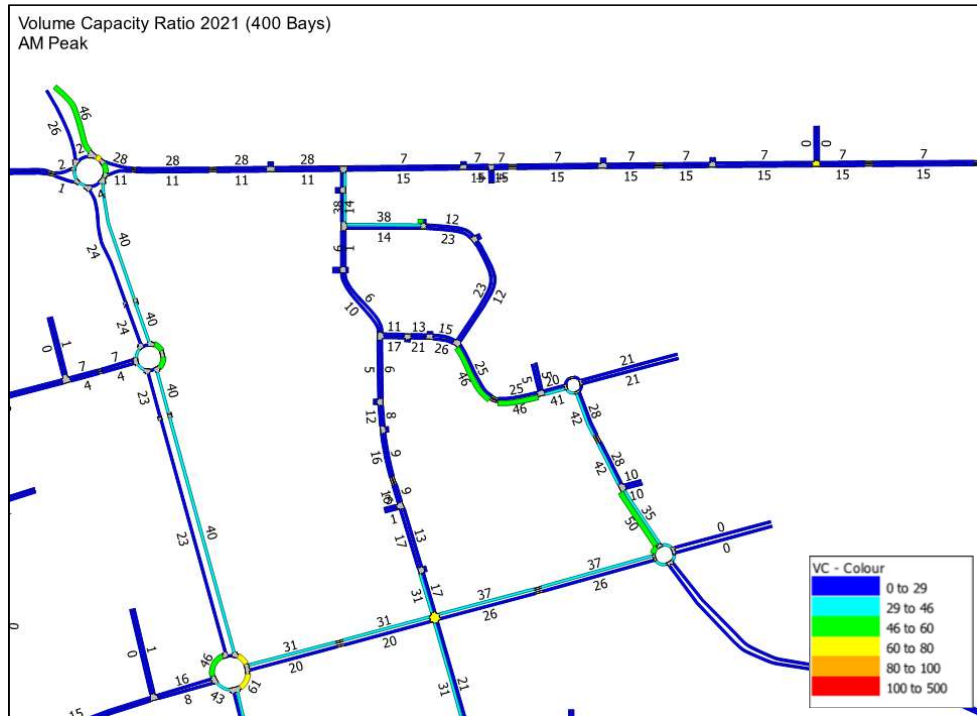


Figure 19 – 2021 AM peak forecast volume to capacity ratio

6.1.2 PM peak hour

The forecast volume to capacity (V/C) ratio of the network is shown in Figure 20. The network is expected to operate well within capacity but again capacity issues on the intersections on Marmion Avenue are becoming apparent.

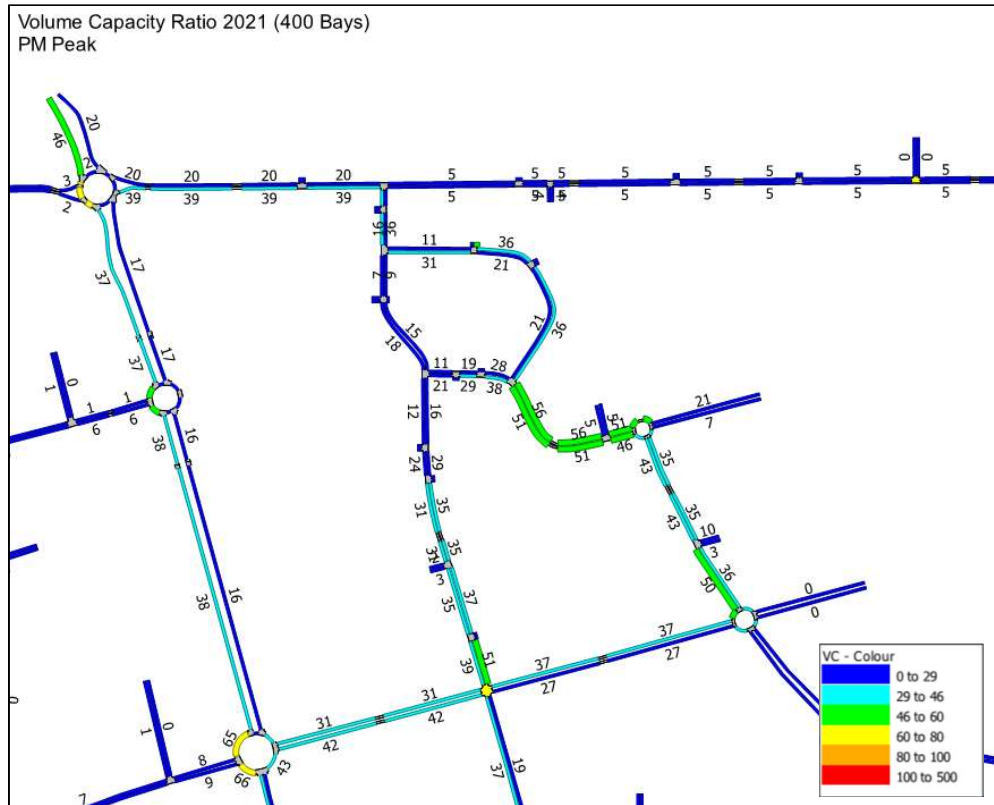


Figure 20 – 2021 PM peak forecast volume to capacity ratio

6.1.3 Forecast Daily Volumes

The resultant daily volumes have been factored based on the peak hour link volumes from the Aimsun model. The forecast daily volumes are shown in Figure 21. While the network is limited at year 2021, the staging has been designed to make sure that the forecast daily volumes are commensurate with the proposed ultimate network street classification.

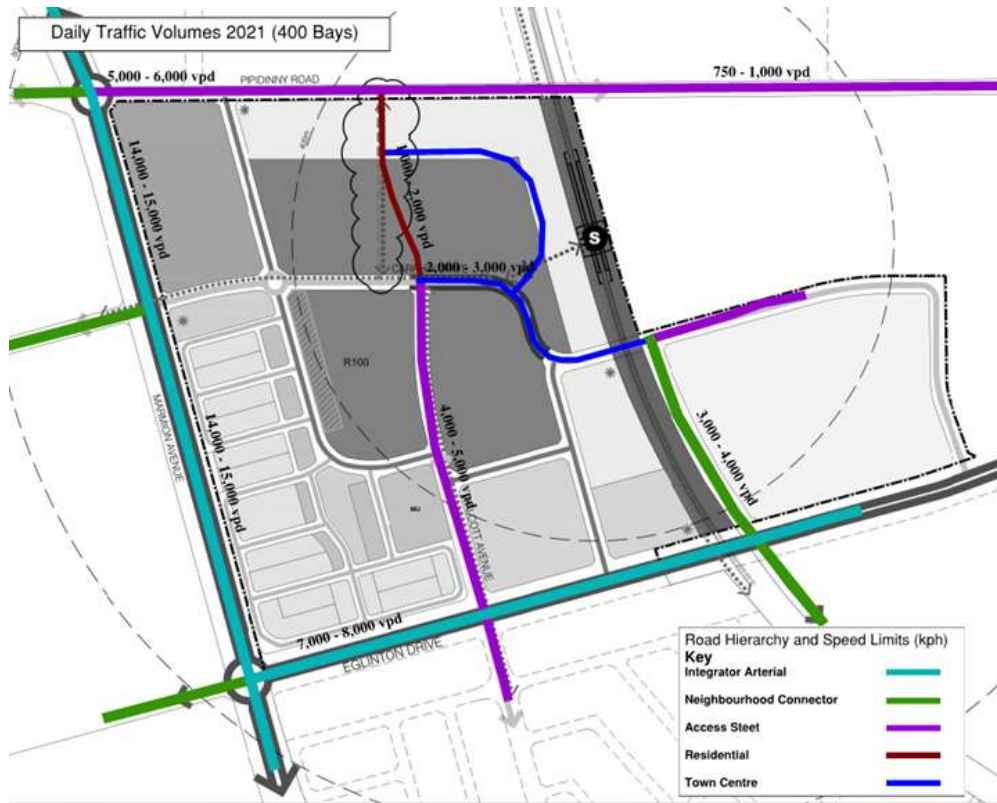


Figure 21 – Eglinton Activity Centre daily traffic, year 2021

6.2 2031 model

The 2031 model has been developed with a network featuring the following configurations:

- The freeway has been extended with a full interchange at Eglinton Drive
- Eglinton Drive two-lanes in both directions
- Marmion Avenue two-lanes in both directions.

The modelled network is shown in Figure 22.

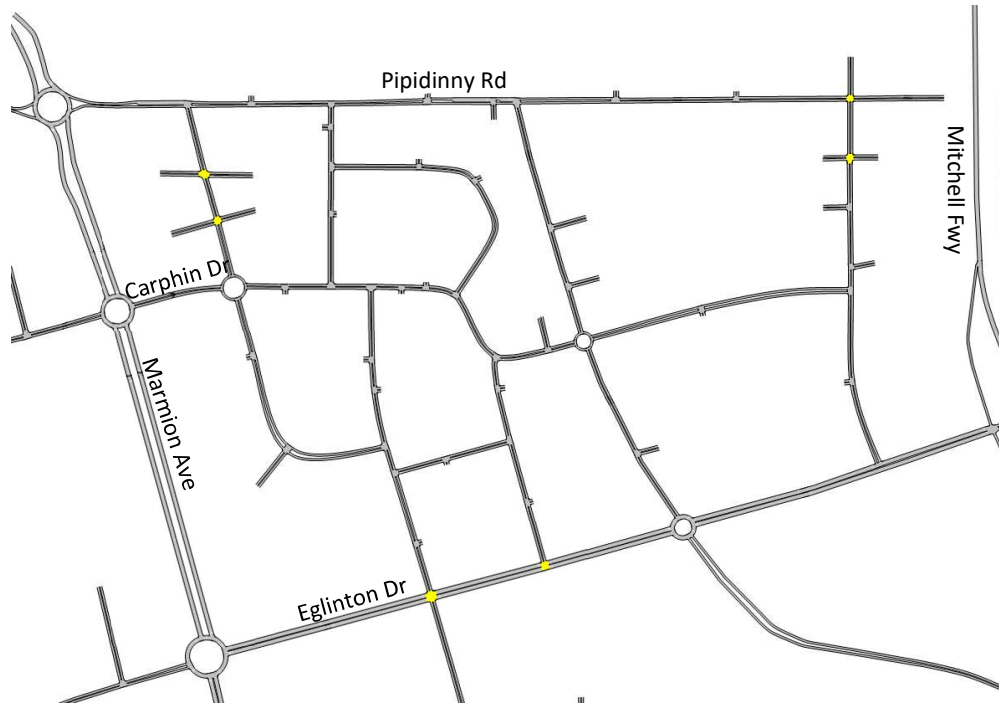


Figure 22 – Adopted 2031 road network

6.2.1 AM peak hour

The forecast volume to capacity (V/C) ratio of the network is shown in Figure 23. The network within the district centre is forecast to operate within capacity however parts of the external network, particularly intersections on Marmion Avenue will be operating at or above capacity. The intersections are modelled as under roundabout control as per MRWA directions. As a means of comparison, the intersections were also tested with signal controls and this yielded higher delays and queues on Marmion Avenue.

The proposed roundabout at the intersection adjacent to the school (east of the railway bridge) will be the busiest location of the internal network as it provides access to the PnR bays and the proposed school. It is forecast to operate within acceptable limits for an urban environment in the peak hour.



Figure 23 – 2031 AM peak forecast volume to capacity ratio

6.2.2 PM peak hour

The forecast volume to capacity (V/C) ratio of the network is shown in Figure 24. There are similar capacity issues in the PM peak on the external network to those described for the AM peak. Within the site, the busiest location will be the main street where a V/C of 0.88 is forecast. The network is expected to operate within capacity and some level of busyness in the main street during peak hours within a district centre is considered acceptable.



Figure 24 – 2031 PM peak forecast volume to capacity ratio

The modelling results have found that the three roundabouts along Marmion Avenue will operate at capacity with the section between Pipidiny Road and Carphin Drive being the most critical with delays expected for traffic wanting to turn onto Marmion Avenue off Pipidiny Road. Testing the intersections under signal control instead of roundabout operation, yields even greater delays for movements on Marmion Avenue.

The modelling results are discussed further in Section 6.5.

6.2.3 Forecast Daily Volumes

The resultant daily volumes have been factored based on the peak hour link volumes from the Aimsun model. The forecast daily volumes are shown in Figure 25. The results show that the two key routes into the centre – the main street (Carphin Drive) in the east-west direction and Walcott Avenue (north-south) will carry volumes commensurate with Integrator Arterials rather than access streets. Accordingly, direct property driveway access on these routes needs to be managed. The modelling shows that the north-south route between Walcott Avenue and the railway line is expected to function and should be designed as a neighbourhood connector. Similarly, the north-south route on the eastern side of the railway should also be classified as a Neighbourhood Connector rather than an Integrator Arterial as proposed under the DSP.

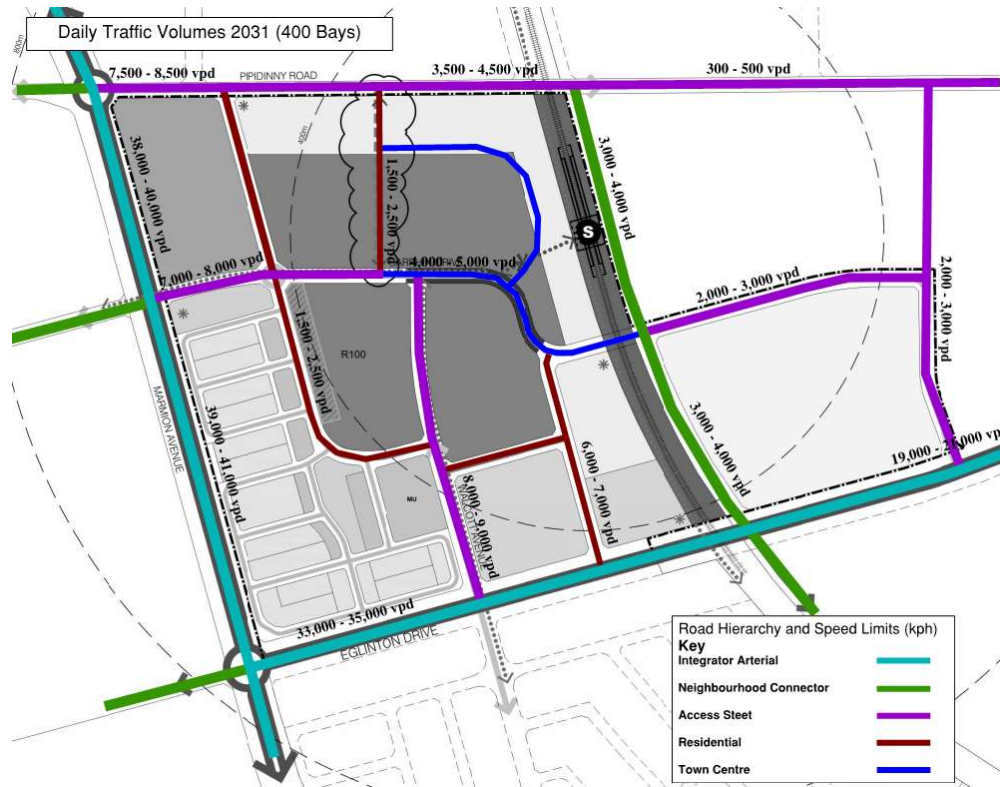


Figure 25 – Eglinton Activity Centre daily traffic volumes, year 2031

6.3 Sensitivity Testing

A sensitivity test was completed to forecast the increase of the PnR facilities to 1000 bays. It is understood that the PTA is considering a long term provision of 1,000 PnR bays at Eglinton Station. The Aimsun modelling resulted in the worsening of the already congested network locations including the three roundabouts on Marmion Avenue and along Pipidiny Road. Importantly, the results show a significant increase in traffic using the main street. This level of traffic would make on street parking and crossing the street for pedestrians and cyclists challenging.

The station layout design is underway and it is important that a secondary street network facilitates vehicular access to the station without reliance on the main street.

The V/C plots for the 2031 AM and PM peaks are shown in Figure 26 and Figure 27; respectively.

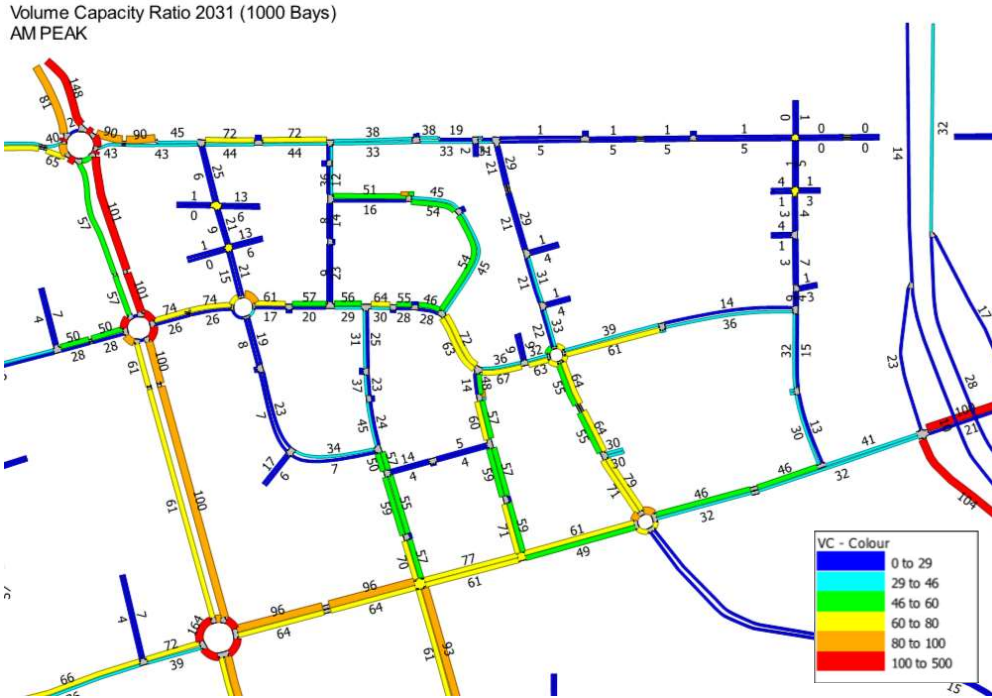


Figure 26 – 2031 AM peak forecast volume to capacity ratio (1000 PnR bays)

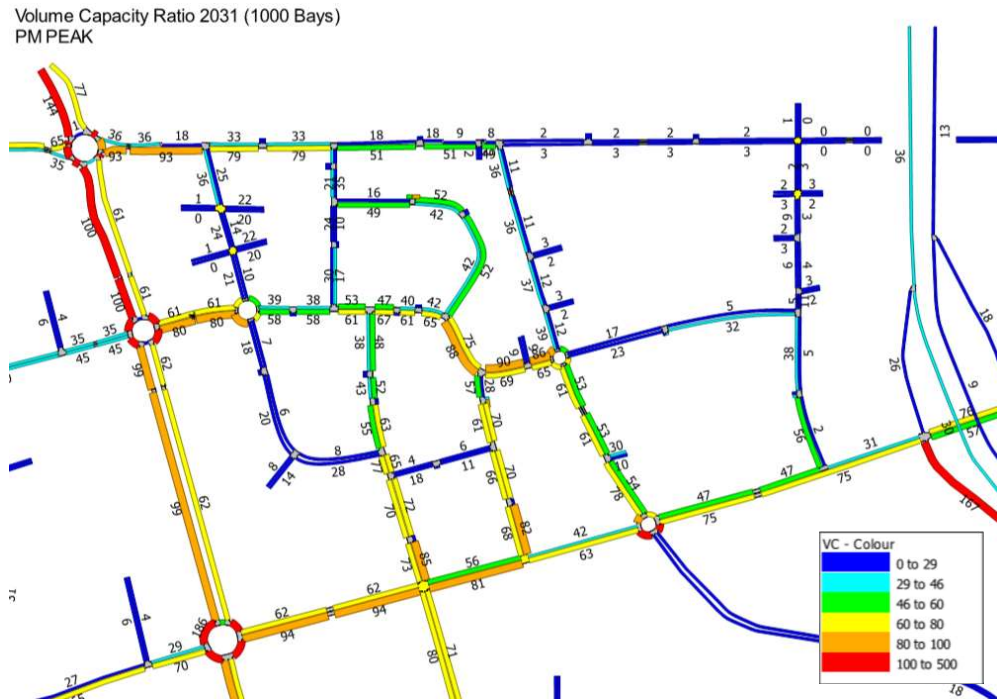


Figure 27 – 2031 PM peak forecast volume to capacity ratio (1000 PnR bays)

6.4 Intersection operation

Typically for a Transport Assessment, any capacity issues in the mesoscopic model are examined further using intersection modelling software such as

SIDRA. Intersection modelling has not been undertaken to examine forecast capacity issues on the basis of the following broader strategic issues:

- Marmion Avenue and Eglinton Drive have been modelled as per their ultimate configurations, as advised by network planning at MRWA, and identification of further upgrades to these strategic assets due to wider network pressures is not the responsibility of individual developers to resolve. The proposal for the Eglinton Activity Centre is in line with earlier planning as part of the DSP where the strategic network needs were identified (and now being designed and built)
- The forecast volumes on the external network at year 2031 as per the ROM24 model show volumes that are, in some sections, (for example Marmion Avenue north of Pipidinnny Drive) far in excess of the modelling undertaken as part of the DSP and importantly higher volumes than those forecast on the Freeway. Marmion Avenue would need to comprise a six lane cross section and thereby fulfil a greater regional role than the planned freeway extension. This highlights a need for the ROM, as a forecasting tool used for strategic planning, to be reviewed in this area. Other signposts for the need to review and revise the ROM are:
 - The freeway alignment depicted in ROM does not match the MRS reserve
 - Eglinton Drive is not modelled as a four lane cross section (despite link volumes in ROM being commensurate with a four lane cross section)
 - The allowance for PnR demands (particularly up to 1,000 bays at Eglinton Station) is unclear.

6.5 Discussion

Bearing in mind the strategic network (modelling) issues highlighted above, from the modelling of Eglinton Activity Centre the following has been determined:

- The internal and external network at years 2021 are forecast to operate well within capacity however, the intersections on Marmion Avenue are showing early signs of capacity issues
- Traffic volumes along Eglinton Drive will require it to be duplicated between the freeway interchange and Marmion Avenue
- The three roundabouts on Marmion Avenue to the west of Eglinton Activity Centre are operating at capacity and will experience significant congestion and delay on all approaches at year 2031. There will be limited gaps in the traffic stream on Marmion Avenue (due to the absence of signalised intersections) for traffic on side streets at roundabout-controlled intersections to access Marmion Avenue. Testing of the intersections operating under signal control (instead of roundabout control) was undertaken and led to increased delays to movements on Marmion Avenue however reduced delays to traffic on side street approaches to Marmion Avenue
- Forecast traffic volumes on Marmion Avenue at year 2031 are extremely high as aligned with ROM24 and two lanes in each direction is insufficient for the forecast volumes. The proposed volumes would require a six lane cross

section. Arup is unaware of any plans for a six lane cross section on Marmion Avenue in the current planning outlook

- Pipidiny Road east of Marmion Avenue is likely to require turning pockets to access the District Centre at two locations as depicted in the modelled network (as per Figure 22)
- The roundabout on Eglinton Drive at the proposed Neighbourhood Connector (east of the railway line) is likely to operate at capacity. Again volumes on Eglinton Drive within the ROM24 model at year 2031 are significantly higher than those identified under the DSP and therefore it is recommended that the ROM is reviewed before making recommendations on any need for further capacity enhancement and/ or appropriateness of a roundabout in this location
- The possible expansion of PnR bays from 400 to 1,000 bays will exacerbate issues on the external road network. Further examination is needed in partnership with the PTA in order to best locate these additional bays so that they result in volumes that are commensurate with the street classification within the centre. PTA's plans were still being developed at the time of preparation of this Transport Assessment.

The modelling for Eglinton has built in a number of conservatisms which means that the internal link volumes depicted in the Aimsun modelling are considered to be worst-case. These conservatisms are namely:

- 20% contingency factor on the trip generation to allow for flexibility in land use planning
- Expected stage 1 build out at year 2025 has been applied to the 2021 network
- Expected ultimate build out at year 2035-2040 has been applied to the 2031 network
- The road network depicted in the model is coarse and there will be a series of secondary streets within the centre that means that traffic volumes will be distributed over a finer-grained network.

7 Public Transport

The proposed Eglinton Station is expected to be operational in year 2021. The PTA is in the process of finalising the station layout plan and importantly the location and required access for PnR bays is still being resolved. It is understood that the station will be unstaffed and the 400 PnR bays will be operational at opening year.

The provision of a station at the heart of the centre means that bus services will be in place early within the development staging. The planned bus network within the centre are summarised in Table 11, Figure 28 and Figure 29. These details have been informed by the Eglinton Station project definition plan (PDP) and consultation with the PTA as part of the development of this TA.

The bus routes at year 2021 from the south/ west are assumed to access the station via Eglinton Drive. These services will revert to Carphin Drive once it is constructed through to Marmion Avenue.

Table 11 - Future bus route information

Route No.	Type of Route	Peak Period headway (mins)	Intended opening year of service
485*	Primary	10	2021
486*	Primary	10	2021
487*	Secondary	20	2021
489	Primary (if demand dictates)	10	2021
490	Secondary	20	2021
491	Secondary	20	2021
491	Secondary	20	2021
492	Secondary	20	2021
STS*	Secondary	20	2031

*Route timed at Alkimos Station

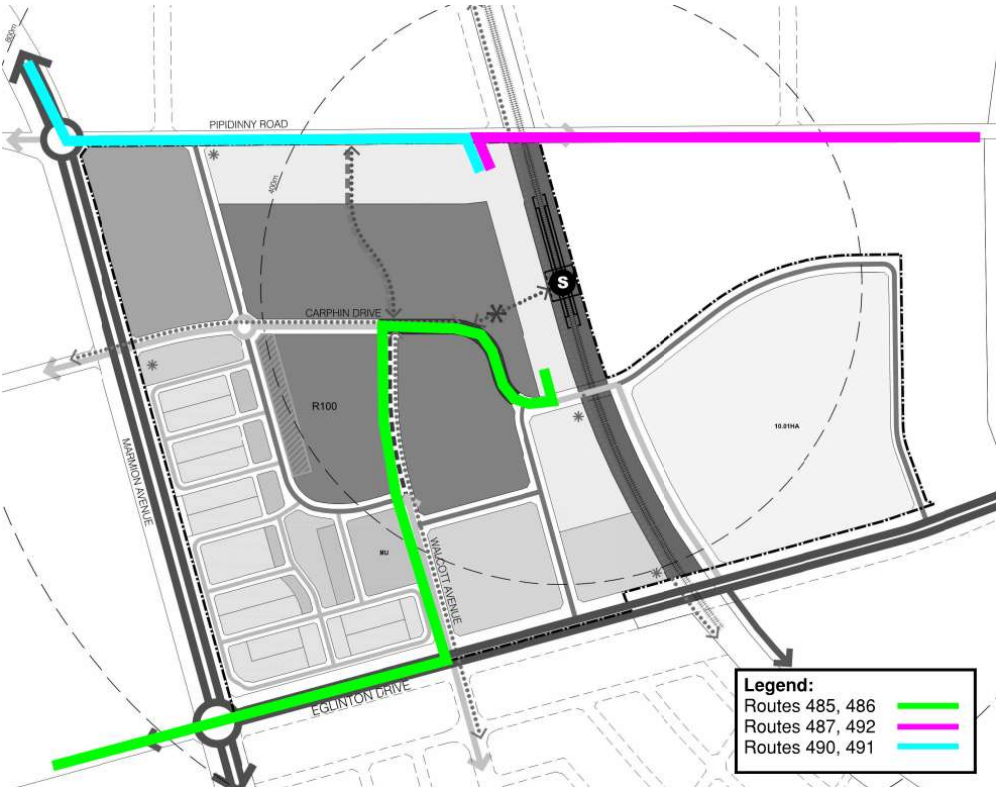


Figure 28 – Future public transport provisions, 2021

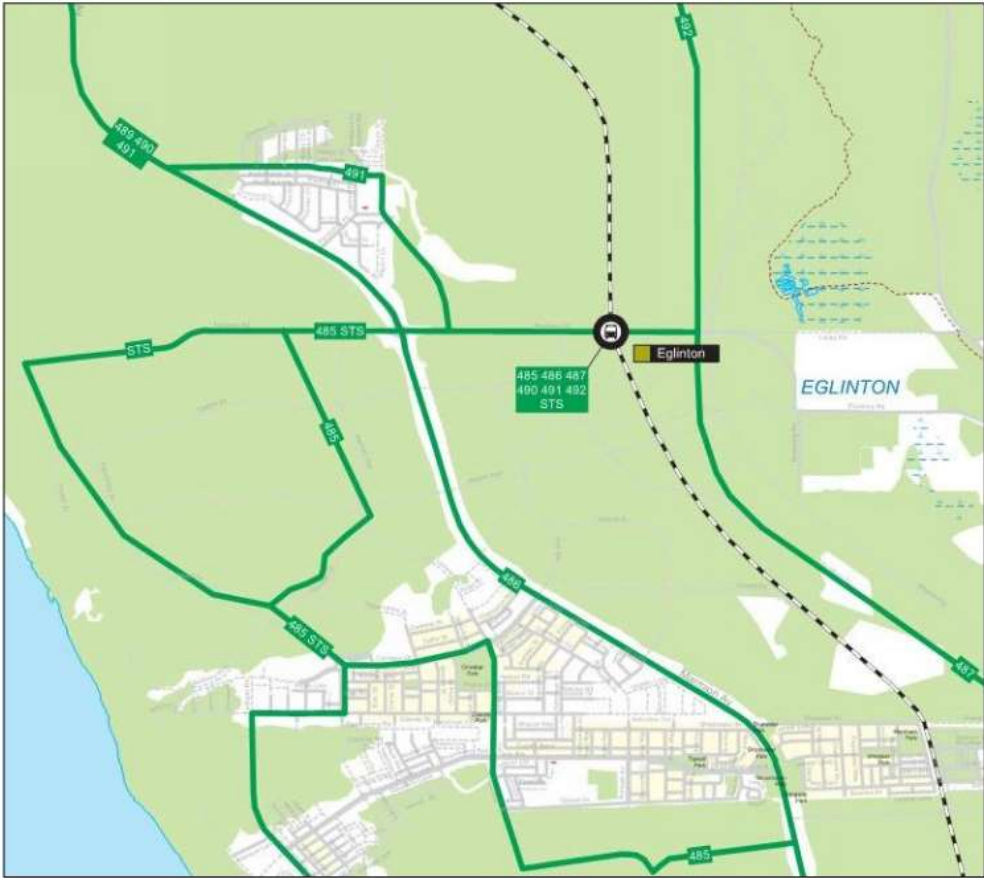


Figure 29 – Future public transport provisions, 2031 (Source: PTA Service Development Plan, July 2017)

8 Active Transport

Active transport in the Eglinton District Centre has been resolved to a high level of detail including some provision for cyclists and pedestrians, with Carphin Drive and Walcott Avenue key links into the District Centre with shared paths leading to the Main Street. The northern end of Walcott Avenue is also proposed to be a shared street for cyclists and vehicles that improves cyclist amenity. There is also provision for a shared path along the rail alignment to the west providing north-south connectivity around the District Centre.

The District Centre should allow for strong cycle links to the east tying into the school and planned PSP that will run adjacent to the Freeway. The existing District Centre Plan has some disconnect over the rail alignment for both pedestrians and cyclists which will need to be resolved.

Pedestrian connectivity between Pipidiny Road and Carphin Drive is adjacent to the temporary access road extending from Walcott Avenue to the north. Eglinton Station is also connected by a pedestrian link from the Main Street through the Station Square.

9 Parking

The Eglinton Activity Centre has been resolved to a high level of detail and further planning will be required in order to resolve details regarding on and off street parking and servicing for the centre. It is recommended that this is covered through detailed design in a Centre Parking strategy in line with State Planning Policy 4.2.

The DSP established principles for Urban Design and Open Space Design. This included a principle to create improved accessibility through:

A well designed place is more walkable, is safe for pedestrians, is compatible with public transit, reduces need for cars and parking, is a more efficient use of time and money for residents and visitors and has a greater connection between uses.

Source: Alkimos Eglinton District Structure Plan March 2016 (Part 2, Explanatory Section).

The LSP also stipulated that:

- Encourage retail parking to be accommodated behind shops, in underground or rooftop form.
- A mix of informal on-street and formal embayed car parking is considered the most effective for visitor car parking.
- Within the vicinity of the proposed Eglinton Station, there is the opportunity to unbundle the sale of residential parking from the sale of units to allow for the more efficient allocation of bays.
- Private vehicle trips within the LSP should be mitigated through appropriate levels of car parking supply and management regime. The management should incorporate dwell time limits, time-based fees, and maximise the supply of short term public compared to long term private parking.

It will be particularly important that a parking management regime is developed that strikes a balance between the demands for long term parking for commuters using Eglinton Station and the need for short term parking to service the centre.

10 Summary and Conclusions

Arup has prepared this Transport Assessment for the proposed Eglinton Activity Centre. Planning for the centre has been informed by the frameworks established at district and local structure planning.

Traffic modelling has been undertaken to inform the preparation of this activity centre plan and has confirmed that the internal road network will operate within capacity. Key locations at ultimate build out, such as the main street, are expected to operate with levels of busyness but within capacity and at levels suitable for a district centre in peak conditions.

Traffic volumes on the external network as forecast within the MRWA ROM 24 model, as an input to this modelling, are escalated for Eglinton Drive and Marmion Avenue and have highlighted strategic capacity issues. It is recommended that MRWA undertake a review of the ROM model in this region to better understand the volumes, function and form on this part of the network. This may include a need for DPLH to review the demographic forecasts for the corridor, which are an input to the ROM model.

Planning for Eglinton Station including the PnR bays in terms of their location and access arrangements are being refined. It is recommended that this planning sees sufficient distribution of bays and resultant link volumes that are in line with the planned street classification.

Subsequent detailed planning of the centre will establish further details for the movement network including street cross sections, pedestrian crossings, access and layout of off street car parking, provisions for on street parking and service vehicle access.

Appendix A

MRWA Regional Operations
Model volume plots 2021 and
2031

2021 Link Volume Plot for Eglinton Activity Centre Structure Plan

All Day

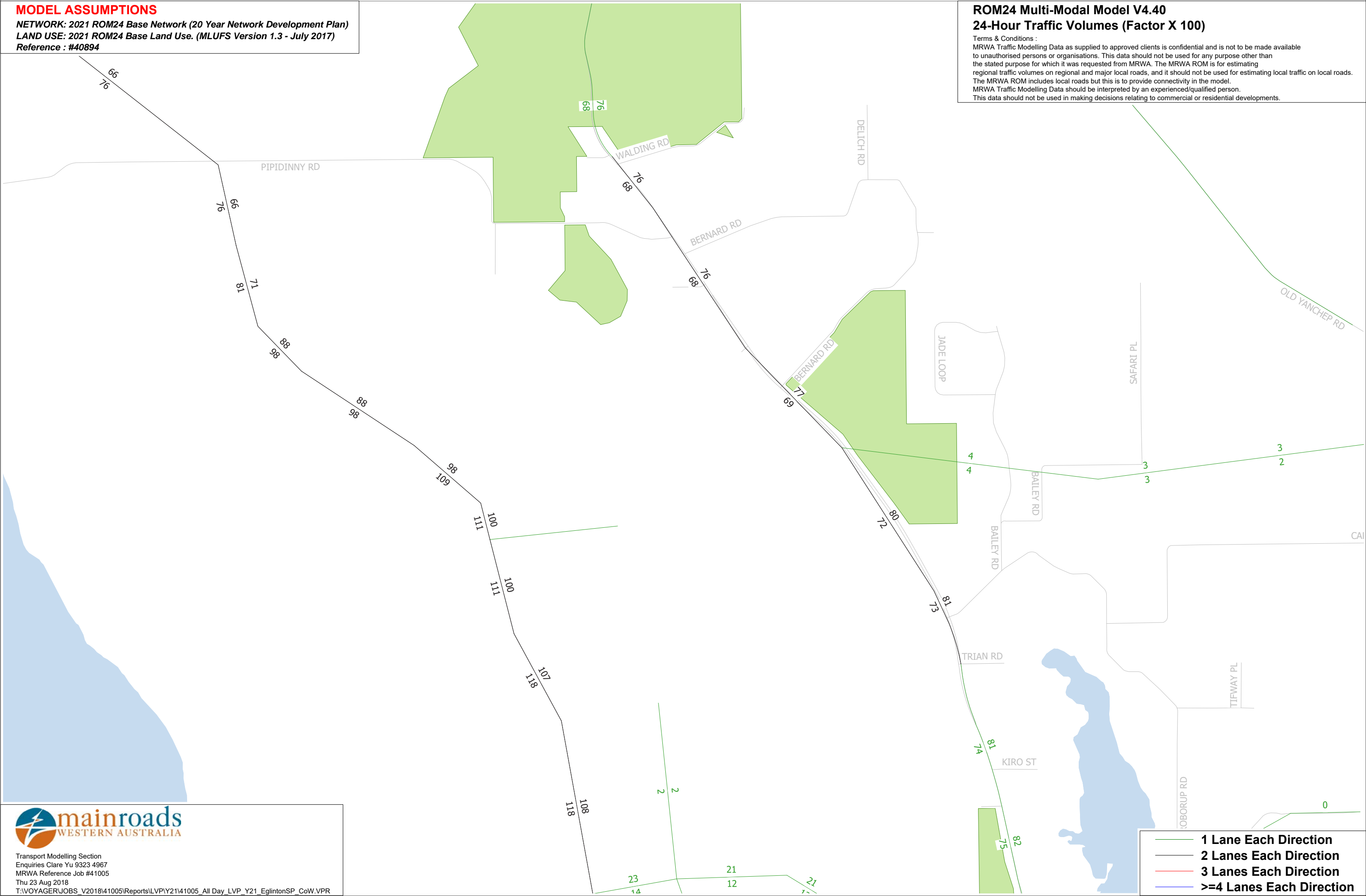
MODEL ASSUMPTIONS

NETWORK: 2021 ROM24 Base Network (20 Year Network Development Plan)
 LAND USE: 2021 ROM24 Base Land Use. (MLUFS Version 1.3 - July 2017)
 Reference : #40894

ROM24 Multi-Modal Model V4.40

24-Hour Traffic Volumes (Factor X 100)

Terms & Conditions :
 MRWA Traffic Modelling Data as supplied to approved clients is confidential and is not to be made available to unauthorised persons or organisations. This data should not be used for any purpose other than the stated purpose for which it was requested from MRWA. The MRWA ROM is for estimating regional traffic volumes on regional and major local roads, and it should not be used for estimating local traffic on local roads. The MRWA ROM includes local roads but this is to provide connectivity in the model. MRWA Traffic Modelling Data should be interpreted by an experienced/qualified person. This data should not be used in making decisions relating to commercial or residential developments.



Transport Modelling Section
 Enquiries Clare Yu 9323 4967
 MRWA Reference Job #41005
 Thu 23 Aug 2018
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2021 Link Volume Plot for Eglinton Activity Centre Structure Plan AM Peak - 7am to 9am

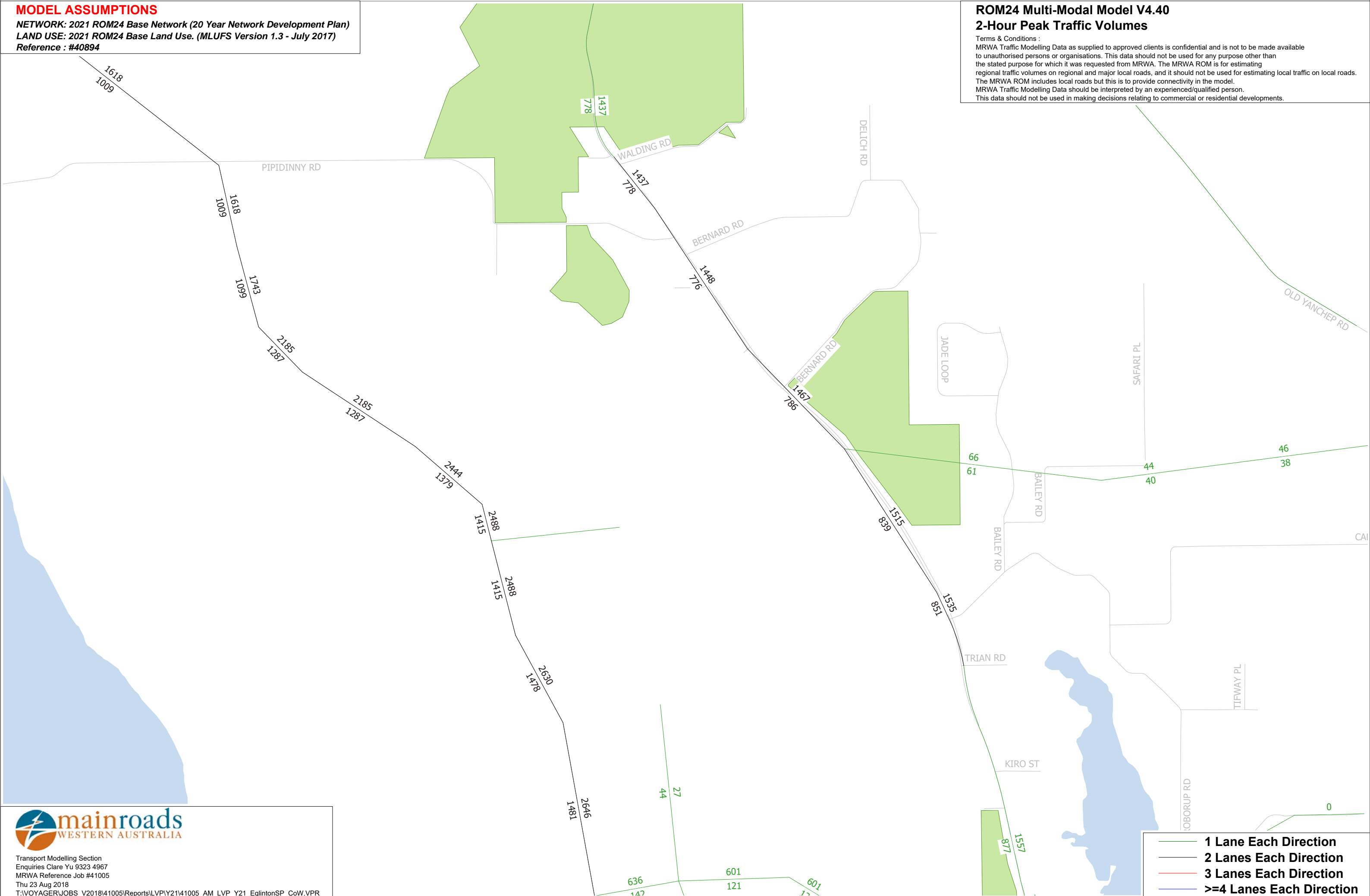
MODEL ASSUMPTIONS

NETWORK: 2021 ROM24 Base Network (20 Year Network Development Plan)
 LAND USE: 2021 ROM24 Base Land Use. (MLUFS Version 1.3 - July 2017)
 Reference : #40894

ROM24 Multi-Modal Model V4.40

2-Hour Peak Traffic Volumes

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- 1 Lane Each Direction
- 2 Lanes Each Direction
- 3 Lanes Each Direction
- >=4 Lanes Each Direction



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2031 Link Volume Plot for Eglinton Activity Centre Structure Plan

All Day

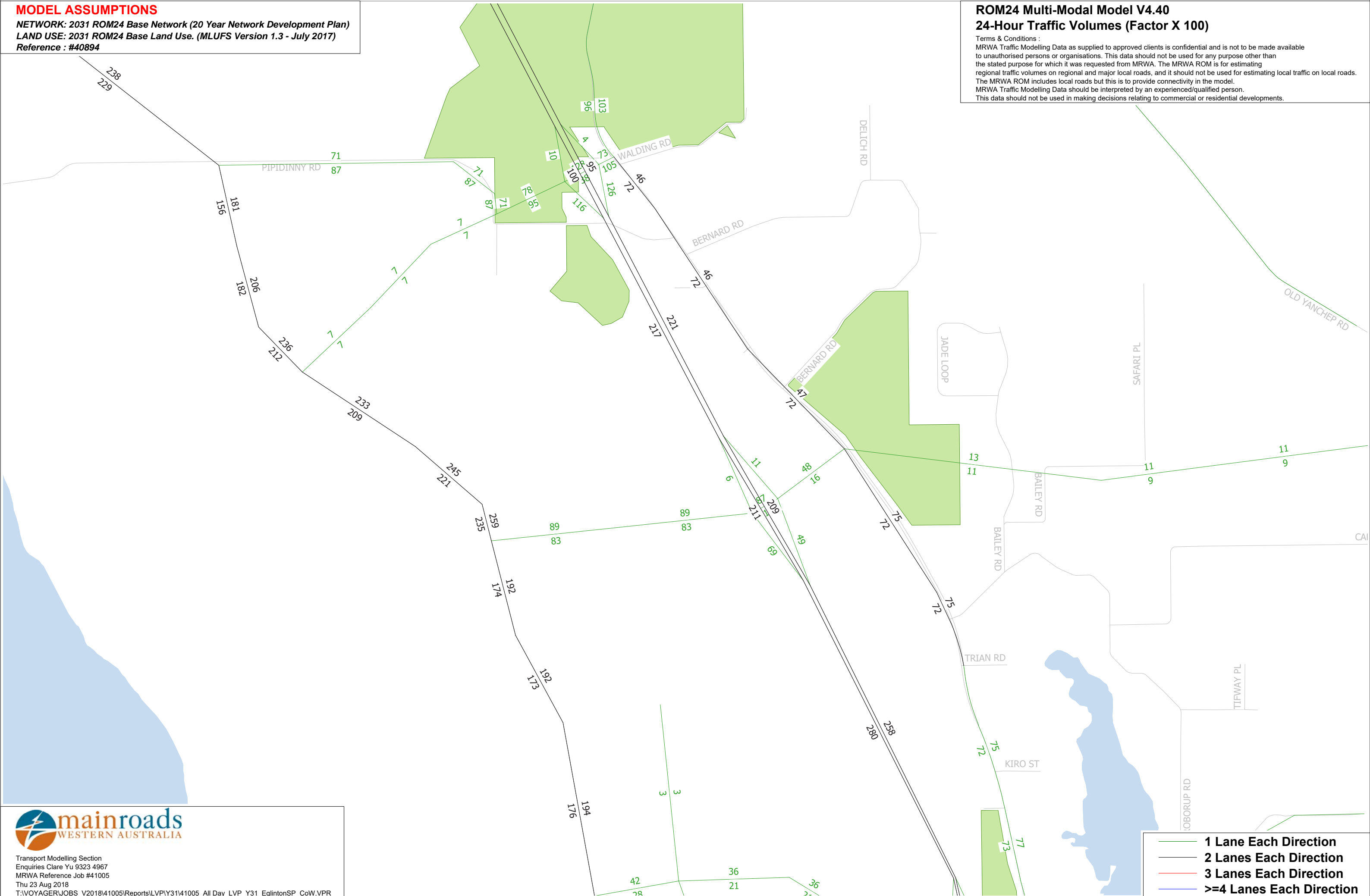
MODEL ASSUMPTIONS

NETWORK: 2031 ROM24 Base Network (20 Year Network Development Plan)
LAND USE: 2031 ROM24 Base Land Use. (MLUFS Version 1.3 - July 2017)
Reference : #40894

ROM24 Multi-Modal Model V4.40

24-Hour Traffic Volumes (Factor X 100)

Terms & Conditions :
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- 1 Lane Each Direction
- 2 Lanes Each Direction
- 3 Lanes Each Direction
- >=4 Lanes Each Direction

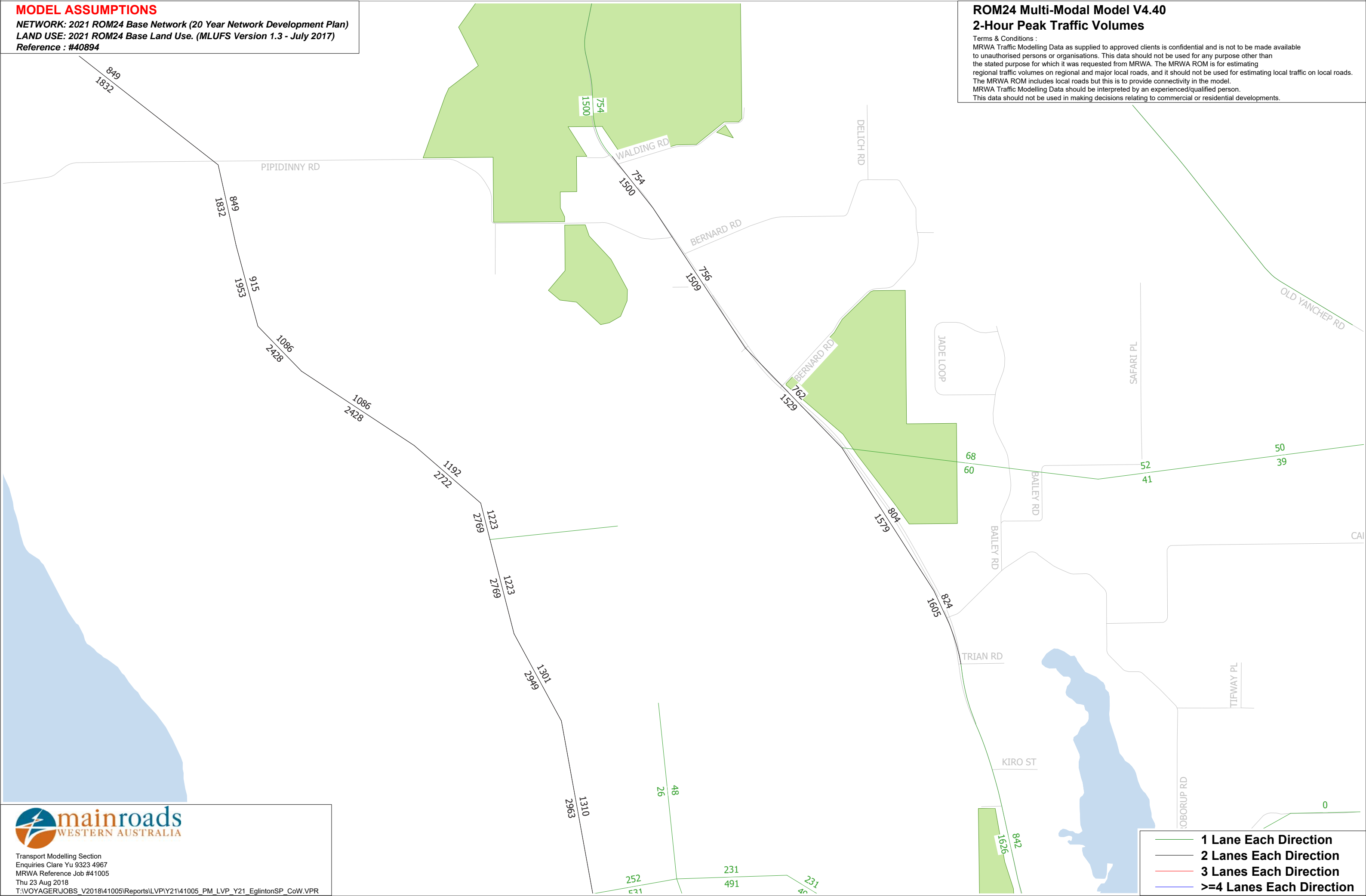
2021 Link Volume Plot for Eglinton Activity Centre Structure Plan PM Peak - 4pm to 6pm

MODEL ASSUMPTIONS

NETWORK: 2021 ROM24 Base Network (20 Year Network Development Plan)
 LAND USE: 2021 ROM24 Base Land Use. (MLUFS Version 1.3 - July 2017)
 Reference : #40894

ROM24 Multi-Modal Model V4.40 2-Hour Peak Traffic Volumes

Terms & Conditions :
 MRWA Traffic Modelling Data as supplied to approved clients is confidential and is not to be made available to unauthorised persons or organisations. This data should not be used for any purpose other than the stated purpose for which it was requested from MRWA. The MRWA ROM is for estimating regional traffic volumes on regional and major local roads, and it should not be used for estimating local traffic on local roads. The MRWA ROM includes local roads but this is to provide connectivity in the model. MRWA Traffic Modelling Data should be interpreted by an experienced/qualified person. This data should not be used in making decisions relating to commercial or residential developments.



Transport Modelling Section
 Enquiries Clare Yu 9323 4967
 MRWA Reference Job #41005
 Thu 23 Aug 2018
 T:\VOYAGER\JOBS_V2018\41005\Reports\LV\P\Y21\41005_PM_LVP_Y21_EglintonSP_CoW.VPR

- 1 Lane Each Direction
- 2 Lanes Each Direction
- 3 Lanes Each Direction
- >=4 Lanes Each Direction

2031 Link Volume Plot for Eglinton Activity Centre Structure Plan AM Peak - 7am to 9am

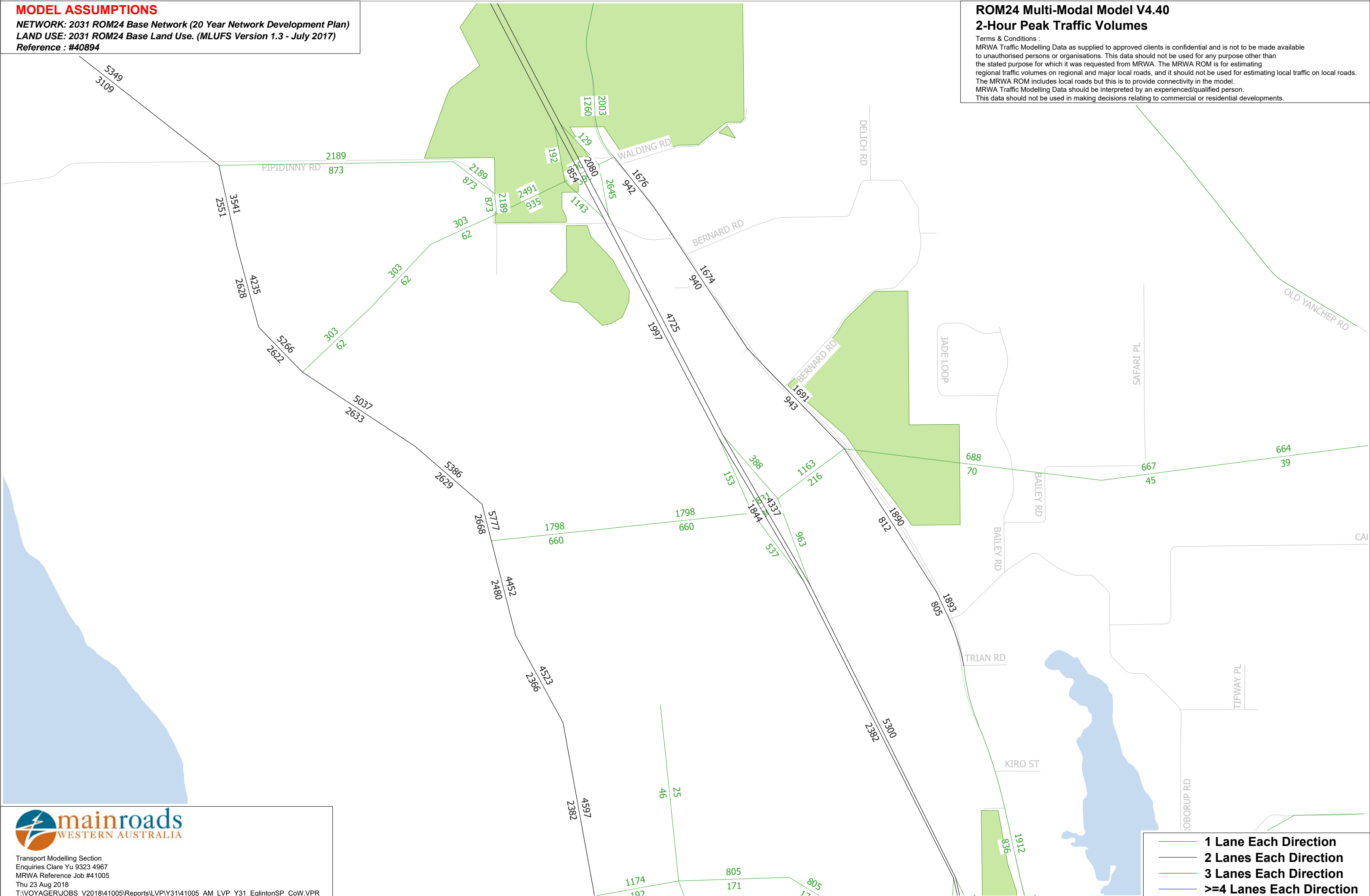
MODEL ASSUMPTIONS

NETWORK: 2031 ROM24 Base Network (20 Year Network Development Plan)
LAND USE: 2031 ROM24 Base Land Use. (MLUFS Version 1.3 - July 2017)
Reference : #40894

ROM24 Multi-Modal Model V4.40

2-Hour Peak Traffic Volumes

Terms & Conditions :
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Transport Modelling Section
 Enquiries Clare Yu 9323 4967
 MRWA Reference Job #41005
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2031 Link Volume Plot for Eglinton Activity Centre Structure Plan

PM Peak - 4pm to 6pm

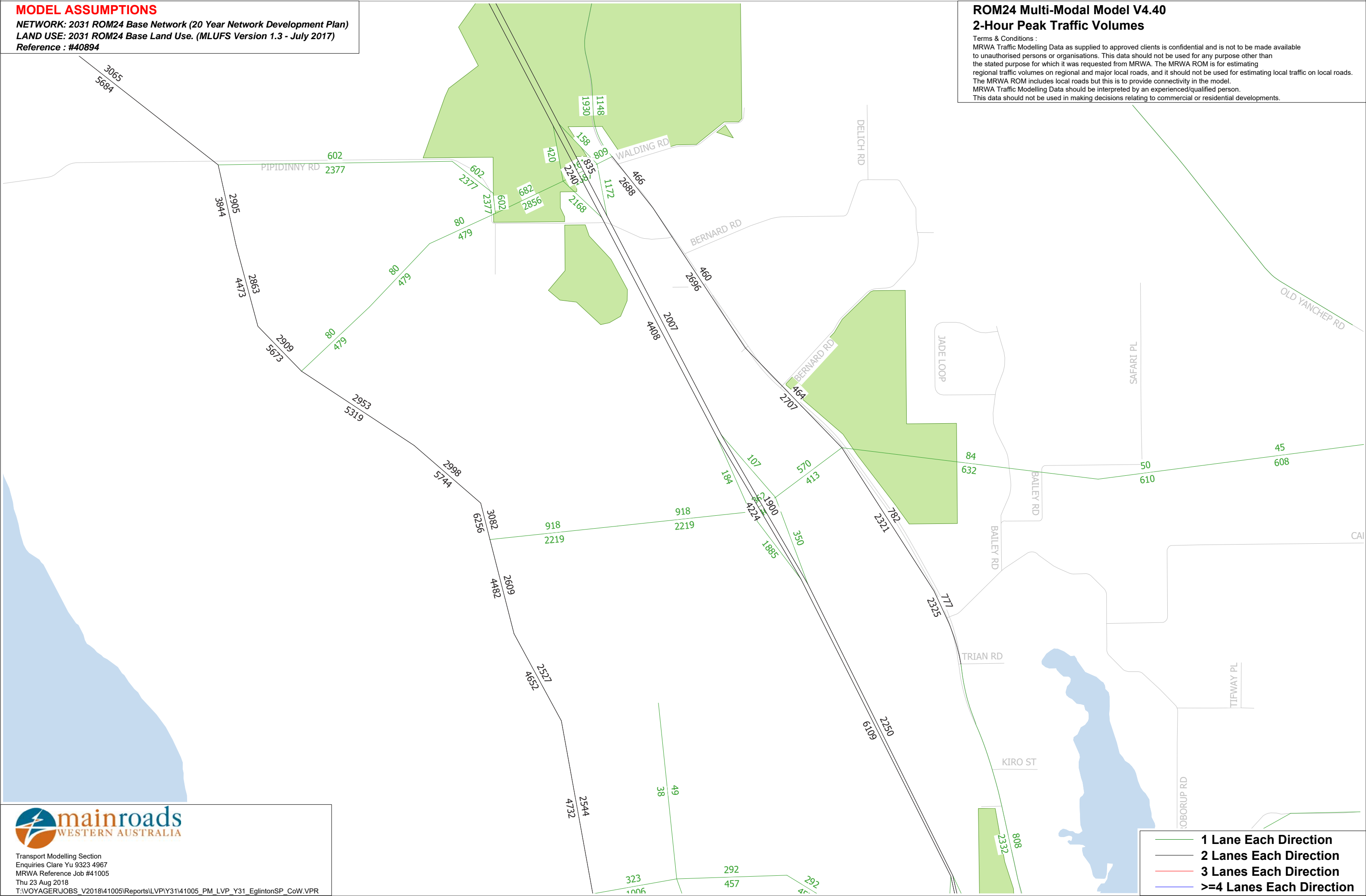
MODEL ASSUMPTIONS

NETWORK: 2031 ROM24 Base Network (20 Year Network Development Plan)
 LAND USE: 2031 ROM24 Base Land Use. (MLUFS Version 1.3 - July 2017)
 Reference : #40894

ROM24 Multi-Modal Model V4.40

2-Hour Peak Traffic Volumes

Terms & Conditions :
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 MRWA Reference Job #41005
 Thu 23 Aug 2018
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- 1 Lane Each Direction
- 2 Lanes Each Direction
- 3 Lanes Each Direction
- >=4 Lanes Each Direction

Appendix B

Trip Generation

Table B12 – Trip generation for residential and education uses

Development Cell	Development Type	AM Peak Trip Rates				PM Peak Trip Rates				Source	Yield (2025) (m2)	Yield (2040) (m2)	Unit	2025 AM Trips			2025 PM Trips			2040 AM Trips			2040 PM Trips		
		Total	IN	OUT	Unit	Total	IN	OUT	Unit					Total	IN	OUT	Total	IN	OUT	Total	IN	OUT	Total	IN	OUT
1	Retirement Village	0.29	0.07	0.22	unit	0.29	0.07	0.22	unit	DPTI 2014	0	75	Unit	0	0	0	0	0	0	22	5	16	22	5	16
2	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016	50	12	Dwelling	40	10	30	40	25	15	10	2	7	10	6	4
3	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		8	Dwelling							6	2	5	6	4	2
4	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		8	Dwelling							6	2	5	6	4	2
5	Residential R60-R80	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		8	Dwelling							6	2	5	6	4	2
6	Residential R60-R80	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		8	Dwelling							6	2	5	6	4	2
7	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		9	Dwelling							7	2	5	7	5	3
8	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		9	Dwelling							7	2	5	7	5	3
9	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		8	Dwelling							6	2	5	6	4	2
10	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		8	Dwelling							6	2	5	6	4	2
11	Residential R60-R80	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		9	Dwelling							7	2	5	7	5	3
12	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		4	Dwelling							3	1	2	3	2	1
13	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		8	Dwelling							6	2	5	6	4	2
14	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		8	Dwelling							6	2	5	6	4	2
15	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		4	Dwelling							3	1	2	3	2	1
16	Residential R80 multi-unit	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		107	Dwelling							86	21	64	86	54	32
17	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		16	Dwelling							13	3	10	13	8	5
18	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		18	Dwelling							14	4	11	14	9	5
19	Residential R60-R80	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		6	Dwelling							5	1	4	5	3	2
20	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		17	Dwelling							14	3	10	14	9	5
21	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		4	Dwelling							3	1	2	3	2	1
22	Residential R30	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		165	Dwelling							132	33	99	132	83	50
23	Residential R25	0.8	0.2	0.6	Dwelling	0.8	0.5	0.3	Dwelling	DoP WA 2016		70	Dwelling							56	14	42	56	35	21
Education	Schools	1	0.5	0.5	Students	1	0.5	0.16*	Students	DoP WA 2016		420	1220							Students	420	210	210	420	210
Total														460	220	240	460	235	82.8	1653	718	935	1653	872	367

*As the PM school peak does not coincide with the commuter peak, this rate was adjusted using the PM distribution of trips for schools from the UK TRICS (2016) database.

Table B13 - Trip generation for non-residential

Detailed Description	High Level Description	AM Peak Trip Rates (100m2)			PM Peak Trip Rates (100m2)			Source	Yield (2025) (m2)	Yield (2040) (m2)	2025 AM Trips			2025 PM Trips			2040 AM Trips			2040 PM Trips		
		Total	IN	OUT	Total	IN	OUT				Total	IN	OUT	Total	IN	OUT	Total	IN	OUT	Total	IN	OUT
Discount Department Store	Retail (Non-Food)	1.25	1	0.25	4	2	2	DPTI 2014	0	5000	0	0	0	0	0	0	63	50	13	200	100	100
Supermarket	Retail (Non-Food)	1.25	1	0.25	4	2	2	DPTI 2014	5600	9600	70	56	14	224	112	112	120	96	24	384	192	192
Mini Majors	Retail (Non-Food)	1.25	1	0.25	4	2	2	DPTI 2014	500	2000	6	5	1	20	10	10	25	20	5	80	40	40
Speciality Shops	Retail (Non-Food)	1.25	1	0.25	4	2	2	DoP WA 2016	3000	7000	38	30	8	120	60	60	88	70	18	280	140	140
Motor Vehicle Services	Retail (Non-Food)	1.25	1	0.25	4	2	2	DoP WA 2016	400	1000	5	4	1	16	8	8	13	10	3	40	20	20
Medical Centre	Retail (Non-Food)	1.25	1	0.25	4	2	2	DoP WA 2016	800	2200	10	8	2	32	16	16	28	22	6	88	44	44
Real Estate/ Finance/ Insurance	Retail (Non-Food)	1.25	1	0.25	4	2	2	DoP WA 2016	900	2500	11	9	2	36	18	18	31	25	6	100	50	50
Retail/ Trade Services	Retail (Non-Food)	1.25	1	0.25	4	2	2	DoP WA 2016	1000	3000	13	10	3	40	20	20	38	30	8	120	60	60
Travel Agency	Retail (Non-Food)	1.25	1	0.25	4	2	2	DoP WA 2016	100	200	1	1	0	4	2	2	3	2	1	8	4	4
Pub/ Tavern	Retail (Non-Food)	1.25	1	0.25	4	2	2	DPTI 2014	300	1000	4	3	1	12	6	6	13	10	3	40	20	20
External	Bulky Goods	2.31	1.85	0.46	2.31	0.46	1.85	DPTI 2014	1500	3500	35	28	7	35	7	28	81	65	16	81	16	65
Hardware	Bulky Goods	2.31	1.85	0.46	2.31	0.46	1.85	DPTI 2014	1300	3900	30	24	6	30	6	24	90	72	18	90	18	72
Furniture	Bulky Goods	2.31	1.85	0.46	2.31	0.46	1.85	DPTI 2014	400	1200	9	7	2	9	2	7	28	22	6	28	6	22
Automotive Accessories	Bulky Goods	2.31	1.85	0.46	2.31	0.46	1.85	DPTI 2014	400	1200	9	7	2	9	2	7	28	22	6	28	6	22
Other	Bulky Goods	2.31	1.85	0.46	2.31	0.46	1.85	DPTI 2014	600	1700	14	11	3	14	3	11	39	31	8	39	8	31
Church/ Community Use	Commercial (Civic)	2	1.6	0.4	2	0.4	1.6	DoP WA 2016	900	2600	18	14	4	18	4	14	52	42	10	52	10	42
Libraries	Commercial (Civic)	2	1.6	0.4	2	0.4	1.6	DoP WA 2016	300	1000	6	5	1	6	1	5	20	16	4	20	4	16
Sporting Facilities	Commercial (Civic)	2	1.6	0.4	2	0.4	1.6	DoP WA 2016	600	1700	12	10	2	12	2	10	34	27	7	34	7	27
Gyms	Gymnasium	5	2.5	2.5	9	5.4	3.6	RTA NSW	900	2500	45	23	23	81	49	32	125	63	63	225	135	90
Cinemas/ Other Entertainment	Movie Theatre w/o matinee	0	0	0	66	62	4	ITE	300	1000	0	0	0	20	19	1	0	0	0	66	62	4
Child care	Childcare (long day)	0.8	0.4	0.4	0.7	0.4	0.35	RTA NSW	52		42	21	21	36	18	18						
Child care	Childcare (long, pre-school, before/ after)	0.9	0.45	0.45	0.7	0.4	0.35	RTA NSW		221							199	99	99	155	77	77
										Contingency (20%)	75.4	55	20.3	155	73	82	223	159	64	432	204	228
										Total	453	331	122	930	437	493	1338	954	385	2590	1223	1367

Appendix C

Aimsun modelling outputs

Volume Capacity Ratio 2021 (400 Bays)

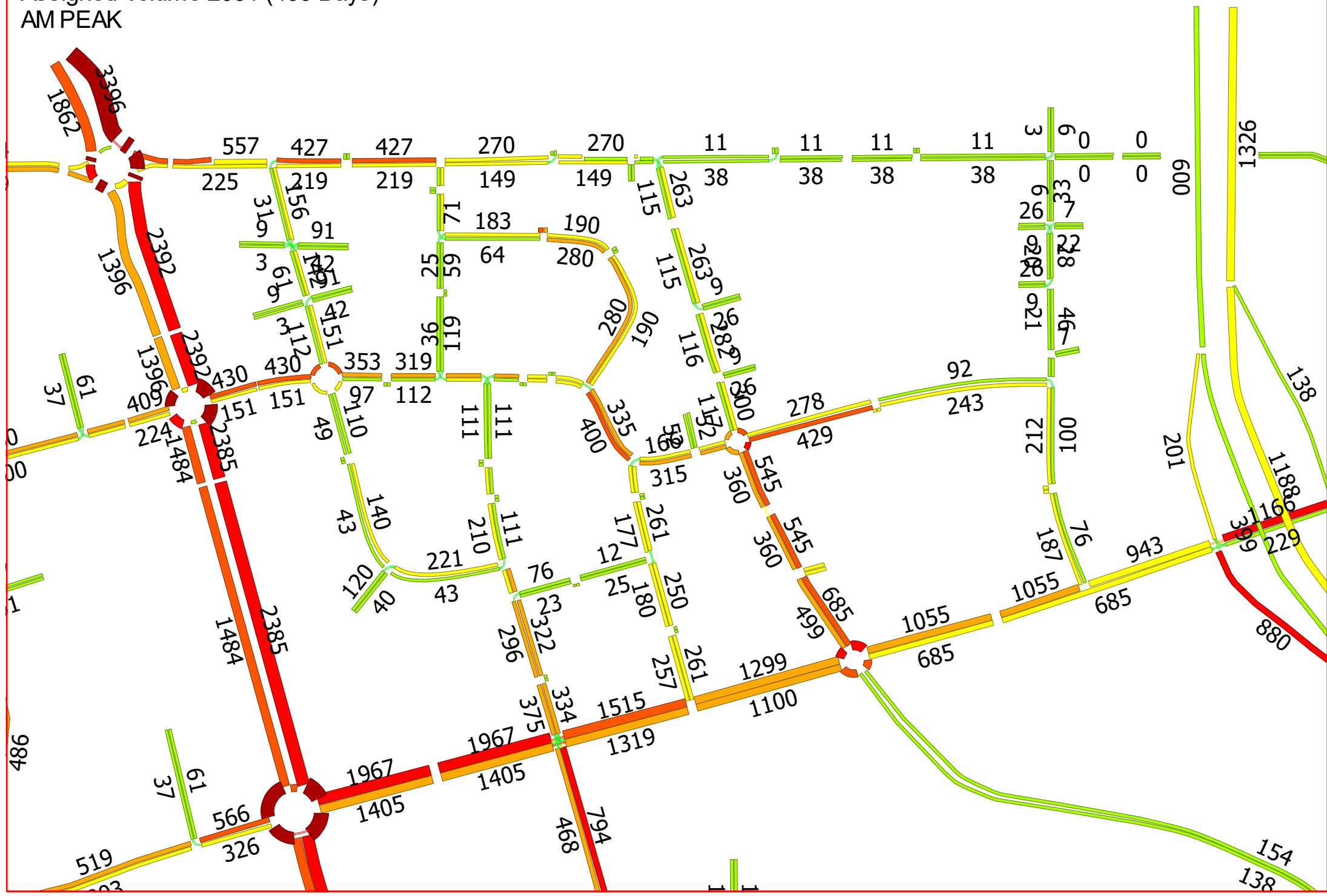
AM Peak



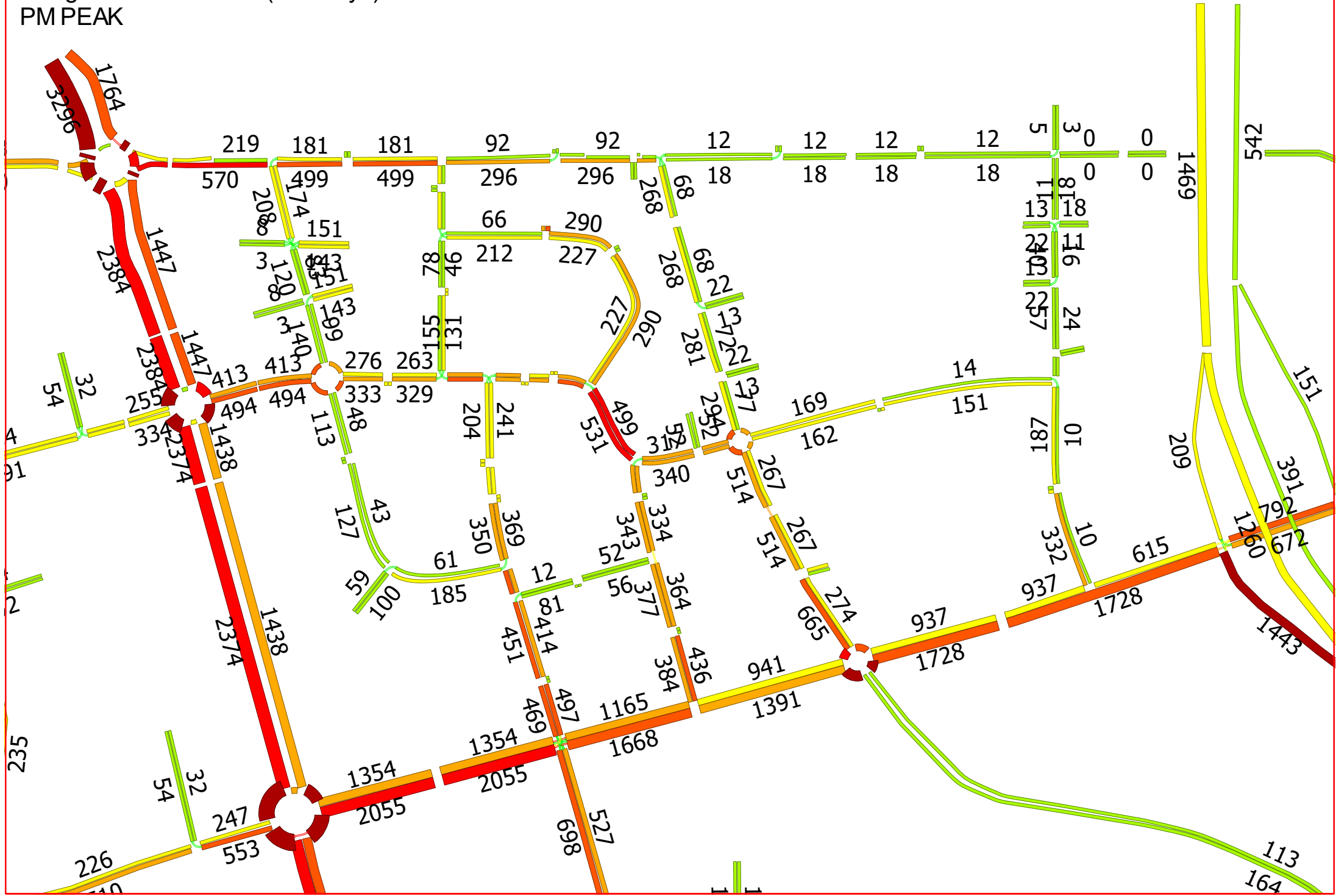
Volume Capacity Ratio 2021 (400 Bays) PM Peak



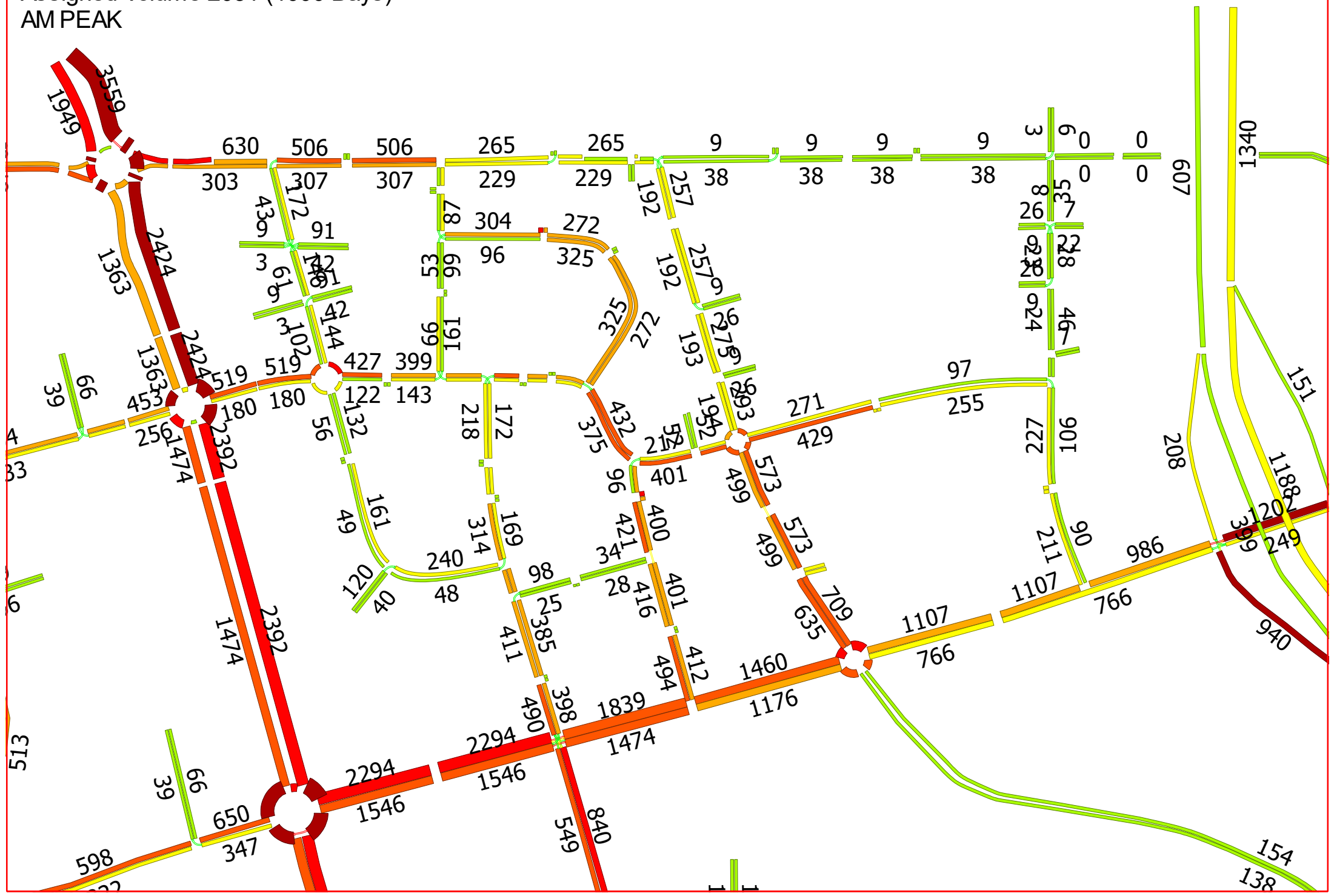
Assigned Volume 2031 (400 Bays)
AM PEAK



Assigned Volume 2031 (400 Bays)
PM PEAK



Assigned Volume 2031 (1000 Bays)
AM PEAK



APPENDIX C BUSHFIRE MANAGEMENT PLAN



Fire Protection
Association Australia
Life. Property. Environment.



Bushfire Management Plan Coversheet

This Coversheet and accompanying Bushfire Management Plan has been prepared and issued by a person accredited by Fire Protection Association Australia under the Bushfire Planning and Design (BPAD) Accreditation Scheme.

Bushfire Management Plan and Site Details

Site Address / Plan Reference: Lot 800 and Part Lot 803

Suburb: Eglinton

State: WA

P/code: 6034

Local government area: City of Wanneroo

Description of the planning proposal: Activity Centre Structure Plan

BMP Plan / Reference Number: WMA18456.01

Version: R001 Rev 0

Date of Issue: 08/03/2019

Client / Business Name: Eglinton Estates Pty Ltd

Reason for referral to DFES

Has the BAL been calculated by a method other than method 1 as outlined in AS3959 (tick no if AS3959 method 1 has been used to calculate the BAL)?

Have any of the bushfire protection criteria elements been addressed through the use of a performance principle (tick no if only acceptable solutions have been used to address all of the BPC elements)?

Is the proposal any of the following special development types (see SPP 3.7 for definitions)?

Unavoidable development (in BAL-40 or BAL-FZ)

Strategic planning proposal (including rezoning applications)

Minor development (in BAL-40 or BAL-FZ)

High risk land-use

Vulnerable land-use

If the development is a special development type as listed above, explain why the proposal is considered to be one of the above listed classifications (E.g. considered vulnerable land-use as the development is for accommodation of the elderly, etc.)?

Strategic Planning Proposal

Note: The decision maker (e.g. local government or the WAPC) should only refer the proposal to DFES for comment if one (or more) of the above answers are ticked "Yes".

BPAD Accredited Practitioner Details and Declaration

Name

Zac Cockerill

Accreditation Level

Level 2

Accreditation No.

BPAD 37803

Accreditation Expiry

31/08/2019

Company

Strategen Environmental

Contact No.

(08) 9792 4797

I declare that the information provided within this bushfire management plan is to the best of my knowledge true and correct

Signature of Practitioner

Date 08/03/2019



intelligent outcomes | respected experience

Eglinton District Centre, Activity Centre Structure Plan

Bushfire Management Plan

Prepared for
Eglinton Estates Pty Ltd
by Strategen

March 2019



Eglinton District Centre, Activity Centre Structure Plan

Bushfire Management Plan

Strategen is a trading name of
Strategen Environmental Consultants Pty Ltd
Level 1, 50 Subiaco Square Road Subiaco WA 6008
ACN: 056 190 419

March 2019

Limitations

Scope of services

This report ("the report") has been prepared by Strategen Environmental Consultants Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

Document control

Client: Eglinton Estates Pty Ltd

Report Version	Revision No.	Purpose	Strategen author	Reviewed by	Submitted to Client	
					Form	Date
Draft Report	Rev A	For client review	Louisa Robertson (BPAD36748)	Zac Cockerill (BPAD37803)	Electronic (email)	31/01/2019
Final Report	Rev 0	For submission	Louisa Robertson (BPAD36748)	Zac Cockerill (BPAD37803)	Electronic (email)	08/03/2019

Filename: WMA18456_01 R001 Rev 0 - 8 March 2019

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Appendix 2 APZ standards (Schedule 1)
Appendix 3 Vehicular access technical standards
Appendix 4 City of Wanneroo Firebreak and Fuel Hazard Reduction Notice (2018/19)
Appendix 5 Water technical standards

1. Proposal details

1.1 Background

Urbis on behalf of Eglington Hill is seeking to lodge an Activity Centre Structure Plan application to guide future development of the Eglington Activity Centre as a District Centre. The Eglington District Centre (the project area) is located in the municipality of the City of Wanneroo and encompasses Lot 800 and Part Lot 803. The Activity Centre Structure Plan (ACSP; Figure 1) identifies:

- R30 to R80 residential zones
- Commercial zones
- Service commercial zones
- Education zone
- Railway reserve (for future rail infrastructure) and railway station
- Station square
- Park and ride facilities
- Transfer station
- Public road network
- Temporary access road between Pipidinny Road and Carphin Drive
- Public Open Space (POS) and drainage.

1.2 Site description

The project area comprises approximately 55 ha within Lot 800 and part Lot 803 and is bound by (see Figure 2):

- Pipidinny Road to the north
- Lot 801 to the south
- part Lot 803 to the east
- Marmion Avenue to the west.

The project area is centrally bisected by Lot 802, which is the future rail corridor extending in a north-south direction that is located partially within the bounds of the project area.

The entirety of the project area is designated as being bushfire prone on the *Map of Bush Fire Prone Areas* (DFES 2018).

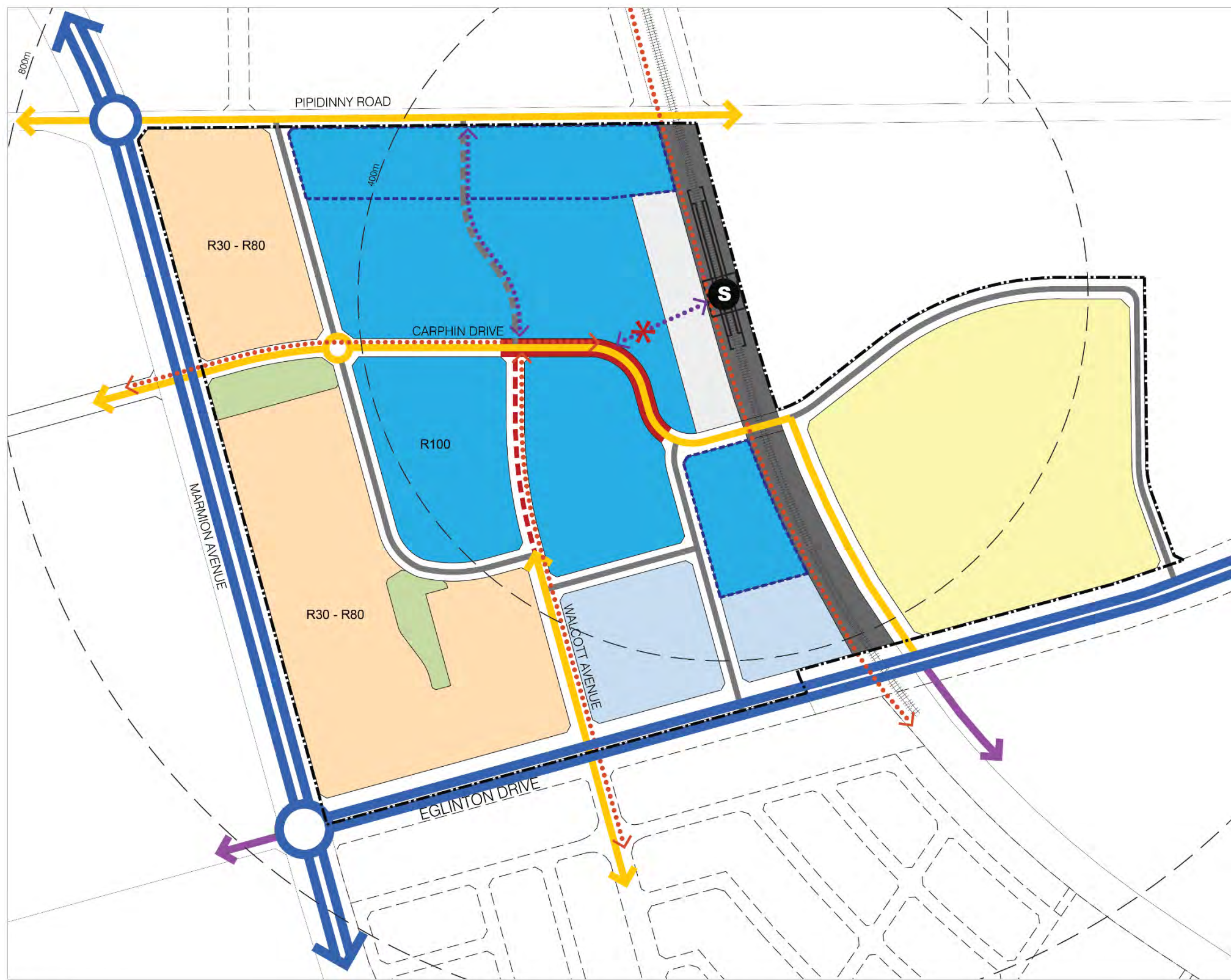
1.3 Purpose

This Bushfire Management Plan (BMP) has been prepared to address requirements under Policy Measure 6.3 of *State Planning Policy 3.7 Planning in Bushfire-Prone Areas* (SPP 3.7; WAPC 2015) and *Guidelines for Planning in Bushfire-Prone Areas* (the Guidelines; WAPC 2017).

1.4 Other plans/reports

A previous BMP was prepared by Strategen in 2016 to guide future development of the Eglington Local Structure Plan No. 82, which includes the project area (Strategen, 2016).

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LEGEND	
	APPLICATION AREA
ZONES	
	RESIDENTIAL
	COMMERCIAL
	SERVICE COMMERCIAL
	EDUCATION
RESERVES	
	PUBLIC OPEN SPACE AND DRAINAGE
	INTEGRATOR ROAD A
	INTEGRATOR ROAD A
	NEIGHBOURHOOD CONNECTOR ROAD
	MAJOR ACCESS ROAD
	RAILWAY RESERVE
	TRANSFER STATION
OTHER	
	RAILWAY STATION
	WALKABLE CATCHMENT 400/800M
	TEMPORARY ACCESS ROAD
	MAIN STREET
	SHARED STREET
	SHARED PATH
	KEY PEDESTRIAN LINKAGES
	STATION SQUARE
	PARK AND RIDE FACILITIES

BIS Eglinton District Centre
Activity Centre Structure Plan
Level 14, The Quadrant, 1 William Street | Perth WA 6000 Australia | +61 8 9346 0500 | URBIS Pty Ltd | ABN 50 105 256 228

DATA SOURCE
Landgate & MNG
PROJECTION
MGA Zone 50

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CLIENT
Woodsome

PROJECT NO.
PA1523
DRAWING NO.
02

DATE
18.12.18
REVISION
B

Source: Urbis 18/12/2018

Figure 1: Activity Centre Local Structure Plan



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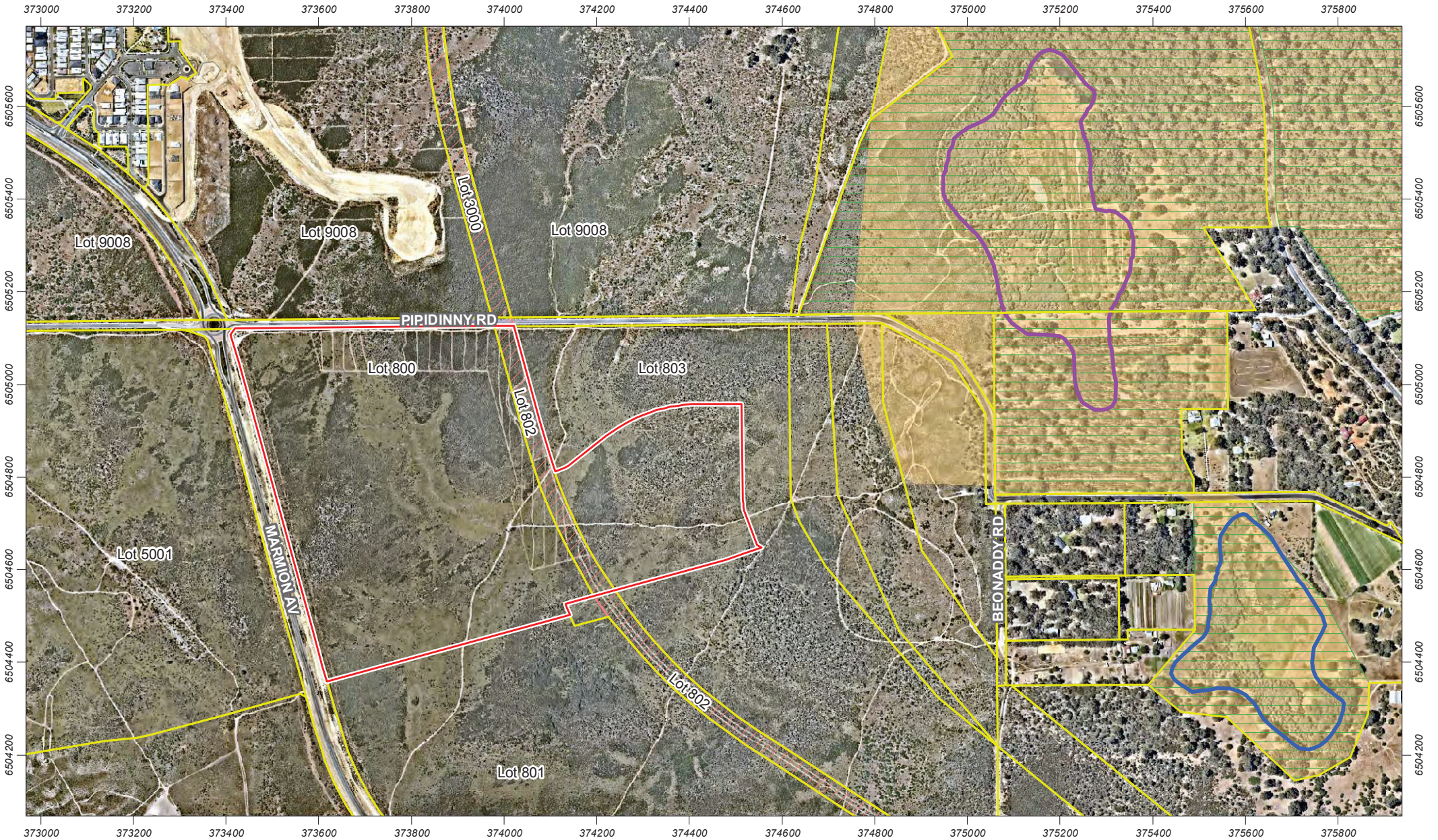


Figure 2: Site overview

Scale 1:11,000 at A4

Coordinate System: GDA 1994 MGA Zone 50
Date: 17/01/2019

Legend

 Project area	 Cadastre	Wetland category	 Yanchep National Park
 Future rail corridor	 Conservation	 Resource Enhancement	 Bush Forever Site 288

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2. Environmental considerations

2.1 Native vegetation – modification and clearing

The majority of the project area contains remnant shrubland/scrub vegetation that will be cleared as part of the proposal. Table 1 provides a summary of a search of publicly available environmental data with significance to the project area.

Environmental impacts resulting from implementation of the proposal will need to be addressed under standard State and Federal environmental assessment and referral requirements under the *Environmental Protection Act 1986* and *Environment Protection and Biodiversity Conservation Act 1999*.

Table 1: Summary of environmental values

Environmental value	Present within or adjacent to project area	Description
Environmentally Sensitive Area	Within and adjacent	The project area and a large proportion of land within the City of Wanneroo is located within an Environmentally Sensitive Area.
Swan Bioplan Regionally Significant Natural Area	No	N/A.
Wetlands	Adjacent	A Conservation Category Wetland and a Resource Enhancement Wetland are located within 1 km east of the project area.
Waterways	No	There are no known waterways within or adjacent to the project area.
Threatened Ecological Communities listed under the EPBC Act	Within	The endangered banksia woodlands of the swan coastal plain TEC is mapped as having potential to occur within the project area.
Threatened and priority flora	No	No threatened and priority flora are mapped as occurring within the project area.
Fauna habitat listed under the EPBC Act	Within	The project area is mapped as being a confirmed Carnaby's Black Cockatoo breeding area and confirmed roosting area. A portion of the project area is mapped as being a potential feeding area. The project area is mapped as containing potential Quenda habitat.
Threatened and priority fauna	Within	The project area is mapped as containing confirmed records of Endangered and Priority fauna species.
Bush Forever Site	Adjacent	Bush Forever Site 288 is located within 1 km east of the project area.
DBCA managed lands and waters (includes legislated lands and waters and lands of interest)	Adjacent	Yanchep National Park is located within 1 km east of the project area (within Bush Forever Site 288).
Conservation covenants	No	No conservation covenants are known to occur over the project area.

2.2 Revegetation / Landscape Plans

The full extent of native vegetation to be retained within the project area will be determined at future planning stages through final allocation of POS and the development of a Landscape Plan. The ACSP (Figure 1) includes a conceptual plan for POS areas which are expected to comprise low threat landscaping in accordance with *AS 3959—2009 Construction of Buildings in Bushfire-Prone Areas* (AS 3959; SA 2009) Clause 2.2.3.2 (f).

3. Bushfire assessment results

3.1 Assessment inputs

3.1.1 Effective slope

Strategen assessed effective slope under classified vegetation through on-ground verification on 10 August 2018 in accordance with AS 3959. Results were cross-referenced with DAFWA 2 m contour data and are depicted in Table 2, Table 3 and Figure 3.

Site observations indicate that slope within the project area and adjacent 150 m assessment area is undulating, with effective slopes ranging from between >0 to 15° downslope.

3.1.2 Vegetation classification

Strategen assessed effective slope and classified vegetation and exclusions within 150 m of the project area through on-ground verification on 14 September 2018 in accordance with AS 3959 and the *Visual Guide for Bushfire Risk Assessment in Western Australia* (DoP, 2016). Georeferenced site photos and a description of the vegetation classifications and exclusions are contained in Appendix 2.

3.1.3 Pre-development inputs

A summary of the assessed pre-development classified vegetation, exclusions and effective slope within the assessment area are listed in Table 2 and illustrated in Figure 3.

Table 2: Pre-development vegetation classifications/exclusions and effective slope

Vegetation plot	Vegetation classification/exclusion	Effective slope under classified vegetation	Comments
1	Class D Scrub	Downslope >0-5°	Scrub vegetation north of Pipidinny Road.
2	Class D Scrub	Downslope >0-5°	Scrub and shrubland vegetation between northern project area boundary and constructed surface of Pipidinny Road.
3	Class D Scrub	Downslope >0-5°	Scrub vegetation east and south of project area.
4	Class C Shrubland	Downslope >0-5°	Shrubland vegetation east and south of project area.
5	Class D Scrub	Downslope >0-5°	Unmanaged/revegetating vegetation within eastern Marmion Avenue Road reserve (Class D Scrub = worst case classification).
6	Class C Shrubland	Downslope >0-5°	Shrubland vegetation west of Marmion Avenue.
7	Class D Scrub	Downslope >0-5°	Scrub vegetation west of Marmion Avenue.
8	Exclusions 2.2.3.2 (e) and (f)	N/A	Existing public road network and associated landscaping.
9	Class D Scrub	Downslope >0-5°	Scrub vegetation within project area.
10	Class C Shrubland	Downslope >0-5°	Shrubland vegetation within project area.
11	Class C Shrubland	Downslope >0-5°	Vegetation within future rail corridor (north, south and within project area).

3.1.4 Post-development inputs

A summary of the potential post-development classified vegetation, exclusions and effective slope within the assessment area are listed in Table 3 and illustrated in Figure 4.

The post-development vegetation classifications are based on the project area being fully cleared to accommodate future development as well as clearing within the rail corridor both external (north and south) or the project area and within the project area. This has been based on advice that the portion of rail corridor within the 150 m wide assessment area will be constructed and operational by 2021, prior to development of Stage 1, which is expected to occur prior to, or at the same time as the rail corridor is developed.

If further external vegetation is altered prior to future planning stages, the change in vegetation condition is to be captured through a future BHL assessment or BAL contour map assessment.

Table 3: Post-development vegetation classifications/exclusions and effective slope

Vegetation Plot	Vegetation classification/exclusion	Effective slope under the classified vegetation (degrees)	Comments
1	Class D Scrub	Downslope >0-5°	Scrub vegetation north of Pipidinny Road.
2	Exclusions 2.2.3.2 (e) and (f)	N/A	Scrub/shrubland vegetation within Pipidinny Road reserve removed as part of future construction/development.
3	Class D Scrub	Downslope >0-5°	Scrub vegetation east and south of project area.
4	Class C Shrubland	Downslope >0-5°	Shrubland vegetation east and south of project area.
5	Class D Scrub	Downslope >0-5°	Unmanaged/revegetating vegetation within eastern Marmion Avenue Road reserve (Class D Scrub = worst case classification).
6	Exclusions 2.2.3.2 (e) and (f)	N/A	Marmion Avenue will be widened to four lanes as part of future development which will remove vegetation within the eastern portion of the road reserve.
7	Class D Scrub	Downslope >0-5°	Scrub vegetation west of Marmion Avenue.
8	Exclusions 2.2.3.2 (e) and (f)	N/A	Existing public road network and associated landscaping.
9	Exclusions 2.2.3.2 (e) and (f)	N/A	Scrub vegetation cleared to accommodate future development within project area.
10	Exclusions 2.2.3.2 (e) and (f)	N/A	Shrubland vegetation cleared to accommodate future development (including Eglinton Drive extension).
11	Exclusions 2.2.3.2 (e) and (f)	N/A	Scrub vegetation cleared to accommodate development of rail corridor (north, south and within project area).

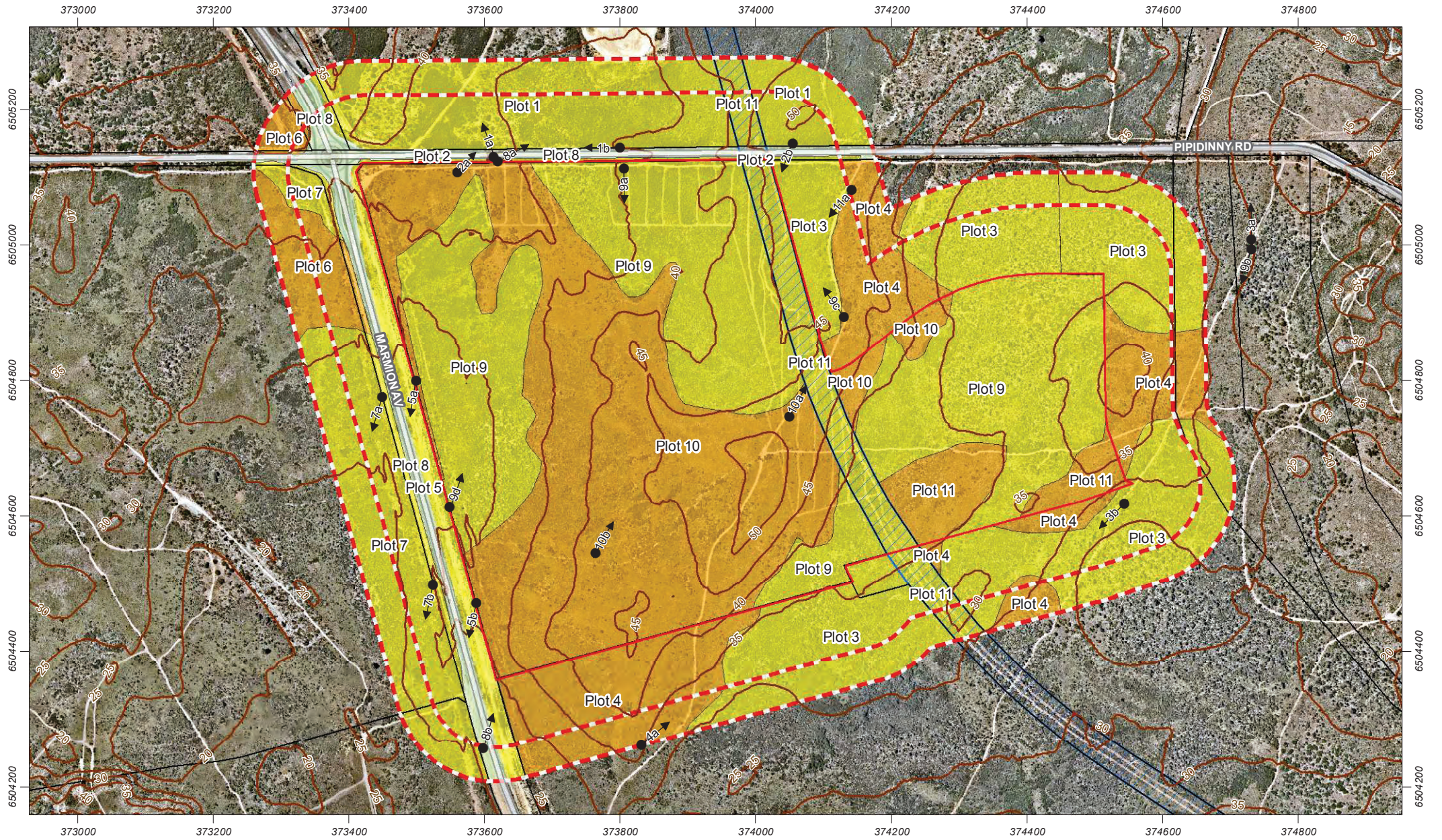
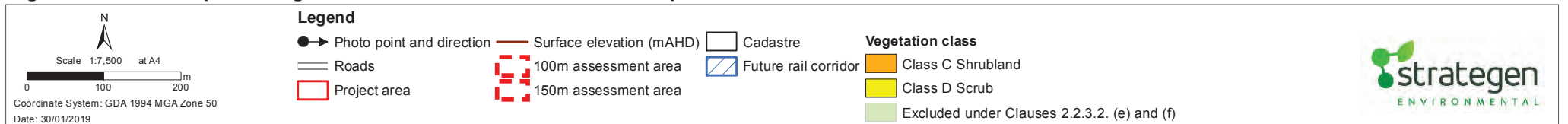


Figure 3: Pre-development vegetation classification and effective slope



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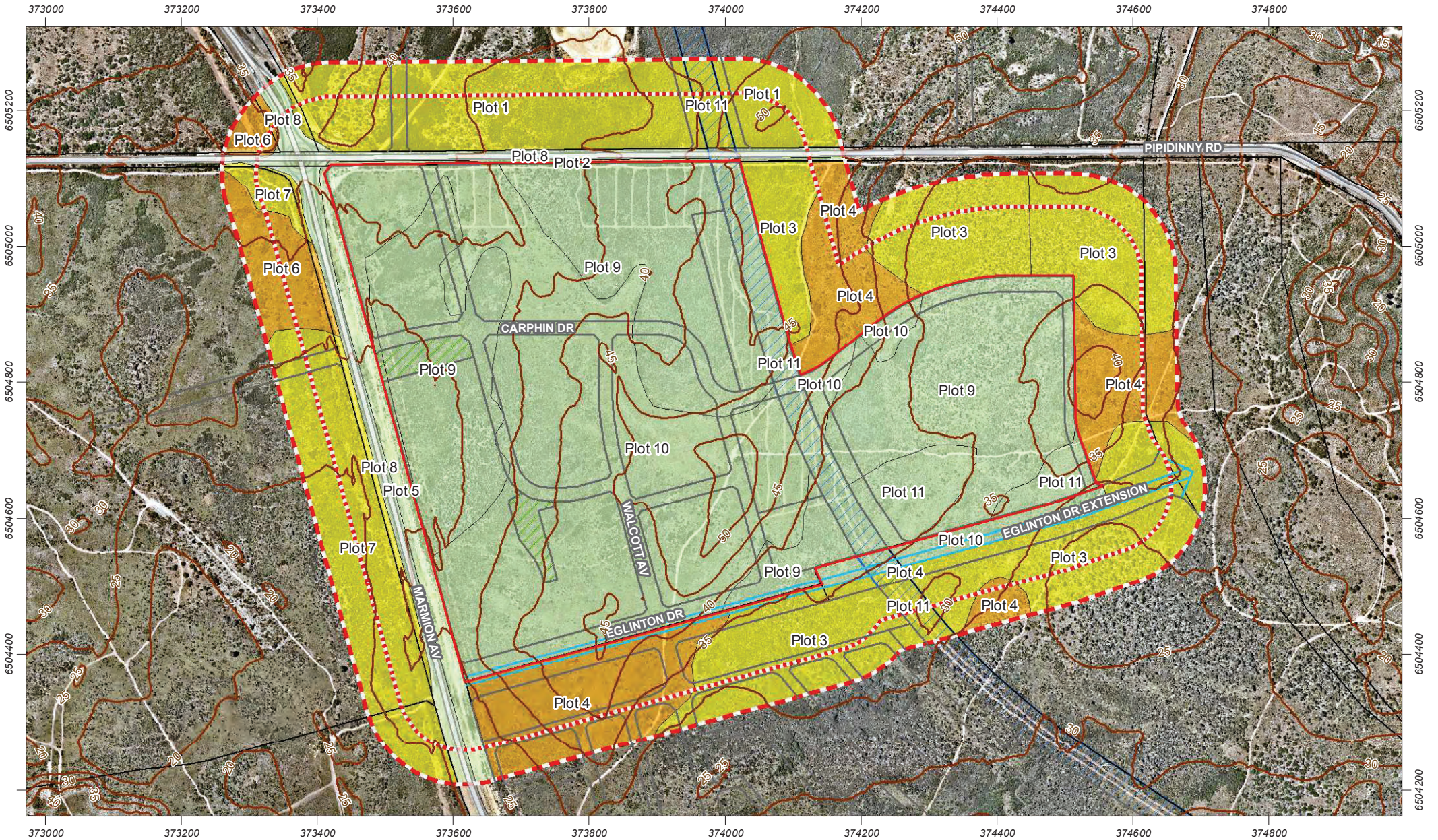


Figure 4: Post-development vegetation classification and effective slope

<p>Scale 1:7,500 at A4</p> <p>Coordinate System: GDA 1994 MGA Zone 50 Date: 30/01/2019</p>	Legend Roads Project area Surface elevation (mAHd)		Concept plan POS/Drainage 100m assessment area 150m assessment area		Cadastre Future rail corridor		Vegetation class Class C Shrubland Class D Scrub Excluded under Clauses 2.2.3.2. (e) and (f)

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3.2 Assessment outputs

3.2.1 Bushfire Hazard Level (BHL) assessment

Pre and post-development vegetation extents have been assigned a bushfire hazard level in accordance with the methodology detailed in Appendix Two of the Guidelines as follows:

- all Class D Scrub has been assigned a bushfire hazard level of Extreme
- all Class C Shrubland has been assigned a bushfire hazard level of Moderate
- all vegetation/land excluded under AS 3959 Clauses 2.2.3.2 (e) and (f) has been assigned a bushfire hazard level of Low
- land that has a Low bushfire hazard level but is within 100 m of Extreme or Moderate bushfire hazard level vegetation has been assigned a Moderate bushfire hazard level.

Pre-development

Strategen has mapped the pre-development bushfire hazard levels within the project area and adjacent 150 m wide assessment area. The bushfire hazard levels have been assessed on the basis of the vegetation discussed in Section 3.1.2 (i.e. the current pre-development extent of vegetation within and surrounding the project area).

The pre-development BHL assessment (refer to Figure 5) shows that based on the existing vegetation, the project area contains land with Moderate and Extreme bushfire hazard levels.

Post-development

Strategen has mapped the potential post-development bushfire hazard levels to demonstrate that the future bushfire hazard levels will be acceptable for future development to occur within the project area. The bushfire hazard levels have been assigned on the basis of the vegetation discussed in Section 3.1.2 and the future expected vegetation extent within and surrounding the project area.

The BHL assessment has been based on the following assumptions:

- vegetation along the eastern side of the Marmion Avenue road will be cleared to accommodate planned future widening of the road
- vegetation within the Pipidinny Road reserve will be removed to accommodate future widening of the road or landscaped to a low threat state
- vegetation within the rail reserve will be cleared and maintained in a low threat state (exclusion 2.2.3.2 (f), or any retained vegetation will meet other exclusion criteria of AS 3959
- vegetation within the POS and drainage areas will comprise low threat vegetation (exclusion 2.2.3.2 [f]), or any retained vegetation will meet other exclusion criteria of AS 3959
- Eglinton Drive will be constructed to the southeast corner of the project area and will be fully cleared or maintained in a fully low threat state.

The post-development BHL assessment (refer to Figure 6) demonstrates that all future habitable development will be located on land with either a Low or Moderate bushfire hazard level.

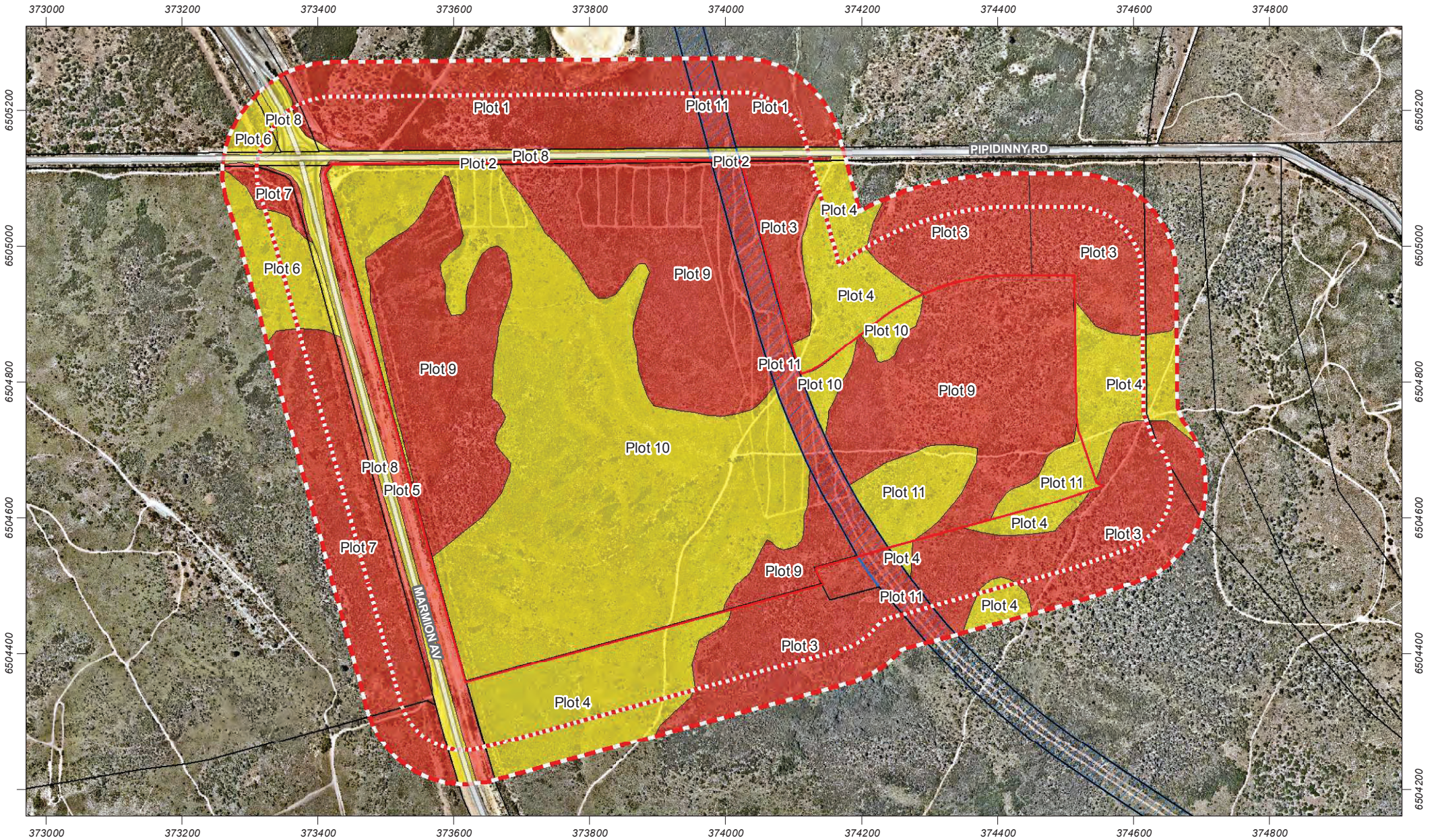

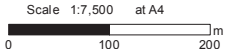









Figure 5: Pre-development bushfire hazard level assessment

 Scale 1:7,500 at A4  Coordinate System: GDA 1994 MGA Zone 50 Date: 30/01/2019	Legend		Bushfire Hazard Level  Extreme  Moderate
	 Roads  100m assessment area  150m assessment area	 Cadastre  Future rail corridor	



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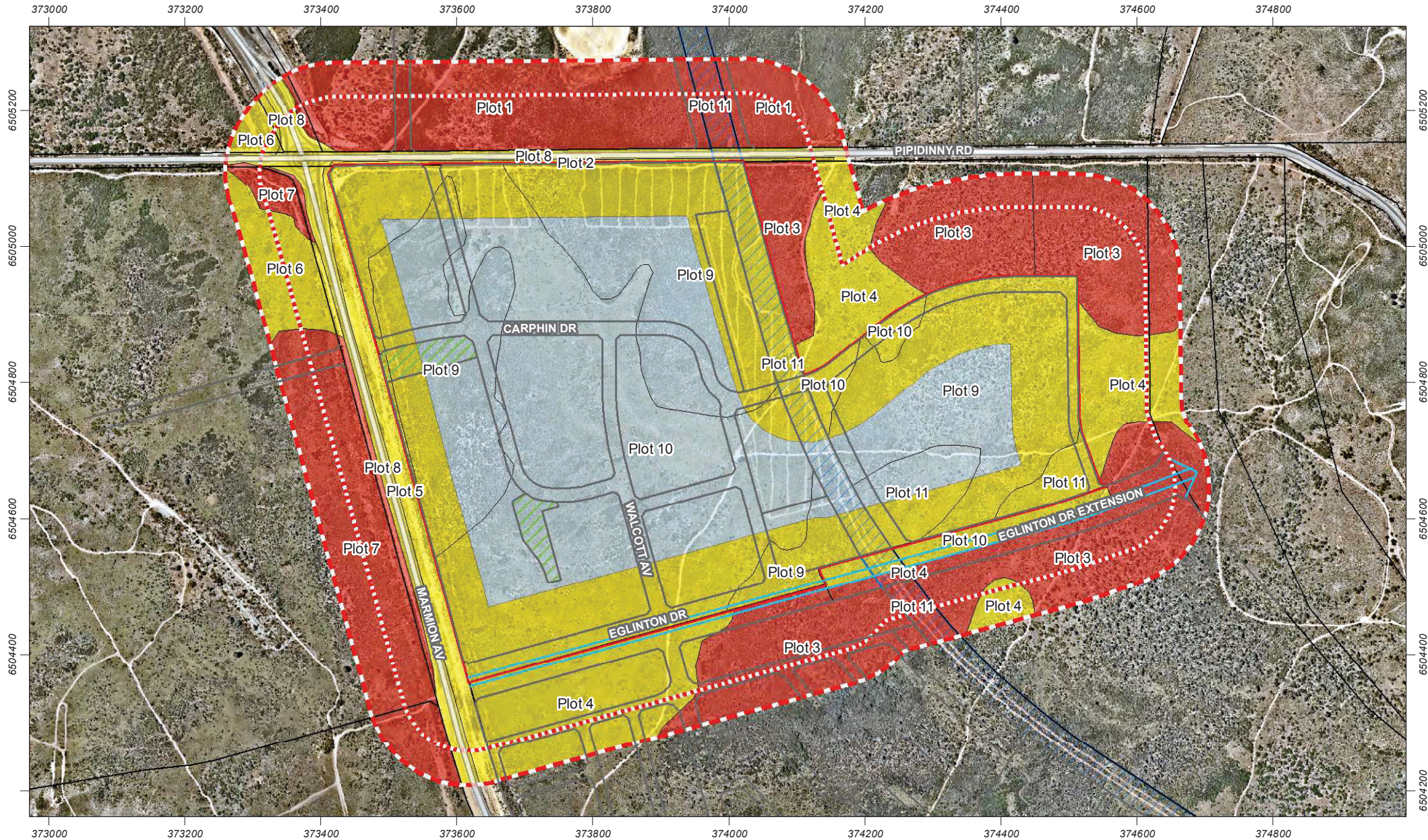
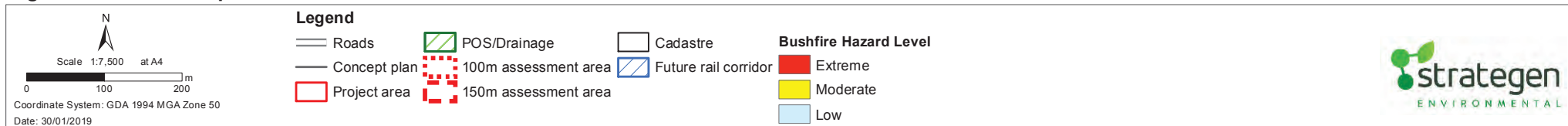


Figure 6: Post-development bushfire hazard level assessment



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 Data source: Nearmap; Aerial image, flown 11/2018. Landgate; Cadastre, 07/2018. Client Woodsome Management Pty Ltd, Development layout, 01/2019. Created by: jcrute

4. Identification of bushfire hazard issues

4.1 Bushfire context

The project area is predominantly surrounded by natural coastal shrub and scrub vegetation that poses a bushfire threat to future development. While this vegetation poses a bushfire threat to the project area currently, consideration of future development within the broader locality should also be considered as a large proportion of immediately surrounding land will either imminently or eventually be cleared to accommodate urban development of the Eglinton area. Future development is known to include:

- continued development of Allara Estate south and east of the project to join Pipidiny Road and the future Mitchell Freeway reserve
- continued development of Amberton Estate, to the south-west of the project area (west of Marmion Avenue) as part of Coastal Village Precinct 3
- development within the Eglinton Hill Precinct 4, immediately south of the project area and Employment Precinct 6 to the south-east
- development within Eglinton Eastern, Central and Western Precincts, to the south-east of the project area
- construction of the railway extension north to Yanchep
- construction of Mitchell Freeway (east of the project area).

The Amberton Estate, Allara Estate and Eglinton Hill development areas are all subject to approved Structure Plans, with various stages going through the subdivision approval process. The railway extension is expected to be completed prior to development of the project area. In this regard, it is highly likely that on commencement of development that the vegetation extents within the area will be reduced and fragmented in comparison to the current extent of vegetation. In the long-term, vegetation extents in proximity to the project area are expected to be limited as the full extent of development potential is realised within the Eglinton locality.

Nevertheless, it is expected that there will be a residual extent of bushfire prone vegetation remaining in proximity to the project area, in which case a bushfire occurring in adjacent vegetation needs to be considered as part of this BMP.

During typical summer afternoon southwest winds, a bushfire has potential to approach the project area through coastal shrub and scrub vegetation west of Marmion Avenue. Marmion Avenue provides a 50 m wide buffer between this vegetation, which would act to provide substantial separation between the bushfire prone vegetation and project area as well as a suitable access corridor for direct bushfire suppression operations.

During adverse, but less common strong northerly winds, Strategen considers a fire approaching the project area from the north/northeast through banksia woodland/ scrub/ shrub vegetation has the potential to be part of a landscape-scale bushfire. Vegetation to the north/northeast is contiguous with large unbroken tracts of vegetation extending several kilometres north towards Yanchep National Park.

As discussed previously it is likely the surrounding vegetation will become fragmented in the future through future urban development along the coast which will significantly reduce the bushfire threat to the project area.

It is considered that the bushfire risk to the proposed development posed by these hazards can be managed through standard application of acceptable solutions under the Guidelines, as well as through a direct bushfire suppression response if required. This is also the case with any vegetation retained and revegetation within proposed POS. Bushfire mitigation strategies applicable to the proposed development are addressed in Section 5 of this BMP.

4.2 Bushfire hazard issues

Examination of strategic development design in accordance with the ACSP concept and pre and post-development bushfire hazard levels has identified the following bushfire hazard issues to be considered at future planning stages:

1. The pre-development BHL assessment (Figure 5) demonstrates that prior to development, the project area contains land with both Moderate and Extreme bushfire hazard levels. In contrast, however, the post-development BHL assessment (Figure 6) demonstrates that on completion of development, the entire project area will comprise land with either a Moderate or Low bushfire hazard level. This satisfies Acceptable Solution A1.1.
2. The pre-development bushfire hazard levels are significant to this particular development as it is expected that development of the area will take a staged approach. Highlighting areas subject to Moderate or Extreme bushfire hazard levels helps to identify interfaces between stages where there is a risk that vegetation retained within future development stages may impose unacceptable bushfire attack levels (i.e. BAL—40 or BAL—FZ) on current stages of development. This bushfire hazard issue can be addressed at future planning stages through the establishment and maintenance of low threat staging buffers, as discussed below under Item 8.
3. The current ACSP design includes direct interfaces between future residential and commercial lots with Marmion Avenue road reserve, Pipidiny Road road reserve, future Eglinton Drive road reserve, the future railway reserve and POS and drainage areas.

These interfaces have potential to contain bushfire prone vegetation which may result in elevated bushfire attack levels (i.e. BAL—40 or BAL—FZ) for adjacent properties as follows:

- Marmion Avenue road reserve has historically been cleared but the full road reserve width is not currently being managed in a low threat state. The post-development BHL map has excluded this vegetation based on planned future widening of the road. If the vegetation within the eastern road is not cleared or managed as low threat, the potential Asset Protection Zone (APZ) setback for future adjacent habitable development to achieve BAL—29 is 15 m (based on Class D Scrub, downslope >0-5° (note that the actual setbacks would be determined through a detailed vegetation assessment during the subdivision stage of development)).
- Pipidiny Road road reserve is currently vegetated with mature Class C Shrubland and Class D Scrub vegetation (classified in the BHL assessment as Class D Scrub) immediately adjacent to the northern boundary of the project area. If vegetation within the road reserve is not managed as low threat as part of future development, then the potential APZ setbacks for future habitable development to achieve BAL—29 are:

- * Class C Shrubland, downslope >0-5° = 10 m
- * Class Scrub, downslope >0-5° = 10 m.

(note that the actual setbacks would be determined through a detailed vegetation assessment during the subdivision stage of development).

Future potential widening and construction works associated with Pipidiny Road are expected to result in removal of this vegetation, meaning APZ setbacks are unlikely to be required..

- care should be taken when designing the Eglinton Drive road reserve to ensure that any retained vegetation is reduced to low threat, and that the road reserve is managed in a low threat state. Vegetation within the Eglinton Drive extension also has potential to create BAL impacts on the future school site, if the extension is not fully constructed prior to development of the school. If this occurs, then potential BAL—29 APZ setbacks may apply as follows:

- * Class C Shrubland, downslope >0-5° = 10 m
- * Class Scrub, downslope >0-5° = 10 m.

The likely future situation is, however, that no natural vegetation will be retained in the Eglinton Drive road reserve and future vegetation would comprise low threat, landscaped streetscaping.

- As the rail corridor will be generally in-cut through this part of Eglinton (i.e. the railway will be cut below ground level, as opposed to at grade), it is likely that all vegetation will be cleared within the future railway reserve, with no remnant vegetation being retained.

Although unlikely, any vegetation retained or introduced within the rail corridor will need to be considered during subsequent planning stages. There is potential that retained vegetation could meet the following exclusion criteria of AS 3959:

- * Clause 2.2.3.2 (a) – vegetation of any type that is more than 100 m away from the site (i.e. developable lots)
 - * Clause 2.2.3.2 (d) – strips of vegetation less than 20 m in width and not within 20 m of developable lots, or each other, or other areas of vegetation being classified.
 - the ACSP includes two POS and drainage areas in the west of the project area. Strategen understands that landscaping is likely to comprise low threat and managed landscaping meeting the exclusion criteria of AS 3959 Clause 2.2.3.2 (f), which would not require APZ setbacks sufficient to achieve BAL—29 for adjacent habitable development. The extent of landscaping will need to be demonstrated through the development of a Landscaping Plan at the relevant future stage of development, otherwise BAL impacts may be applied.
4. As an alternative to providing APZ setbacks to achieve BAL—29 at the interfaces mentioned above, perimeter roads could be used as a strategy to provide the required separation. Perimeter roads would also serve the purpose of providing firefighter access to vegetation hazards at the project area boundary, however, on completion of development, it is expected that the project area will be surrounded by low threat urban development.
 5. The concept design makes provisions for future road connections to the east via the Eglinton Drive extension. As timing of extension through to meet the future Mitchell Freeway further east has not yet been determined, there is potential for Eglinton Drive to terminate in a dead-end. To ensure that occupants and firefighters are able to turn around safely along this road a temporary cul-de-sac head, compliant with Acceptable Solution A3.3 is to be provided where required. Similarly, during staged development within the project area, any temporary dead-end roads will need to be provided with a compliant temporary turnaround area where required. Any temporary dead-end roads will serve to provide for future enhanced access and are therefore not considered to be prohibitive to development.
 6. Construction of the Neighbourhood Connector Road across the railway reserve will need to be timed carefully to coincide with development of the school site, to ensure that the school is provided with two access routes.
 7. Staging of construction will need to ensure that each stage of development is provided with two access routes. The second access route may be provided by a public road, or alternatively by a temporary emergency access way (EAW) to link two public roads.
 8. As the project area contains existing bushfire prone vegetation, including Class C Shrubland and Class D Scrub, staged construction at the subdivision stage of planning is to consider the BAL impacts from adjacent future stages that have not yet been developed. 100 m wide low threat buffers may need to be implemented around the current stage of development to ensure there is no residual BAL impact from vegetation that has not yet been cleared or landscaped to achieve a low threat state.

Based on the above, Strategen considers the bushfire hazards within and adjacent to project area and the associated bushfire risks are readily manageable through standard management responses outlined in the Guidelines and AS 3959. These responses will be factored into proposed development as early as possible at all stages of the planning process to ensure a suitable, compliant and effective bushfire management outcome is achieved for protection of future life, property and environmental assets.

5. Assessment against the bushfire protection criteria

5.1 Compliance table

An acceptable solutions assessment against the bushfire protection criteria is provided in Table 4, with the intent of demonstrating how compliance can be achieved at future planning stages.

Table 4: Compliance with the bushfire protection criteria of the Guidelines

Bushfire protection criteria	Method of compliance	Proposed bushfire management strategies
	Acceptable solutions	
Element 1: Location	A1.1 Development location	The post-development BHL assessment (Figure 6) identifies that on completion of development, all developable land will comprise either a Low or Moderate bushfire hazard level.
Element 2: Siting and design	A2.1 Asset Protection Zone	<p>APZs sufficient to achieve BAL—29 are to be implemented for all lots subject to a BAL above BAL-LOW, where required.</p> <p>The required APZs are to be identified at future planning stages based on future subdivision/development design and following a BAL contour assessment.</p> <p>APZs are to be implemented and maintained in accordance with Schedule 1 of the Guidelines (Appendix 3).</p>
Element 3: Vehicular access	A3.1 Two access routes.	<p>On completion of development, the existing and future public road network and proposed public internal roads will provide all occupants with the option of travelling to more than two different destinations. The ACSP (Figure 1) depicts the following future road connections:</p> <ul style="list-style-type: none"> • two connections to Pipidinnny Road in the north (one being via a temporary access road) • three connections to Marmion Avenue in the west via Pipidinnny Road, Carphin Drive and Eglinton Drive • three connections to Eglinton Drive in the south via Walcott Avenue; an unnamed neighbourhood connector road east of the railway reserve; and an unnamed major access road extending the perimeter of the education zone. <p>The timing of construction of the Eglinton Drive extension is yet to be determined, however, Strategen understands that this road will be extended at least to the Education zone to provide the future school with two access routes.</p> <p>The access roads described above will provide occupants with options to achieve access to:</p> <ul style="list-style-type: none"> • Allara Estate approximately 600 m to the north via Marmion Avenue • Amberton Estate approximately 600 m to the south via Marmion Avenue and • Wanneroo Road approximately 2 km to the west via Pipidinnny Road. <p>The future extension of Eglinton Drive eastward to connect with the future Mitchell Freeway will also provide additional future access to the east. Future connections to Allara Estate via Pipidinnny Road will provide access options to areas directly north of the project area and future connections to Eglinton Hill Estate (south of Eglinton Drive) will provide access options to areas directly south of the project area.</p> <p>In this regard, the proposed development is provided with more than two access routes, which exceeds the requirements of Acceptable Solution A3.1.</p> <p>In addition to the above, two access routes are to be provided for each individual stage of development.</p>
	A3.2 Public road	All public roads are to be constructed to relevant technical requirements under the Guidelines (see Appendix 3).

Bushfire protection criteria	Method of compliance	Proposed bushfire management strategies
	Acceptable solutions	
	A3.3 Cul-de-sac (including a dead-end-road)	No permanent dead-end roads are included in the ACSP. Where temporary dead-ends are created during staged development, or staged construction of Eglinton Drive, temporary cul-de-sac heads are to be installed to the standards stated under Acceptable Solution A3.3, including a minimum 17.5 m diameter turn-around head. Refer to Appendix 3 for full technical requirements.
	A3.4 Battle-axe	Battle-axes are to be avoided in bushfire prone areas. At this stage of planning, the ACSP does not include any battle-axes, however, if battle-axes are included in future subdivision design they are to comply with the requirements of Acceptable Solution A3.4 (refer to Appendix 3) and it must be demonstrated why they are unavoidable. This would only apply to lots in an area subject to BAL-12.5 or higher.
	A3.5 Private driveway longer than 50 m	All private driveways longer than 50 m are to be constructed to relevant technical requirements under the Guidelines (see Appendix 3), including turn-around areas within 50 m of each building, passing bays if driveways are longer than 200 m and additional turn-around areas for fire appliances every 500 m.
	A3.6 Emergency access way	Based on the ACSP design, the proposed development is not considered to require permanent emergency access ways (EAWs). However, temporary EAWs may be required to provide through access to public roads during staged development and are to be constructed to relevant technical requirements under the Guidelines (see Appendix 3).
	A3.7 Fire service access routes (perimeter roads)	Based on the ACSP design, the proposed development is not considered to require permanent fire service access routes (FSARs). Temporary FSARs may be required during staged development to provide firefighter access to and around the perimeter of undeveloped portions of the project area. Any proposed temporary FSAR is to be constructed to the relevant technical requirements of Acceptable Solution 3.7 (see Appendix 3).
	A3.8 Firebreak width	<p>Each stage of development is required to comply with the requirements of Acceptable Solution A3.8 and the annual City of Wanneroo Firebreak and Fuel Hazard Reduction Notice as amended (refer to Appendix 4).</p> <p>The City of Wanneroo Firebreak and Fuel Hazard Reduction Notice details the following requirements:</p> <ul style="list-style-type: none"> • Land with an area <4,000 m² and >4,000 m² <ul style="list-style-type: none"> * a fire break, not less than three (3) metres wide must be cleared immediately inside (or as close as possible) around all external boundaries of the land * all tree branches that over-hang a fire break must be trimmed back to a minimum height of three and a half (3.5) metres above ground level and the growth on the fire break cannot exceed fifty (50) millimetres high. <p>On completion of development, it is expected that the residential lots would be smaller than 4,000 m², however as they will be fully developed with residential buildings, cultivated gardens and reticulated lawns (i.e. low threat vegetation), firebreaks would not be required. Similarly, it is likely that the commercial and education lots will comprise fully developed land, in which case firebreaks would not be required. This is to be confirmed at the subdivision and/or development application planning stages.</p> <p>Firebreak requirements are relevant to staged development, where 3 m wide by 3.5 m high perimeter firebreaks will be required to be installed immediately inside all boundaries of balance lots in accordance with the City of Wanneroo Firebreak and Fuel Hazard Reduction Notice (as detailed above),</p>
Element 4: Water	A4.1 Reticulated areas	The proposed development will be connected to reticulated water supply via surrounding development (refer to Appendix 5) in accordance with Water Corporations Design Standard 63 requirements. Existing water hydrants are located at 200 m intervals along Marmion Avenue adjacent to the western boundary of the project area.
	A4.2 Non-reticulated areas	N/A – the proposed development will be provided with a reticulated firefighting water supply.

Bushfire protection criteria	Method of compliance	Proposed bushfire management strategies
	Acceptable solutions	
	A4.3 Individual lots within non-reticulated areas (Only for use if creating 1 additional lot and cannot be applied cumulatively)	N/A – the proposed development will be provided with a reticulated firefighting water supply.

6. Responsibilities for implementation and management of the bushfire measures

This BMP has been prepared as a strategic guide to demonstrate how development compliance will be delivered at future planning stages in accordance with the Guidelines. Aside from the preparation of future BMPs to accompany future subdivision and development applications where appropriate, there are no further items to implement, enforce or review at this strategic stage of the planning process.

Future BMPs prepared for subsequent subdivision and development applications are to meet the relevant commitments outlined in this strategic level BMP, address the relevant requirements of SPP 3.7 (i.e. Policy Measures 6.4 and 6.5 respectively) and demonstrate in detail how the proposed development will incorporate the relevant acceptable solutions or meet the performance requirements of the Guidelines.

Future BMPs are to include the following detailed information:

- proposed lot layout, including any public open space (POS) and drainage areas
- detailed landscaping design/plans in regard to POS and drainage areas, consistent with the provisions of this BMP
- post development classified vegetation extent and effective slope
- BAL contour map demonstrating that proposed development areas will achieve BAL–29 or lower
- width and alignment of compliant APZs/setbacks
- confirmation of how bushfire management will be addressed during development staging
- proposed approach to fuel management or AS 3959 application in response to on-site POS
- vehicular access provisions, including demonstration that a minimum of two access routes will be achieved for each stage of development in accordance with Acceptable Solution A3.1
- water supply provisions with regards to reticulated water
- future requirements for any potential vulnerable land uses, such as provision of a Bushfire Emergency Evacuation Plan (if relevant)
- future requirements for any potential high-risk land uses, such as provision of a Bushfire Risk Management Plan (if relevant)
- provisions for notification on Title for any future lots with a rating of BAL–12.5 or greater as a condition of subdivision
- compliance requirements with the current City of Wanneroo annual firebreak notice
- construction of Class 1, 2, 3 or associated 10a buildings in accordance with AS 3959 to the assessed BAL rating
- requirements for BMP/BAL compliance reports as conditions of subdivision
- compliance with performance principles of the bushfire protection criteria
- proposed implementation and audit program outlining all measures requiring implementation and the appropriate timing and responsibilities for implementation.

On the basis of the information contained in this BMP, Strategen considers the bushfire hazards within and adjacent to the project area and the associated bushfire risks are readily manageable through standard management responses outlined in the Guidelines and AS 3959. Strategen considers that on implementation of the proposed management measures, the project area will be able to be developed with a manageable level of bushfire risk whilst maintaining full compliance with the Guidelines and AS 3959.

7. References

- Department of Fire and Emergency Services (DFES) 2018, *Map of Bush Fire Prone Areas*, [Online], Government of Western Australia, available from:
<https://maps.slip.wa.gov.au/landgate/bushfireprone/>, [10/01/2019].
- Department of Planning (DoP) 2016, *Visual guide for bushfire risk assessment in Western Australia*, Department of Planning, Perth.
- Standards Australia (SA) 2009, *Australian Standard AS 3959–2009 Construction of Buildings in Bushfire-prone Areas*, Standards Australia, Sydney.
- Strategen Environmental (Strategen) 2016, *Bushfire Management Plan: Eglinton Estates*, Strategen Environmental, Perth.
- Western Australian Planning Commission (WAPC) 2015, *State Planning Policy 3.7 Planning in Bushfire Prone Areas*, Western Australian Planning Commission, Perth.
- Western Australian Planning Commission (WAPC) 2017, *Guidelines for Planning in Bushfire Prone Areas*, Version 1.3 August 2017, Western Australian Planning Commission, Perth.

Appendix 1
Vegetation plot photos and description



Photo ID: 1a

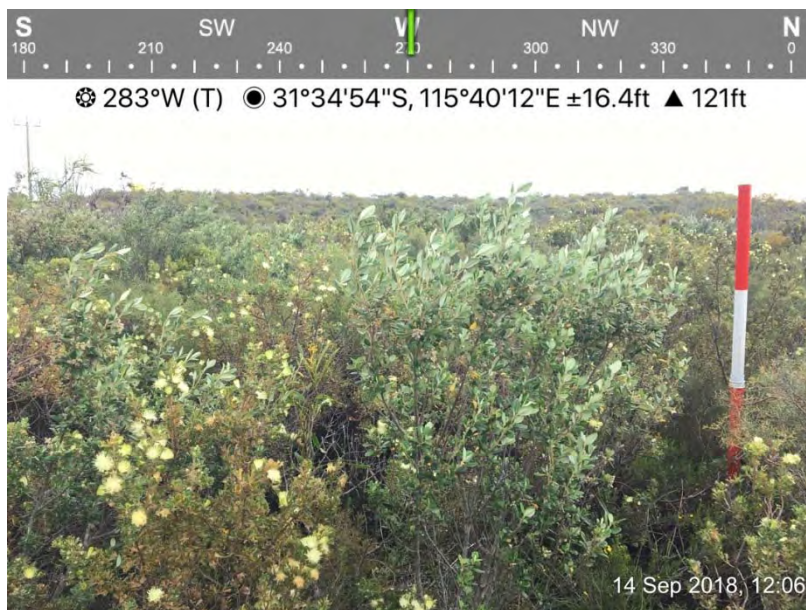


Photo ID: 1b

Plot number		Plot 1
Vegetation classification	Pre-development	Class D Scrub
	Post-development	Class D Scrub
Description / justification		Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity. Majority of vegetation observed less than 2 m high, classification has applied a worst case approach.



Photo ID: 2a (in right of photo)



Photo ID: 2b (in photo background)

Plot number		Plot 2
Vegetation classification	Pre-development	Class D Scrub
	Post-development	Excluded – Non-vegetated & Low threat (Clauses 2.2.3.2 [e] and [f])
Description / justification		Plot 2 comprises a combination of Class C Shrubland (<2m height) and Class D Scrub (>2m height). Vegetation is located within Pipidinnny Road road reserve, immediately adjacent to the northern boundary of the project area. This vegetation is expected to be cleared or landscaped to low threat as part of future development stages.



Photo ID: 3a



Photo ID: 3b

Plot number		Plot 3
Vegetation classification	Pre-development	Class D Scrub
	Post-development	Class D Scrub
Description / justification		Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity.

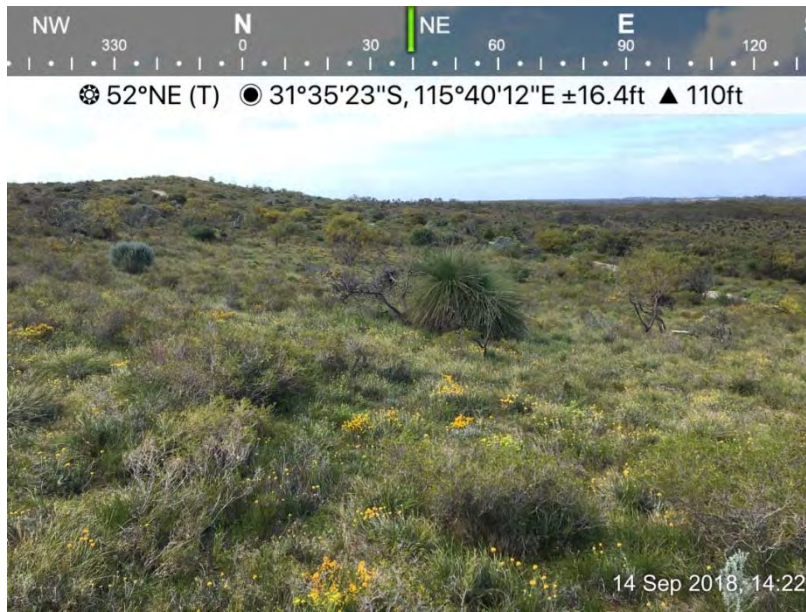


Photo ID: 4a

Plot number		Plot 4
Vegetation classification	Pre-development	Class C Shrubland
	Post-development	Class C Shrubland
Description / justification		Shrub vegetation less than 2 m high at maturity.



Photo ID: 5a



Photo ID: 5b

Plot number		Plot 5
Vegetation classification	Pre-development	Class D Scrub
	Post-development	Excluded – Non-vegetated & Low threat (Clauses 2.2.3.2 [e] and [f])
Description / justification		Vegetation in a state of natural revegetation within eastern Marmion Avenue road reserve. On completion of the development, the vegetation is expected to be cleared to accommodate planned future widening of Marmion Avenue.



Photo ID: N/A (nearmap imagery dated 5/1/2019)



Photo ID: N/A (Google earth imagery)

Plot number		Plot 6
Vegetation classification	Pre-development	Class C Shrubland
	Post-development	Class C Shrubland
Description / justification		Plot 6 predominantly comprises open shrubland vegetation less than 2 m high at maturity. A search of historical imagery dating back to 2009 indicates that this vegetation is in its mature state.

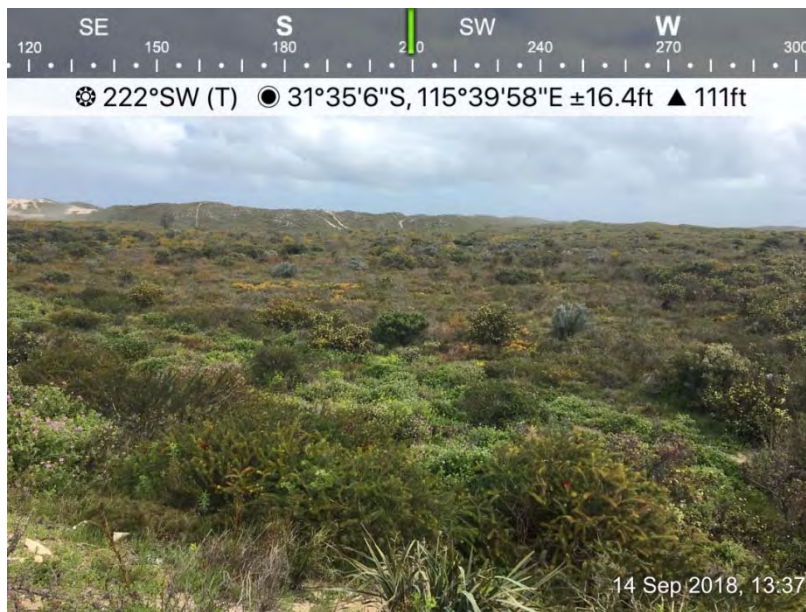


Photo ID: 7a

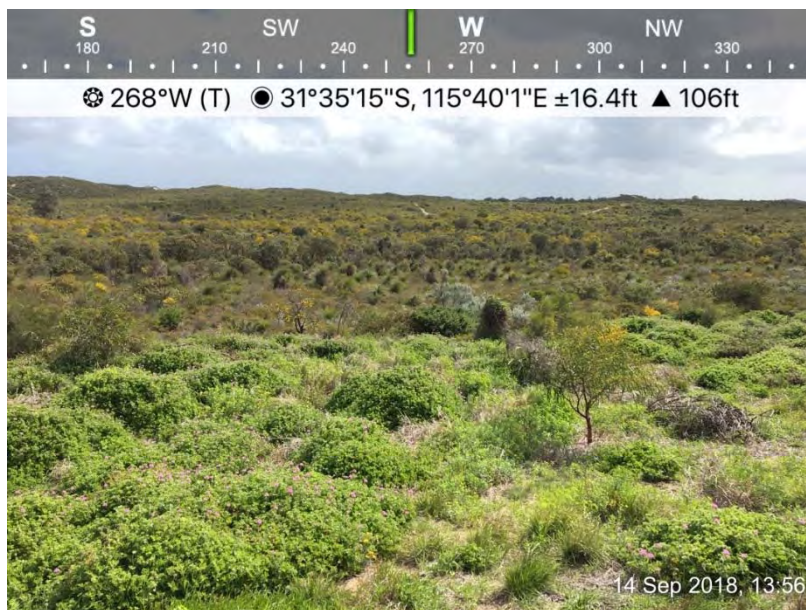


Photo ID: 7b

Plot number		Plot 7
Vegetation classification	Pre-development	Class D Scrub
	Post-development	Class D Scrub
Description / justification		Vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity.



Photo ID: 8a



Photo ID: 8b

Plot number		Plot 8
Vegetation classification	Pre-development	Excluded – Non-vegetated & Low threat (Clauses 2.2.3.2 [e] and [f])
	Post-development	Excluded – Non-vegetated & Low threat (Clauses 2.2.3.2 [e] and [f])
Description / justification		Plot 8 includes all existing public roads within the assessment area, comprising non-vegetated bitumen roads and low threat landscaping within nature strips/roundabouts.

E SE SW W
90 120 150 180 210 240 270
193°S (T) 31°34'55"S, 115°40'12"E ±16.4ft ▲ 126ft



Photo ID: 9a

S SW W NW
150 180 210 240 270 300 330
251°W (T) 31°34'59"S, 115°40'47"E ±16.4ft ▲ 78ft



Photo ID: 9b

SW W NW N
10 240 270 300 330 360
316°NW (T) 31°35'3"S, 115°40'24"E ±16.4ft ▲ 158ft



Photo ID: 9c

NW N NE E
300 330 360 0 30 60 90
34°NE (T) 31°35'12"S, 115°40'2"E ±16.4ft ▲ 104ft



Photo ID: 9d

Plot number		Plot 9
Vegetation classification	Pre-development	Class D Scrub
	Post-development	Excluded – Non-vegetated & Low threat (Clauses 2.2.3.2 [e] and [f])
Description / justification		Pre-development vegetation comprises vegetation with a continuous horizontal and vertical structure, greater than 2 m high at maturity. On completion of the development, the plot is expected to be cleared and maintained in a non-vegetated/low threat state to accommodate residential development within the project area.

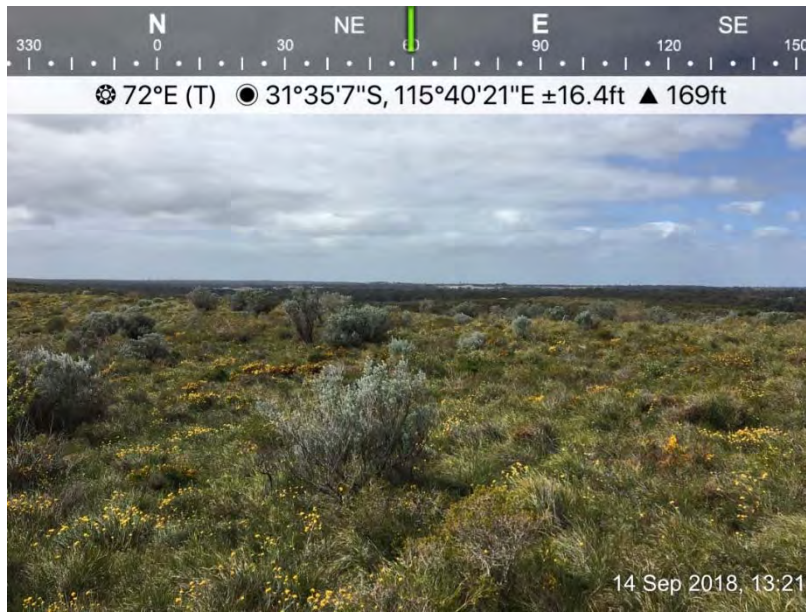


Photo ID: 10a

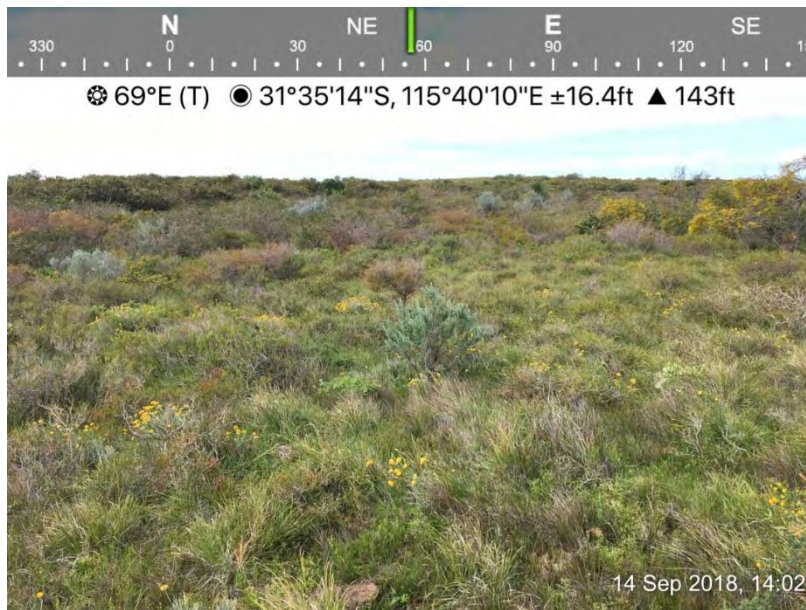


Photo ID: 10b

Plot number		Plot 10
Vegetation classification	Pre-development	Class C Shrubland
	Post-development	Excluded – Non-vegetated & Low threat (Clauses 2.2.3.2 [e] and [f])
Description / justification		Pre-development vegetation comprises shrub vegetation less than 2 m high at maturity. On completion of the development, the plot is expected to be cleared and maintained in a non-vegetated/low threat state to accommodate residential development within the project area.



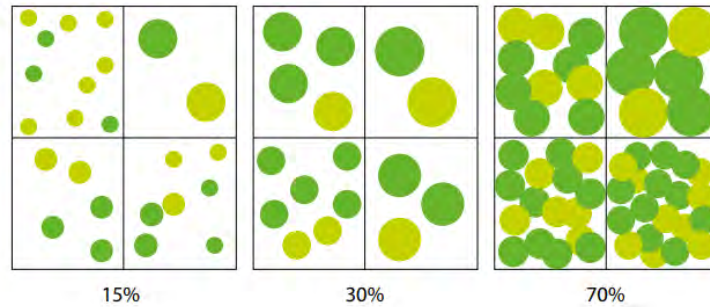
Photo ID: 11a

Plot number		Plot 11
Vegetation classification	Pre-development	Class D Scrub
	Post-development	Excluded – Non-vegetated & Low threat (Clauses 2.2.3.2 [e] and [f])
Description / justification		<p>Pre-development vegetation comprises a combination of (shrub < 2 m height) and Class D Scrub (>2 m height). On completion of the development, the plot is expected to be cleared and maintained in a non-vegetated/low threat state to accommodate development of rail corridor.</p> <p>Note: the photo included is representative of vegetation within Plot 11, however, no photo was specifically taken of the future rail corridor.</p>

Appendix 2
APZ standards (Schedule 1; WAPC
2017)

Schedule 1: Standards for Asset Protection Zones

- **Fences:** within the APZ are constructed from non-combustible materials (e.g. iron, brick, limestone, metal post and wire). It is recommended that solid or slatted non-combustible perimeter fences are used.
- **Objects:** within 10 metres of a building, combustible objects must not be located close to the vulnerable parts of the building i.e. windows and doors.
- **Fine Fuel load:** combustible dead vegetation matter less than 6 millimetres in thickness reduced to and maintained at an average of two tonnes per hectare.
- **Trees (> 5 metres in height):** trunks at maturity should be a minimum distance of 6 metres from all elevations of the building, branches at maturity should not touch or overhang the building, lower branches should be removed to a height of 2 metres above the ground and or surface vegetation, canopy cover should be less than 15% with tree canopies at maturity well spread to at least 5 metres apart as to not form a continuous canopy.



- **Shrubs (0.5 metres to 5 metres in height):** should not be located under trees or within 3 metres of buildings, should not be planted in clumps greater than 5m² in area, clumps of shrubs should be separated from each other and any exposed window or door by at least 10 metres. Shrubs greater than 5 metres in height are to be treated as trees.
 - **Ground covers (<0.5 metres in height):** can be planted under trees but must be properly maintained to remove dead plant material and any parts within 2 metres of a structure, but 3 metres from windows or doors if greater than 100 millimetres in height. Ground covers greater than 0.5 metres in height are to be treated as shrubs.
 - **Grass:** should be managed to maintain a height of 100 millimetres or less.
-

Appendix 3
Vehicular access technical standards
(WAPC 2017)

Public roads

Acceptable solution A3.2

A public road is to meet the requirements in Table 1, Column 1.

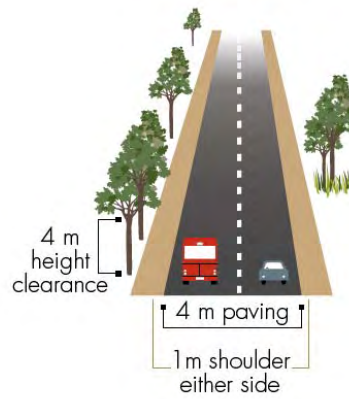
Explanatory note E3.2

Trafficable surface:

Widths quoted for access routes refer to the width of the trafficable surface. A six metre trafficable surface does not necessarily mean paving width. It could, for example, include four metre wide paving one metre wide constructed road shoulders. In special circumstances, where eight lots or less are being serviced, a public road with a minimum trafficable surface of four metres for a maximum distance of 90 metres may be provided subject to the approval of both the local government and Department of Fire and Emergency Services.

Public road design:

All roads should allow for two-way traffic to allow conventional two-wheel drive vehicles and fire appliances to travel safely on them.



Cul-de-sac (including a dead-end road)

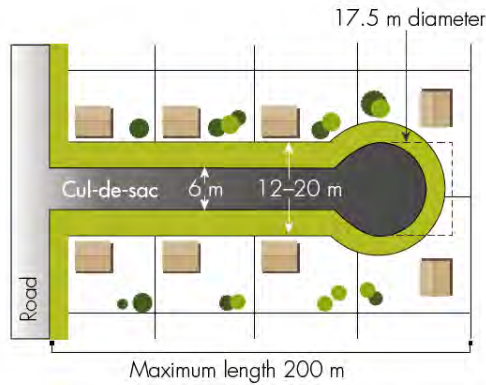
Acceptable solution A3.3

A cul-de-sac and/ or a dead end road should be avoided in bushfire prone areas. Where no alternative exists (i.e. the lot layout already exists and/ or will need to be demonstrated by the proponent), the following requirements are to be achieved:

- Requirements in Table 1, Column 2
- Maximum length: 200 metres (if public emergency access is provided between cul-de-sac heads maximum length can be increased to 600 metres provided no more than eight lots are serviced and the emergency access way is no more than 600 metres)
- Turn-around area requirements, including a minimum 17.5 metre diameter head.

Explanatory note E3.3

In bushfire prone areas, a cul-de-sac subdivision layout is not favoured because they do not provide access in different directions for residents. In some instances it may be possible to provide an emergency access way between cul-de-sac heads to a maximum distance of 600 metres, so as to achieve two-way access. Such links must be provided as right of ways or public access easements in gross to ensure accessibility to the public and fire services during an emergency. A cul-de-sac in a bushfire prone area is to connect to a public road that allows for travel in two directions in order to address Acceptable Solution A3.1.



Battle-axe

Acceptable solution A3.4

Battle-axe access leg should be avoided in bushfire prone areas. Where no alternative exists, (this will need to be demonstrated by the proponent) all of the following requirements are to be achieved:

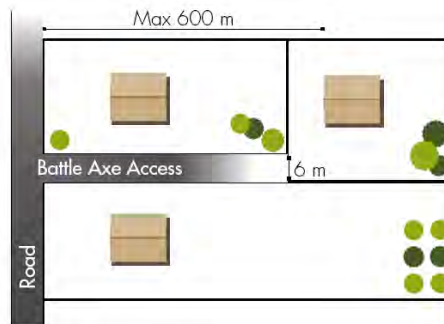
- Requirements in Table 1, Column 3
- Maximum length: 600 metres
- Minimum width: six metres.

Explanatory note E3.4

In bushfire prone areas, lots with battle-axe access legs should be avoided because they often do not provide two-way access and egress for residents and may be easily blocked by falling trees or debris. In some instances, however; it may be appropriate for battle-axe access to be used to overcome specific site constraints. Where used, they should comply with the minimum standards for private driveways.

Passing bays should be provided at 200 metre intervals along battle-axe access legs to allow two-way traffic. The passing bays should be a minimum length of 20 metres, with the combined width of the passing bay and the access being a minimum of six metres.

Turn-around areas should allow type 3.4 fire appliances to turn around safely (i.e. kerb to kerb 17.5 metres) and should be available at house sites and at 500 metre intervals along the access leg.



Private driveway longer than 50 metres

Acceptable solution A3.5

A private driveway is to meet all of the following requirements:

- Requirements in Table 1, Column 3
- Required where a house site is more than 50 metres from a public road
- Passing bays: every 200 metres with a minimum length of 20 metres and a minimum width of two metres (i.e. the combined width of the passing bay and constructed private driveway to be a minimum six metres)
- Turn-around areas designed to accommodate type 3.4 fire appliances and to enable them to turn around safely every 500 metres (i.e. kerb to kerb 17.5 metres) and within 50 metres of a house
- Any bridges or culverts are able to support a minimum weight capacity of 15 tonnes
- All-weather surface (i.e. compacted gravel, limestone or sealed).

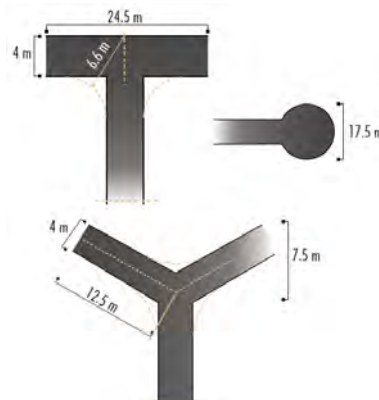
Explanatory note E3.5

For a driveway shorter than 50 metres, fire appliances typically operate from the street frontage however where the distance exceeds 50 metres, then fire appliances will need to gain access along the driveway in order to defend the property during a bushfire. Where house sites are more than 50 metres from a public road, access to individual houses and turnaround areas should be available for both conventional two-wheel drive vehicles of residents and type 3.4 fire appliances.

Turn-around areas should be located within 50 metres of a house. Passing bays should be available where driveways are longer than 200 metres and turn-around areas in driveways that are longer than 500 metres. Circular and loop driveway designs may also be considered. These criteria should be addressed through subdivision design.

Passing bays should be provided at 200 metre intervals along private driveways to allow two-way traffic. The passing bays should be a minimum length of 20 metres, with the combined width of the passing bay and the access being a minimum of six metres.

Turn-around areas should allow type 3.4 fire appliances to turn around safely (i.e. kerb to kerb 17.5 metres) and should be available at the house sites and at 500 metre intervals along the driveway.



Emergency access way

Acceptable solution A3.6

An access way that does not provide through access to a public road is to be avoided in bushfire prone areas. Where no alternative exists (this will need to be demonstrated by the proponent), an emergency access way is to be provided as an alternative link to a public road during emergencies. An emergency access way is to meet all of the following requirements:

- Requirements in Table 1, Column 4
- No further than 600 metres from a public road
- Provided as right of way or public access easement in gross to ensure accessibility to the public and fire services during an emergency
- Must be signposted.

Explanatory note E3.6

An emergency access way is not a preferred option however may be used to link up with roads to allow alternative access and egress during emergencies where traffic flow designs do not allow for two-way access. Such access should be provided as a right-of-way or easement in gross to ensure accessibility to the public and fire emergency services during an emergency.

The access should comply with minimum standards for a public road and should be signposted. Where gates are used to control traffic flow during non-emergency periods, these must not be locked. Emergency access ways are to be no longer than 600 metres and must be adequately signposted where they adjoin public roads.

Where an emergency access way is constructed on private land, a right of way or easement in gross is to be established.



Fire service access routes (perimeter roads)	
Acceptable solution A3.7	<p>Fire service access routes are to be established to provide access within and around the edge of the subdivision and related development to provide direct access to bushfire prone areas for fire fighters and link between public road networks for firefighting purposes. Fire service access routes are to meet the following requirements:</p> <ul style="list-style-type: none"> • Requirements in Table 1, Column 5 • Provided as right of ways or public access easements in gross to ensure accessibility to the public and fire services during an emergency • Surface: all-weather (i.e. compacted gravel, limestone or sealed) • Dead end roads are not permitted • Turn-around areas designed to accommodate type 3.4 appliances and to enable them to turn around safely every 500 metres (i.e. kerb to kerb 17.5 metres) • No further than 600 metres from a public road • Allow for two-way traffic • Must be signposted.
Explanatory note E3.7	<p>Fire service access routes should be established to separate bushfire prone areas from developed areas, and to provide access within and around the edge of subdivisions and related development. Fire service access is used during bushfire suppression operations but can also be used for fire prevention work. Fire service access routes should:</p> <ul style="list-style-type: none"> • Link up with the road network at regular intervals - the development and road network forms part of the fire service access system • Be adequately signposted • Allow for two-way traffic - that is, two fire appliances must be able to safely pass each other • Have an all-weather surface (i.e. compacted gravel, limestone or sealed) • Have erosion control measures in place. <p>Driveways may be used as part of the designated fire service access system, provided they meet the minimum standard for fire service access routes. It is beneficial to link the fire service access routes with individual driveways to allow quick access to properties and houses during fire emergencies.</p> <p>Where gates are used, these should be wide enough to accommodate type 3.4 fire appliances (minimum width of 3.6m) with the design and construction to be approved by the relevant local government. Gates on fire service access routes may be locked to restrict access provided that a common key system is used and such keys are made available for fire appliances and designated fire officers within the local government area and/or surrounding district. Gates should be installed where fences cross fire service access routes.</p> <p>Management and access arrangements should be in place to ensure that the maintenance of fire service access routes will occur in the long term after an area has been subdivided. A number of options can be used to achieve this, including but not limited to:</p> <ul style="list-style-type: none"> • Individual property owners being responsible for maintaining fire service access routes where these fall on their property • Providing such access as a right-of-way or easement in gross to ensure accessibility to fire services during an emergency; and/or • A levy system administered by local government to cover the cost of maintaining fire service access routes. <p>Such arrangements should be documented in the relevant planning application (such as a structure plan, subdivision plan or development plan) and should be agreed to by local government.</p>

Table 1: Vehicular access technical requirements

Technical requirement	1	2	3	4	5
	Public road	Cul-de-sac	Private driveway longer than 50 m	Emergency access way	Fire service access routes
Minimum trafficable surface (m)	6*	6	4	6*	6*
Horizontal distance (m)	6	6	6	6	6
Vertical clearance (m)	4.5	N/A	4.5	4.5	4.5
Maximum grade <50 m	1 in 10	1 in 10	1 in 10	1 in 10	1 in 10
Minimum weight capacity (t)	15	15			
Maximum crossfall	1 in 33	1 in 33	1 in 33	1 in 33	1 in 33
Curves minimum inner radius	8.5	8.5	8.5	8.5	8.5

* Refer to E3.2 Public roads: Trafficable surface

Appendix 4
City of Wanneroo Firebreak and Fuel
Hazard Reduction Notice (2018/19)

Under the Bushfires Act (1954), all owners and occupiers of land in Western Australia must establish and maintain fire breaks.

Fire breaks and protection measures are vital in assisting the prevention of fires spreading and to allow safer access for bushfire fighters and vehicles.

Land with an area of less than 4,000m²

- A fire break, not less than three (3) metres wide must be cleared immediately inside (or as close as possible) around all external boundaries of the land.
- All tree branches that over-hang a fire break must be trimmed back to a minimum height of three and a half (3.5) metres above ground level and the growth on the fire break cannot exceed fifty (50) millimetres high.

Land with an area of 4,000m² or more

- A fire break, not less than three (3) metres wide, must be cleared immediately inside (or as close as possible) around all external boundaries of the land.
- All tree branches that over-hang a fire break must be trimmed back to a minimum height of three and a half (3.5) metres above ground level and the growth on the fire break cannot exceed fifty (50) millimetres high.

Buildings

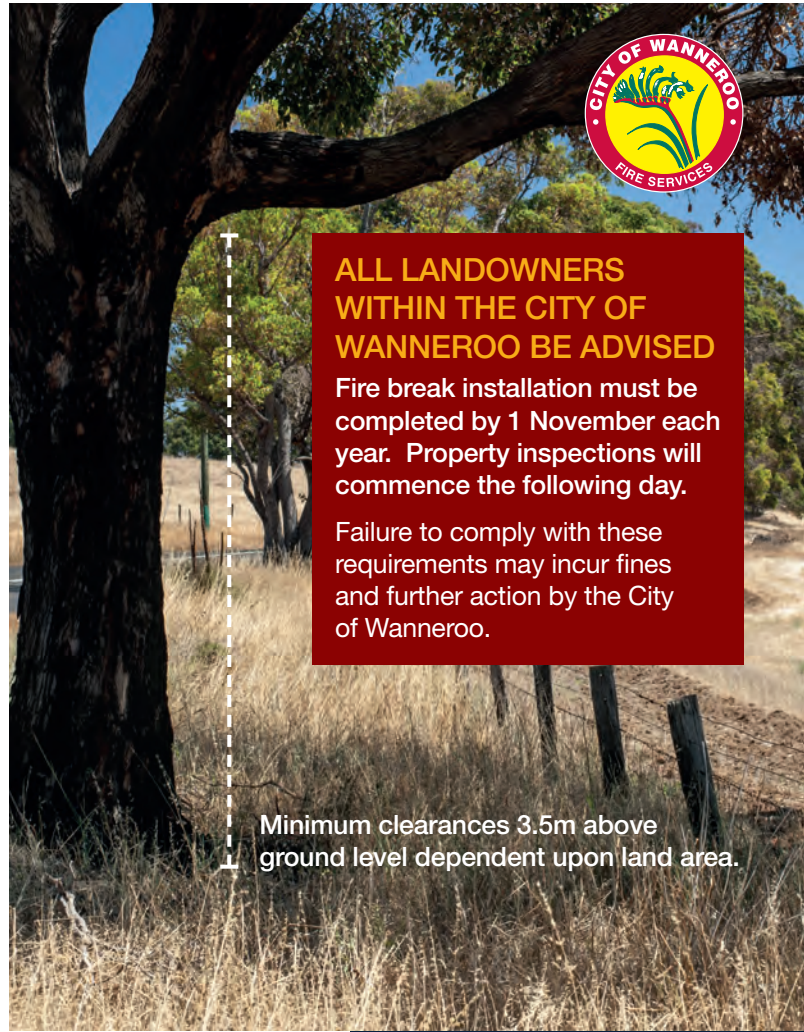
- Install and maintain a twenty (20) metre building protection zone surrounding all buildings, large hay stacks and fuel storage areas. A building protection zone includes undertaking measures such as pruning all lower tree branches to prevent fire entering the trees, ensuring three (3) metre spacing between tree canopies to prevent treetop fires spreading between trees, keeping all grasses to a height of not more than fifty (50) millimetres and storing all firewood piles more than twenty (20) metres away from the buildings.

APPLICATION TO VARY THE ABOVE REQUIREMENTS

If it is considered impracticable for any reason to implement any of the requirements of this Notice, application may be made not later than the 18th of October annually to the Council or its authorised officer for permission to provide alternative fire protection measures. If permission is not granted the requirements of this Notice must be complied with.

ADDITIONAL WORKS

In addition to the requirements of this Notice, you may be required to carry out further works which are considered necessary by an Authorised Officer and specified by way of a separate written notice forwarded to the address of the owner/s as shown on the City of Wanneroo rates record for the relevant land.



Minimum clearances 3.5m above ground level dependent upon land area.



Non-compliant: no fire break installed inside boundary fence



Compliant: grass slashed to ground level



Non-compliant: mineral earth fire break showing grass/weed regrowth



Compliant: mineral earth fire break



Non-compliant: thick scrub creates a fire hazard around power poles



Compliant: cleared buffer zone around power poles



Appendix 5
Water technical standards

Reticulated areas	
Acceptable solution A4.1	The subdivision, development or land use is provided with a reticulated water supply in accordance with the specifications of the relevant water supply authority and Department of Fire and Emergency Services.
Explanatory note E4.1	<p>Water supply authorities in Western Australia include the Water Corporation, Aqwest and the Busselton Water Board.</p> <p>The Water Corporation's 'No. 63 Water Reticulation Standard' is deemed to be the baseline criterion for developments and should be applied unless local water supply authorities' conditions apply.</p>

APPENDIX D

LOCAL EMPLOYMENT STRATEGY

LOCAL EMPLOYMENT STRATEGY

EGLINTON DISTRICT CENTRE



29 AUGUST 2018
PA 1523
DRAFT
PREPARED FOR EGLINTON ESTATES



URBIS STAFF RESPONSIBLE FOR THIS REPORT WERE:

Director	Tim Connoley
Project Code	PA 1523
Report Number	Draft v2

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1. ROLE OF THE STRATEGY

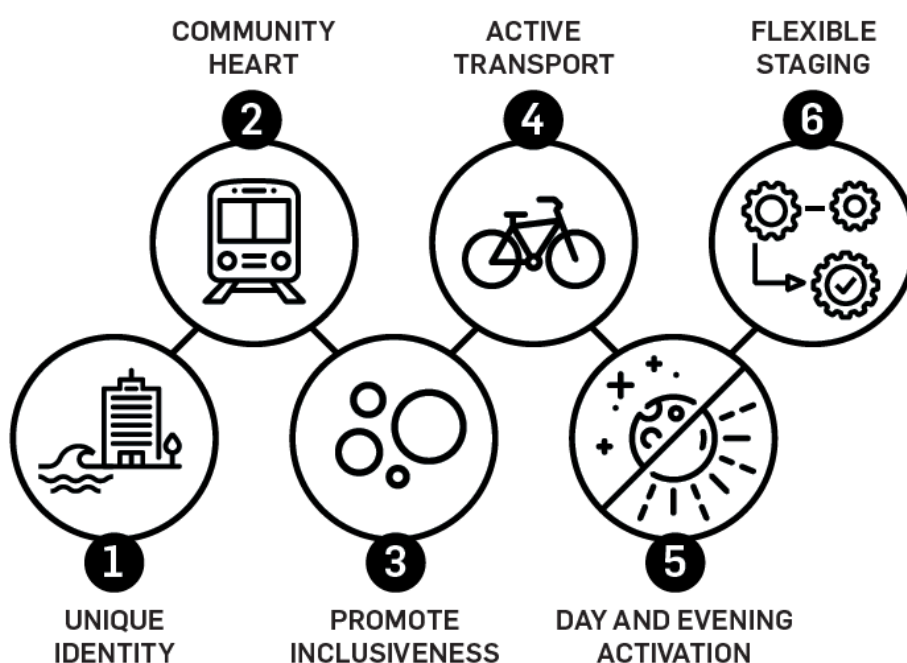
1.1. PURPOSE OF THE STRATEGY

The Eglinton District Centre Local Employment Strategy (the strategy) provides the direction for the district centre to become a vibrant hub that attracts and retains skilled and professional workers, residents and visitors to work, live in and visit the Alkimos / Eglinton region. Focus is afforded to defining the likely future size, composition and character of economic activity in the district centre and the framework and indicative action plan for stakeholders to facilitate this growth and evolution over time.

It is intended that this strategy provides a road map for residents, community groups, businesses, service providers and importantly for these stakeholders to form partnerships. This collaborative approach ensures that any future economic development action and initiative aligns with the identified focus areas and priorities within this strategy.

This strategy complements a visioning exercise that identified six core principles which underpin the activity centre plan.

Figure 1 – Vision Principles



1.2. DEVELOPING THE STRATEGY

This strategy is the outcome of engagement and analytical understanding of the region. In particular, analysis focussed on understanding:

- The expected development potential throughout the district centre and the attributes and market factors which impact on the ability of the centre to attract investment;
- How the district centre can complement other centres to maximise employment and optimise the distribution of land use and floorspace in the region; and
- What potential investment attraction and innovative urban renewal strategies and actions stakeholders should adopt and champion.

1.3. STRUCTURE OF THE STRATEGY

The strategy is comprised of the following key sections.

- **Regional Economy** – overview of the economic objectives, precincts and likely development outcomes in the Alkimos / Eglinton region and identification of the key drivers and challenges to the economic health of the district centre.
- **Economic and Employment Activity** – estimates of projected employment, floorspace and self-sufficiency.
- **Implementation and Action Plan** – definition of the initiatives which will facilitate the development of the district centre's economy.

1.4. POLICY ALIGNMENT

This local employment strategy is a guiding strategy for the Eglinton District Centre that has been informed by a range of policies, strategies, plans and frameworks covering a diversity of issues. To facilitate change, the local employment strategy relies on, links to and builds upon other strategic priorities put in place.

Key documents of relevance include:

- Perth and Peel@3.5 Million;
- Smart Cities Plan;
- Alkimos – Eglinton District Structure Plan;
- Local structure plans; and
- City of Wanneroo Economic Development Strategy.

In particular, this strategy aligns actions and initiatives with the City of Wanneroo's five core focus areas detailed within its economic development strategy.

Figure 2 – City of Wanneroo Economic Development Strategy Programs



2. REGIONAL ECONOMY

2.1. THE NORTH WEST CORRIDOR

Rapid population growth has transformed Perth into a global city which is home to more than two million people and globally recognised within the top ten most liveable cities in the world. The city has benefited from a wave of migration as result of lifestyle and employment opportunities.

The North West Corridor – defined by the City of Joondalup and City of Wanneroo boundaries – has been central to accommodating Perth’s growth over the past three decades and today is home to more than 350,000 people and 180,000 workers.

However recent population growth has resulted in a number of challenging circumstances.

Primarily, local employment in the corridor has long been identified as a significant challenge. As of 2016, the resident labour force outnumbered the number of local job opportunities across all sectors. The most significant disparities were across some of Western Australia’s fastest growing industries over the past decade – finance/professional services, mining and construction services, health care and retail trade.

Against this backdrop, the State Government predicts that Perth is set to develop into a city of 3.5 million residents by 2050 and central to the future growth outlook is the role of the North West Corridor. The numbers of residents and workers in the corridor are expected to double in the corridor to 740,300 and 376,000 respectively. This predicted growth has lent urgency to the need to develop a network of economic precincts to connect people to quality and appropriate employment, health care, education, and social, cultural and recreational facilities.

Whilst this strategy is focused on the Eglinton District Centre, it seeks to recognise the role of the activity centre within the whole North West Corridor; and how supporting the development of the district centre’s economy will facilitate addressing employment challenges in the corridor.

2.2. ALKIMOS / EGLINTON

The need to support local employment opportunities has been a particular focus within the Alkimos to Yanchep growth areas which are expected to accommodate much of the corridor’s future growth. The development of the Alkimos – Eglinton area – given its large predominantly government land holdings – presented an opportunity to more strategically approach the need for local employment. The Alkimos – Eglinton District Structure Plan therefore represented a step-change for the City of Wanneroo and State Government.

When the DSP was being developed a decade ago, the City of Wanneroo had a target of 40% employment self-sufficiency (ESS) for DSPs. However the *Alkimos – Eglinton DSP Economic and Employment Strategy* identified that a 40% ESS (equivalent to 11,000 jobs in DSP area by 2040) is more than achievable. This analysis instead identified that employment could feasibly reach between 13,500 and 17,900 jobs (between 49% and 65% ESS). A more ambitious 60% ESS target was subsequently adopted and continues to be championed throughout developments in the area.

In order to understand how employment was to be accommodated in the DSP area, the *Alkimos – Eglinton Economic and Employment Strategy* and subsequent Alkimos – Eglinton DSP identified that future employment was going to be accommodated across the Alkimos City Centre, Eglinton District Centre, three coastal nodes, local centres, schools and a service commercial activity corridor.

However much has changed over the past decade. Technology is reshaping the way we work, live, shop and socialise more so than the DSP had envisaged. The shifting landscape means that a significant portion of jobs that exist today will no longer exist in 20 years’ time. A greater understanding of these trends has therefore informed local structure planning across the Alkimos – Eglinton DSP area and the role of different employment areas now has been better defined.

In particular, land owners have a greater understanding of striking the right balances between the scale, diversity and location of employment zoned land to optimise employment outcomes and particular attention has been given to advancing vibrant, intensive activity centres.

A review of these LSPs has highlighted the significant change in employment mix and scale of employment generation underway and envisaged. Analysis as part of the development of the LSPs has highlighted a

greater need for clustering and employment density to support centre viability (the notion of an activity centre functioning as a social and economic hub was not fully recognised in the DSP). Many LSPs have also recognised the current and emerging changes in our labour market and what this means in terms of land use requirements.

Several key changes have been made in terms of the roles of different employment precincts. These changes have been summarised below.

Significant growth of neighbourhood / local centre floor space is expected to support three times more employment than originally envisaged.

The DSP identified ten centres to deliver approximately 18,000 square metres of retail (net lettable area), with the majority of this retail space to be accommodated within three coastal nodes. However this analysis didn't recognise the strong demand for neighbourhood centres anchored by major supermarkets, deregulation of shopping hours and the declining viability of small local centres due new developments such as convenience petrol stations.

As such, many centres have subsequently planned to be expanded centres, including Shorehaven Coastal Node, Alkimos Coastal Node, Trinity West Neighbourhood Centre, etc. Based on updated plans, employment in these centres is approximately three times more than originally envisaged in the Alkimos – Eglinton DSP.

The Alkimos Secondary Centre is expected to be home to a mix of shop retail, large format retailers, office accommodation, medical services, education and light industrial uses, as well as higher density residential.

The DSP highlighted the role the city centre in meeting local employment needs however it was assumed that the centre would ultimately only accommodate around 5,200 jobs. In order to define what the Alkimos City Centre would be in 30-years' time, it was assumed that the centre would replicate what Midland was in 2001 (the applicability of Midland as an appropriate comparison could be questioned given the dramatic change Midland has undergone in recent years, with the State Government supporting the expansion of health, large format retail, tertiary education and aged care employment).

It is important to note that the growth in large format retail wasn't anticipated by the DSP. It was assumed the city centre would have 15,000sqm of non-shop retail (in comparison, Joondalup is home to more than 125,000 square metres of large format retail).

Through the development of the centre's local economic strategy, RPS Group undertook employment modelling which identified a more significant role for the centre overall, with current trends demonstrating that it will be able to accommodate 11,600 to 14,600 jobs. Employment modelling also recognised that the mix of employment anticipated for the centre would require a reduction in service commercial land uses.

The Service Commercial Activity Corridor has undergone significant modification reflecting issues relevant to viability and industry growth projections, the evolving nature of activity centres and industrial areas and site constraints.

Approximately 152.7 hectares of service commercial land uses were identified within the eastern portion of the Alkimos – Eglinton DSP area. This activity corridor was envisaged to incorporate uses such as business and research parks, service commercial uses and service industry uses. It is important to note that the *Alkimos – Eglinton Economic and Employment Strategy*, the *Alkimos – Eglinton Retail Assessment* nor any other supporting document explored whether this is an appropriate and feasible level of service commercial land use.

What the *Economic and Employment Strategy* instead explored was what the service commercial land use could develop into. To do this, it looked at Osborne Park, Myaree and Joondalup. However the analysis took the decision to reduce the proportion of retail in these areas as part of the comparison given planning frameworks had not (and probably still haven't) caught on to the fact that service commercial areas are retail-anchored land uses (Myaree is largely home to retail uses, including a specialty supermarket and numerous take-away and food dining options). What this meant was that the service commercial for Alkimos – Eglinton was assumed to largely be made up of light industrial uses within industry sectors which have experienced limited growth in recent years (e.g. manufacturing). In effect, the DSP assumed that the 'service commercial corridor' would function unlike any service commercial/light industrial estate in Perth.

Furthermore, this land use was located between the freeway and the railway in order to have maximum accessibility but this vision has been constrained by uncertainty regarding the delivery of major transport infrastructure.

Table 1 – Employment by Employment Centre, Alkimos-Eglinton DSP Area

	DSP	LSPs
Alkimos Secondary Centre	5,230	13,000
Eglinton District Centre	1,150	1,956
Neighbourhood & Local Centres	1,050	2,940
Service Commercial Activity Corridor	6,820	1,480
TOTAL	14,250	19,376

2.3. ECONOMIC INFLUENCES

Employment precincts are increasingly confronted with changing regional and global trends shaping the economic and environmental landscape.

2.3.1. Retail Evolution

As a primarily retail-anchored centre, it is important to note that the centre will not be immune to structural changes that are occurring in the economy and society. The retail sector in Australia is being tested by numerous factors summarised below.

- **Online retail will become more convenient and ubiquitous** through streamlining of browsing, transaction and fulfilment aspects. This, along with the growth in mobile platforms, will mean that online retail becomes increasingly ubiquitous, allowing customers to shop ‘anytime, anywhere’.
- **Physical retail will begin to take on more characteristics of a service.** With online retail channels offering more seamless transactions and more convenient fulfilment, physical retail will offer more in terms of in-store experience, and customer service to create a point of difference, or complimentary experience. Stores will become more like experiences, allowing customers to view and try products, and ask questions of staff.
- **Ongoing development of new user marketplaces to facilitate exchanges between one another rather than through businesses,** supported by technologies such as blockchain, can support the development of a secure record of ownership. This will go beyond eBay style services and extend into new areas, such as energy sharing in microgrids.
- **Retail is declining as a share of household consumption.** Increased spending on non-retail categories, such as education, healthcare and utilities, is diverting household spending from retail goods. This is exacerbated by deflation in non-food retail goods, driven by increased trade and retail competition.
- **Out-of-centre retailers are adopting smaller floorplate and pop-up mediums** within activity centres and complementing these with large experiential offerings and fulfillment centres.
- **Customers are demanding a seamless experience and self-service options for 24/7 ‘just in time’ consumption options.** This will see the ongoing development of self-service opportunities in stores, which may support longer retail hours due to reduced labour costs and the ongoing development of afterhours delivery platforms (e.g. after-hours delivery services and/or drones).

- **Food retail as a portion of spending has been increasing**, as well as food catering (dining and fast food). The spending categories that have seen substantial declines are household goods, clothing and accessories and department stores.

2.3.2. The Future of Employment

Social, political and economic factors are driving changes in how we work. Key trends of note to the district centre are summarised below.

- **Sharing principles will integrate with traditional business models** as car manufactures move to transport as a service rather than sales of new cars, and retailers provide curated solutions for consumers (e.g. wardrobe subscriptions). Other leaders in this space are software companies like Microsoft as it redefines its business model through Cloud-based services.
- **The “gig economy”** is a direct reference to the freelance or contingent nature of the work undertaken by people in the sharing economy. Australian-based Airtasker is a platform that connects people who need to outsource tasks, to people who can earn money completing those tasks. This trend has implications for both traditional labour hire companies and the relationship between companies and the workforce.
- **From asset heavy to asset light business models.** There is a major shift away from owning the means of capital / production (e.g. Uber not owning any cars, AirBNB not owning any hotels). Growth of freelancing and AirBNB style services will continue to create flexible models for work and property/capital ownership (supported by peer to peer networks).
- **The emergence of shared offices or co-working spaces** is providing an opportunity for employees to work remotely or closer to home rather than travel into their employer’s offices in the CBD.

3. ECONOMIC & EMPLOYMENT ACTIVITY

3.1. DEVELOPMENT FLOORSPACE

Analysis informing the land uses was undertaken by Urbis as part of the retail / commercial needs assessment.

In addition to retail / commercial uses, *Eglinton Estates Pty Ltd* has been in discussions with Catholic Education WA and identified a need to expand the provision of secondary school education facilities within the Eglinton LSP area. According to Catholic Education WA, there is expected to be demand for a three-stream Catholic secondary school by 2026 and a five-stream Catholic secondary school by 2036.

Furthermore, a site is identified for future aged care / independent living units. A 120-bed aged care facility was assumed for the purpose of this analysis (comparable to Aegis Hermitage in Ellenbrook).

Floorspace mix and timing estimates are summarised below.

Table 2 – Floorspace Estimates

	2025	2030	2035	2040
DDS	0	0	5000	5000
Supermarket	5600	9600	9600	9600
Mini Majors	500	1000	2000	2000
Specialty Shops	3000	4000	7000	7000
External	1500	2500	3000	3500
Total Retail	10600	17100	26600	27100
Bulky Goods	2700	4600	6200	8000
Church/Community	900	1500	2100	2600
Library	300	600	800	1000
Pub/Tavern	300	600	800	1000
Sporting Facilities	600	900	1300	1700
Medical Centre	800	1300	1800	2200
Gyms	900	1400	2000	2500
Cinemas/Other Entertainment	300	600	800	1000
Child Care	400	700	1000	1300
Motor Vehicle Services	400	600	800	1000
Real Estate / Finance / Insurance / Etc.	1,000	1,500	2,200	2,700
Retail / Trade Services	1,000	1,700	2,300	3,000
Private School	6,000	12,000	18,000	18,000
Aged Care	0	0	6,000	6,000
Total Activity Centre Floorspace	26,200	45,100	72,700	79,100

3.2. EMPLOYMENT ESTIMATES

The local employment generation potential of the district centre was estimated by applying industry specific workspace ratios to the floorspace estimates for different land uses. In addition, home-based and co-working space employment was based on a conservative proportion of workers (5%).

In summary, the district centre is expected to **support approximately 2,161 jobs by 2040.**

Table 3 – Employment Estimates

	2025	2030	2035	2040
DDS	0	0	167	167
Supermarket	175	300	300	300
Mini Majors	17	33	67	67
Specialty Shops	100	133	233	233
External	115	192	231	269
Total Retail	582	959	1297	1336
Bulky Goods	33	55	75	97
Church/Community	4	6	9	11
Library	2	4	6	7
Pub/Tavern	10	20	26	33
Sporting Facilities	6	9	13	17
Medical Centre	33	53	73	90
Gyms	10	16	22	28
Cinemas/Other Entertainment	4	7	10	12
Child Care	10	17	25	32
Motor Vehicle Services	15	22	29	37
Real Estate / Finance / Insurance	54	79	118	144
Retail / Trade Services	21	36	49	64
Private School	40	80	120	120
Aged Care	0	0	85	85
Total Activity Centre Floorspace	822	1,365	1,957	2,111
Home-Based / Co-Working Hub	10	30	50	50
TOTAL	832	1,395	2,007	2,161

3.3. EMPLOYMENT DIVERSITY

It is expected that population-serving industries will dominate early employment generation, responding to the growth of the retail catchments and associated expenditure levels and service demand. However, as the district centre develops, its exposure to visitation and the provision of co-working spaces will support a more diversified industry base.

3.4. REGIONAL EMPLOYMENT CONTRIBUTION

Assuming a workforce share of total residential population of 50% (in line with corridor averages and accounting for the demographic breakdown of the population), the ESS within the district centre was estimated at 216% by 2040. This is ESS varies across the development profile and staging, reflecting the evolution of the local economy over time and changes in the composition of economic activity.

Table 4 – Employment Self Sufficiency Estimates

	2025	2030	2035	2040
Labour Force	200	600	1,000	1,000
Employment	832	1,395	2,007	2,161
ESS	416%	233%	201%	216%

4. IMPLEMENTATION & ACTION PLAN

4.1. STAKEHOLDER ROLES

The realisation of the district centre's potential, aspirations and objectives will rely on a long term cooperative partnership between Eglinton Estates, Stage Government agencies and the City of Wanneroo.

Eglinton Estates will play a leading role through its commitment to and delivery of key components within its sphere of influence.

Government support and investment is critical to the economic potential of the district centre being realised and employment self-sufficiency targets being achieved. Government will play a fundamental role in the district centre's economic growth and prosperity by:

- Providing a regulatory framework conducive to private sector investment (regulator);
- Delivering a range of community services (service provider); and
- Investing in enabling infrastructure that supports economic and business growth and employment generation (investor).

The absence of effective government investment and facilitation will significantly constrain the economic potential of the district centre, reduce its employment generation capacity and hamper the achievement of employments self-sufficiency targets.

4.2. ACTION PLAN

To support the implementation of the strategy, an action plan has been developed. The plan outlines potential initiatives, objectives and deliverables of responsible stakeholders to facilitate the development of the district centre's economy.

Importantly, the action plan identifies that achieving the vision for the district centre will require effort directed towards achieving a range of town centre principles identified through the visioning process and alignment with the City of Wanneroo's economic development priorities. Actions are therefore purposely aligned with these two documents.

Table 5 – Action Plan

Initiative	Description	Lead	Key Partners
INDUSTRY DIVERSIFICATION			
Local Visitor Amenities	Promote the district centre as a regional visitor hub through development of recreation, entertainment, leisure and retail amenities	Eglinton Estates	Private Developers / Businesses City of Wanneroo
Visitor Events	Implement ongoing events schedule	City of Wanneroo	Eglinton Estates Private Developers / Businesses
Home-Based Employment	Facilitate home-based start-ups and small businesses to locate within the district centre	Eglinton Estates	City of Wanneroo
Clean Technology	Support the adoption of clean energy, water and waste technologies and sustainability measures	Eglinton Estates	City of Wanneroo Utility Providers / Agencies
Private Education	Support the attraction of private education providers to the district centre	Eglinton Estates	City of Wanneroo
EMPLOYMENT LOCATIONS			
Adaptive Buildings	Promote flexible building design to support transition between commercial and residential uses	Eglinton Estates	City of Wanneroo
Uniquely Eglinton	Promote and brand the district centre to support its desirability as a place to invest, live, work and visit	Eglinton Estates	Private Developers / Businesses
Employment Clusters	Support development of an intensive employment core	Eglinton Estates	Private Developers / Businesses City of Wanneroo
INVESTMENT ATTRACTION & ADVOCACY			
Mitchell Freeway	Support the extension of the Mitchell Freeway	City of Wanneroo	Eglinton Estates Private Developers / Businesses
Whiteman Yanchep Highway	Support early investment in the construction of the Whiteman Yanchep Highway	City of Wanneroo	Eglinton Estates Private Developers / Businesses
Development Investment Attraction	Identify and target strategic businesses and services to establish in the district centre	Eglinton Estates	Eglinton Estates Private Developers / Businesses

Initiative	Description	Lead	Key Partners
BUSINESS SUPPORT & WORKFORCE DEVELOPMENT			
Co-Working Hub	Support co-working space development, business networking and support services	City of Wanneroo	Eglinton Estates Co-Working Hub Organisation Wanneroo Business Association
Youth Employment Programme	Support the identification and implementation of youth employment initiatives that can be delivered by private education providers in the district centre	City of Wanneroo	Department of Training and Workforce Development
REGIONAL ECONOMIC DEVELOPMENT			
Collaborative Forum	Support stakeholder collaboration through regular information exchange and shared advocacy	City of Wanneroo	Eglinton Estates Private Developers / Businesses

DISCLAIMER

This report is dated 29 August 2018 and incorporates information and events up to that date only and excludes any information arising, or event occurring, after that date which may affect the validity of Urbis Pty Ltd's (**Urbis**) opinion in this report. Urbis prepared this report on the instructions, and for the benefit only, of Eglinton Hill Pty Ltd (**Instructing Party**) for the purpose of Employment Strategy (**Purpose**) and not for any other purpose or use. To the extent permitted by applicable law, Urbis expressly disclaims all liability, whether direct or indirect, to the Instructing Party which relies or purports to rely on this report for any purpose other than the Purpose, and to any other person which relies or purports to rely on this report for any purpose whatsoever (including the Purpose).

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This report has been prepared with due care and diligence by Urbis and the statements and opinions given by Urbis in this report are given in good faith and in the reasonable belief that they are correct and not misleading, subject to the limitations above.



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APPENDIX E

**LOCAL WATER MANAGEMENT STRATEGY
ADDENDUM**

Local Water Management Strategy Addendum

Eglinton District Centre

Project No: EP18-100(02)

**Prepared for Eglinton Estates Pty Ltd
March 2018**



Local Water Management Strategy Addendum

Eglinton District Centre



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Local Water Management Strategy Addendum

Eglinton District Centre



Executive Summary

Eglinton Estates Pty Ltd (the 'Proponent') are developing Lot 800 and part of Lot 803, Marmion Avenue as a district centre which is part of the greater Eglinton Estate development. The Eglinton District Centre (the 'site') is located within the City of Wanneroo (CoW), 45 km's north west of the Perth central business district and is zoned 'Urban' under both the Metropolitan Region Scheme (MRS) (WAPC 2010) and CoW District Planning Scheme No.2 (DPS 2) (CoW 2012).

This local water management strategy (LWMS) addendum has been prepared to support the Eglinton District Town Centre Activity Centre Plan (ACP) and has been developed in consideration of the principles of *Better Urban Water Management* (WAPC 2008a), *State Planning Policy 2.9 Water Resources* (WAPC 2006a) and *Planning Bulletin 92 Urban Water Management* (WAPC 2008b) and in accordance with the overarching, approved *Eglinton Local Structure Plan Area (LSPA) Local Water Management Strategy* (LWMS)(Coffey 2011). Water will be managed using an integrated water cycle management approach, which has been developed using the philosophies and design approaches described in the *Stormwater Management Manual for Western Australia* (DoW 2007).

The first step in applying integrated water cycle management to the site is to establish agreed environmental values for receiving waters and their ecosystems. Characteristics of both the existing and past environment within the site have been investigated and indicate that:

- The site receives an average of 732 mm of rainfall with the majority of rainfall during winter.
- The site ranges from 27 m AHD to 53 m AHD with a north-westerly aspect.
- Soils of the site are characterized as Safety Bay Sands and Tamala Limestone. This is consistent with regional landform mapping which describes the site as being representative of the Quindalup Formation with undulating dunal landforms.
- Regional acid sulfate soil (ASS) risk mapping indicates that the site has no known risk of ASS occurring within 3 m of the natural soil surface.
- There are no surface water features or classified geomorphic wetlands located within the site. This is due to the presence of highly permeable sands and significant depth to groundwater.
- Groundwater levels on site are approximately 1 m AHD.
- The site is located within the Quindalup Complex for vegetation.
- The site is largely covered with remnant vegetation, with the exception of a number of firebreaks and access tracks.
- The site is located within a Priority 3 public drinking water source area (P3-PDWSA) and well head protection zone (WHPZ).
- Groundwater underlying the site flows west towards the Indian Ocean.
- Nutrient concentrations in groundwater beneath the site are generally low.

The Eglinton District Centre ACP covers an area of 55.4ha and will deliver residential housing densities of R30 to R80, along with commercial lots, areas for public open space (POS) a residential nursing home and a school, as shown in the activity centre plan and structure plan in **Appendix A**.

Local Water Management Strategy Addendum

Eglinton District Centre



The overall objective for integrated water cycle management for the site is to maintain the existing hydrological regime and minimise pollution. The LWMS design objectives seek to deliver best practice outcomes using a water sensitive urban design (WSUD) approach, including management approaches for water conservation, flood mitigation, stormwater quality management and groundwater management.

The criteria proposed within this LWMS are based on consultation with key stakeholders, the characteristics of the existing environment and a contemporary best-practice approach to integrated water cycle management.

The overall approach to water conservation is to reduce the amount of scheme water required within the development at both a lot and estate scale. Within the lot, potable water consumption will be reduced by promoting water efficient fixtures and appliances (WEFA) and water wise gardening (WWG) principles within lot gardens. On an estate scale, groundwater will be utilised for irrigation of landscaped areas within POS which will also utilise WWG principles.

The stormwater management strategy for the site aims to maintain the existing hydrology by retaining flows up to the major rainfall event on site. Retention will be provided through the use of lot soakwells, median swales, bio-retention areas (BRAs), flood storage areas (FSAs) and sub-surface storage, in POS and drainage reserves.

Stormwater quality will be addressed using a treatment train approach. The first 15 mm of rainfall will be retained as close to source as practicably possible. Lots will retain up to the major rainfall event in soakwells. Runoff from the road network will be retained in vegetated median swales within Eglinton Drive with the remaining runoff conveyed to downstream BRAs located within POS and drainage reserves.

Groundwater level management focusses on protecting properties from flooding due to inundation by groundwater. The depth to groundwater on site is over 26 m so no groundwater level management is required. The objective of the management of groundwater quality is to maintain or improve the existing groundwater quality. This will be achieved by reducing total nutrient loads originating from the development and treating surface water runoff as close to source as possible.

The proposed criteria and the manner in which they are proposed to be achieved are presented in **Table E 1**. This table provides a readily auditable summary of the required outcomes which can be used in the future detailed design stage to demonstrate that the agreed objectives for water management at the site have actually been achieved.

This LWMS demonstrates that by following the recommendations detailed in the report the site is capable of being developed for residential and commercial purposes.

Local Water Management Strategy Addendum

Eglinton District Centre



Table E 1 Water Management criteria and compliance

Management Element	Criteria number	Criteria description	Manner in which compliance has been achieved	Responsibility for implementation	When implemented
Water conservation	WC1	Consumption target for water of 100 kL/person/year, including not more than 40-60 kL/person/year of scheme water	Provide advice to residents on water conservation measures	Proponent	Point of sale
			Promotion of rainwater tanks (RWT) within lots	Proponent	Point of sale
			Promotion of waterwise gardening principles (WWG) in lots	Proponent	Point of sale
			Use of WWG principles in lots	Lot owner	Post-house construction
			Use of WWG principles in public open space (POS)	Proponent	Landscape design
			Promotion of water efficient appliances	Proponent	Point of sale
			Use of water efficient appliances	Lot owner	Post-house construction
			Use of water efficient fixtures and fittings	Lot owner	Building construction
	WC2	Maintain an average irrigation rate of 6,750 kL/ha/year in POS	Use of WWG principles in POS	Proponent	Landscape design and maintenance
Groundwater management	GW1	Maintain groundwater quality leaving the site	Treat surface water runoff prior to infiltration to groundwater in vegetated median swales and bio-retention areas (BRAs)	Proponent	Detailed drainage design
			Minimise fertiliser use to establish and maintain POS and road verges	Landscape contractor	Landscape implementation
			Use of drought tolerant species that require minimal water and nutrients	Landscape contractor	Landscape implementation

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Table E 1 Water Management criteria and compliance (continued)

Management Element	Criteria number	Criteria description	Manner in which compliance has been achieved	Responsibility for implementation	When implemented
			Education of residents regarding fertiliser use and vegetation species within lots	Proponent	Point of sale
	GW2	Use water sensitive design approaches to recharge the superficial aquifer	Retain and infiltrate all runoff up to the major rainfall event in soakwells, median swales, BRAs, flood storage areas (FSA) and sub-surface storage on site	Proponent	Detailed drainage design
Stormwater management	SW1	All runoff up to the major rainfall event to be retained on site	All rail reserve areas are assumed to fully retain runoff from the major rainfall event within the reserve	Perth Transit Authority	Detailed drainage design
			Commercial and school lots to retain major rainfall events onsite	Lot owner/developer	Construction
			Road runoff will be retained within median swales, BRAs, FSAs and sub-surface storage within POS and drainage reserves	Proponent	Detailed drainage design
	SW2	Finished floor levels to have a minimum of 300 mm clearance above the major rainfall event flood level in road reserves and 500 mm clearance from major rainfall event flood levels in surface storage areas	Lots adjacent to BRAs and FSAs are provided a minimum of 500 mm clearance from the major rainfall event top water level (TWL)	Proponent	Detailed drainage design
			Lots are provided a minimum of 300 mm clearance above the major rainfall event TWL in adjacent road reserves	Proponent	Detailed drainage design
	SW3	Ensure minor roads remain passable in the minor rainfall event	The pipe network is designed to convey the minor rainfall event to ensure roads remain passable in this event	Proponent	Detailed drainage design
SW4	Retain and treat the small event (first 15mm) of rainfall as close to source as possible	Residential lots to retain the major rainfall event in soakwells and garden areas	Lot owner/developer	Building construction	

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Table E 1 Water Management criteria and compliance (continued)

Management Element	Criteria number	Criteria description	Manner in which compliance has been achieved	Responsibility for implementation	When implemented
			Road runoff will be retained within median swales in road verge, and BRAs within POS and drainage reserves	Proponent	Detailed design stage
	SW5	Reduce nutrient loads by applying appropriate non-structural measures	Minimise use of fertilisers within POS and road verges	Landscape contractor	Landscape implementation
			Use of drought tolerant turf species	Landscape contractor	Landscape implementation
			Maintenance of POS and drainage areas	Maintenance contractor	2 years following construction
			Education of residents regarding responsible nutrient application	Proponent	Point of sale
	SW6	Size surface treatment areas to (at least) 2% of the connected impervious area	BRAs are sized to 3% of the connected impervious area	Proponent	Detailed drainage design

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Appendices

Appendix A

Activity Centre Plan and concept Structure Plan

Appendix B

Eglinton Local Structure Plan Area LWMS Figure 7a and 7b

Appendix C

Concept Earthworks plan

Appendix D

Eglinton District Centre Modelling Assumptions Report

Appendix E

Concept landscape plans and section

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Abbreviation Tables

Table A1: Abbreviations – general terms

General terms	
ACP	Activity centre plan
AEP	Annual exceedance probability
ARI	Average recurrence interval
ASS	Acid sulfate soils
BRA	Bio-retention area
BUWM	Better Urban Water Management
DWMS	District water management strategy
DSP	District Structure Plan
FSA	Flood Storage Area
IWSS	Integrated water supply scheme
LSP	Local Structure Plan
LWMS	Local water management strategy
NDW	Non drinking water
NWGC	North West Growth Corridor
NWQMS	National Water Quality Management Strategy
POS	Public open space
UWMP	Urban water management plan
TWL	Top water level
WEFA	Water efficient fixtures and appliances
WSUD	Water sensitive urban design
WWG	Waterwise gardens
WWTP	Wastewater treatment plant

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Table A2: Abbreviations – organisations

Organisations	
ABS	Australian Bureau of Statistics
ANZECC	Australian and New Zealand Environment and Conservation Council
BoM	Bureau of Meteorology
CoW	City of Wanneroo
DBCA	Department of Biodiversity, Conservation and Attractions
DoP	Department of Planning
DoW	Department of Water (now DWER)
DWER	Department of Water and Environmental Regulation
WAPC	Western Australian Planning Commission

Table A3: Abbreviations – units of measurement

Units of measurement	
°C	Degrees centigrade
ha	Hectare
kL	Kilolitres
km	Kilometre
m	Metre
m AHD	Metres in relation to the Australian height datum
Mm	Millimetre
mm	Millimetre

Table A4: Rainfall events conversion chart

Rainfall event	Annual exceedance probability (AEP)	Equivalent average recurrence interval (ARI)
Small (first 15 mm)	1 exceedance year (EY) event	1 in 1 year ARI event
Minor (residential purposes)	20% AEP event	1 in 5 year ARI event
Minor (commercial/industrial purposes)	10% AEP event	1 in 10 year ARI event
Major	1% AEP event	1 in 100 year ARI event

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1 Introduction

1.1 Background

Eglinton Estates Pty Ltd proposes to develop Lot 800 and part of Lot 803 (herein referred to as “the site”) as the Eglinton District Centre within the wider Eglinton Estate, for residential and commercial purposes.

The site is situated 15 km’s north of Joondalup and 45 km’s north west of Perth central business district. The site has an area of approximately 55.4 ha and is bounded by Pipidinny Road to the north and Marmion Avenue to the west. The location of the site and current aerial imagery is shown in **Figure 1**.

1.2 Town planning context

The Eglinton District Centre was included within the Alkimos-Eglinton District Structure Plan (DSP), which was approved by the City of Wanneroo (CoW) in July 2008 and the West Australian Planning Commission (WAPC) in June 2010. It is proposed that the Eglinton District Centre will be developed for mixed use, residential and commercial purposes.

The site is zoned ‘Urban’ under the Metropolitan Redevelopment Scheme (MRS), ‘Urban Development’ under District structure Plan 2, and ‘Centre’ under the adopted Alkimos-Eglinton District and Local Structure plans.

1.3 Purpose of this report

This local water management strategy (LWMS) addendum is being prepared to support the Eglinton District Centre - Activity Centre Plan (ACP). This LWMS addendum, in conjunction with the *Eglinton Local Structure Plan LWMS* (Coffey 2011) details the water management approach to support the Eglinton District Centre development and is intended to satisfy the requirement to prepare a LWMS in accordance with *Better Urban Water Management* (WAPC 2008a).

1.4 Policy framework

There are a number of state and local government policies of relevance to the site. These policies include:

- *State Water Strategy* (Government of WA 2003a)
- *Statement of Planning Policy 2.9 Water Resources* (WAPC 2006a)
- *Statement of Planning Policy No. 3: Urban Growth and Settlement* (WAPC 2006b)
- *State Water Plan* (Government of WA 2007)
- *Guidance Statement No. 33: Environmental Guidance for Planning and Development* (EPA 2008)
- *Liveable Neighbourhoods Edition 4* (WAPC 2007)
- *Planning Bulletin No. 64: Acid Sulfate Soils* (WAPC 2009)

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- *Bush Forever* (Government of WA 2000)
- *Local Planning Policy 4.4: Urban Water Management* (CoW 2012).
- *Statement of Planning Policy 2.7: Public Drinking Water Source Policy* (WAPC 2003).

In addition to the above policies, there are a number of published guidelines and standards available that provide direction regarding the water discharge characteristics that urban developments should aim to achieve. These are key inputs that relate either directly or indirectly to the site and include:

- *Better Urban Water Management (BUWM)* (WAPC 2008a)
- *Australian Runoff Quality* (Engineers Australia 2006)
- *Australian Rainfall and Runoff (ARR)* (Engineers Australia 2016)
- *Decision Process for Stormwater Management in Western Australia* (DoW 2009)
- *Stormwater Management Manual for Western Australia* (DoW 2007)
- *National Water Quality Management Strategy* (ANZECC 2000)
- *Urban Water Management Plans: Guidelines for Preparing Plans and for Complying with Subdivision Conditions* (DoW 2008).
- *North West Growth Corridor (NWGC) licensing schedule and guidelines* (DoW 2013)
- *Development Design Specification WD5: Stormwater Drainage Design* (CoW 2015).

The guidance documents listed indicate a need for accurate baseline data prior to urban development. This will ensure that any future development is able to fulfil the stormwater management requirements of the Department of Water and Environmental Regulation (DWER) and engineering standards specified by the CoW, but will also ensure that realistic water quality criteria that are practically achievable are adopted.

1.5 Previous documentation

1.5.1 Alkimos-Eglinton District Structure Plan

The Alkimos-Eglinton DSP was prepared by CoW in 2007 (CoW 2007). A district water management strategy (DWMS) was not initially prepared as part of the DSP. Initially a Sustainability Strategy including an Integrated Water Cycle Management Strategy was produced by GHD and appended to the DSP (GHD Australia 2006). In 2011 a DWMS was prepared by GHD to outline the total water cycle management approach for development within the area (GHD Australia 2011). The integrated water management strategy proposed in the DWMS included:

- Efficient use of water inside buildings and for irrigation.
- Restricted supply of potable water for drinking and associated uses.
- Supply of a separate fit-for-purpose water service for non-drinking water uses.
- Best practice stormwater and groundwater management.

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1.5.2 Eglinton Local Structure Plan Area LWMS

The *Eglinton Local Structure Plan Area LWMS* (Coffey 2011) was prepared to support structure planning of the Eglinton estate landholdings. The key principles proposed in the LWMS are consistent with integrated water cycle management principles and include:

- Maximise water use efficiency
 - Optimise the use and reuse of rainwater.
 - Minimise use of scheme water at a lot scale to 100 kL/person/year.
 - Minimise use of water at an estate scale.
- Protect life and property from flooding
 - Retain the 100 year average recurrence interval (ARI) event within downstream POS infiltration areas.
 - Provide minimum 500 mm clearance to 100 year ARI storage levels.
 - Provide minimum 300 mm clearance from dynamic 100 year ARI flood levels.
 - Minor roads must remain passable during the 5 year ARI event.
 - Provide stormwater flow pathway for 100 year ARI event runoff.
 - Provide adequate lot clearance to trapped low points.
 - Provide storage to accommodate extreme events.
 - Design infiltration areas to avoid creating mosquito habitat.
- Protect groundwater quality
 - Treat stormwater runoff before discharging to groundwater.
 - Use water sensitive design approaches to recharge the superficial aquifer.

These key principles have been used to determine the water management objectives identified in this LWMS.

1.6 LWMS addendum objectives

The manner in which stormwater runoff from the site is to be managed to avoid flooding and protect the environment should be clearly documented early in the planning process. This approach provides the framework for actions and measures to achieve the desired outcomes at subdivision and development stages. This LWMS addendum details the water management approach to support the Eglinton District Centre ACP as required in accordance with *Better Urban Water Management* (WAPC 2008a), CoW guidelines and expectations, and incorporates the objectives indicated in the overarching LWMS (detailed in **Section 1.5.2**).

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2 Proposed Development

The Eglinton District Centre covers an area of approximately 55.4 ha. The proposed land uses include:

- Residential
- Commercial
- Retirement village
- School
- Public open space (POS)
- Perth Transit Authority infrastructure
- Drainage reserves
- Road network.

The Eglinton District Centre ACP and concept structure plan are provided in **Appendix A**.

The stormwater approach for the Eglinton District Centre focuses around optimising the location and amenity provided by POS through appropriate inclusion and configuration of drainage across the development. This has been achieved through the integration of water sensitive urban design (WSUD) measures within road reserves where possible, and by minimising the footprint of stormwater infrastructure through the use of spatially efficient storage (detailed in **Section 7**).

3 Pre-development Environment

3.1 Sources of information

The following sources of information were used to provide a broad regional environmental context to the site:

- *National Water Quality Management Strategy* (ANZECC 2000)
- *Perth Metropolitan Region 1:50 000 Environmental Geology Series* (Gozzard 1986)
- *Geomorphic Wetland Database – Swan Coastal Plain* database (DBCA 2018)
- *Acid Sulfate Soil - Swan Coastal Plain* database (DWER 2018a)
- *Locate* (Landgate 2018)
- *Water Register* (DWER 2018)
- *Perth Groundwater Atlas* (DWER 2018)
- *Weather and Climate Statistics Data* (BoM 2018).

3.2 Climate

The site experiences a warm dry climate characterised by hot dry summers and mild wet winters. Most rain falls during the winter months with a median rainfall of 732 mm (BoM 2018). Air temperatures are similar to those experienced in Perth, with the mean daily temperature ranging from a maximum of 31.6°C in summer to a minimum of 7.8°C in winter.

3.3 Geotechnical conditions

3.3.1 Topography

The site is a roughly undulating dune landscape overlain by well-defined vegetated dunes. The site has a minimum elevation of 27 m Australian height datum (AHD) along the western boundary with Marmion Avenue, and a maximum elevation of 53 m AHD in the east of the site. The site has a generally northwesterly aspect. The topographic contours are shown in **Figure 2**.

3.3.2 Geology

The two geological units most evident at the site are the Safety Bay Sand and Tamala Limestone. Safety Bay Sand is white, fine to medium grained sand of Aeolian origin. Tamala limestone is a light yellowish-brown fine to coarse grained Aeolian calcarenite and is often overlain by Safety Bay Sand. This is consistent with regional landform mapping which describes the site as being representative of the Quindalup Formation with undulating dunal landforms.

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A review of the *Perth Metropolitan Region 1:50 000 Environmental Geology Series* (Gozzard 1986) was undertaken to determine the underlying geology of the site. This indicated that the site is largely underlain by:

- (LS1) Light yellowish-brown, fine to coarse grained sub-angular to well-rounded quartz, trace feldspar, shell debris, variable lithified, surface kankar of Aeolian origin. This soil type is moderately permeable, has a moderate-high slope stability, and is suitable for construction of roads and urbanisation.
- (S7) Sand-pale and olive yellow, medium to coarse grained, sub-angular quartz with traces of feldspar, moderately sorted, of residual origin. This soil type is moderately permeable, has a low-moderate slope stability, and is suitable for construction of roads and urbanisation.

The mapped extent of the geological units across the site is shown in **Figure 3**.

3.3.3 Acid sulfate soils

Regional acid sulfate soil (ASS) risk mapping indicates that the site has no known risk of ASS occurring within 3 m of the natural soil surface (DER 2006).

3.4 Hydrology

3.4.1 Wetlands

The *Geomorphic Wetlands Database* (DPAW 2017) indicates that there are no wetlands within the site.

3.4.2 Surface water quantity

The soil profile consists of permeable sands and as such rainfall at the site is largely infiltrated, with sheetflow seen in major rainfall events. Therefore, there are no surface water features present on site.

3.4.3 Groundwater levels

The *Perth Groundwater Map* (DWER2018) indicates that groundwater flow direction is westerly towards the coast. The maximum groundwater level beneath the site is approximately 1 m AHD. Due to the variable topography of the site depth to groundwater is between 26 m and 52 m.

There are no groundwater monitoring bores within the site, however there is a nearby DWER bore approximately 300 m west of the site which is screened into the superficial aquifer. This location is identified as site 61611672 on DWER *Water Information Reporting*. Groundwater elevations at this location (as recorded by DWER from 1989 until 2010) have ranged from 0.78 m AHD to 1.43 m AHD.

3.4.4 Groundwater quality

There is no groundwater quality data available for the site.

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3.4.5 Public drinking water source area

The site is located within a priority 3 (P3) drinking water source area (PDWSA) with a wellhead protection zone (WHPZ) across the southwest of the site (shown in **Figure 4**). SPP 2.7 (WAPC 2003) states that P3 source protection areas are defined to manage the risk of pollution of the water source. P3 areas are declared over land where water supply sources need to co-exist with other land uses such as residential, commercial and light industrial developments, although there is some restriction on potentially highly polluting land uses. Land uses that area not permitted include:

- Piggeries and abattoirs
- General industry including metal finishing, heavy industry and petroleum refining
- Tanneries and animal product rendering
- Power stations and fuel based energy production
- Mineral processing
- Landfill class II or higher and used tyre storage
- Managed aquifer recharge.

None of the land uses above are proposed for the site.

3.5 Flora

The site is within the Quindalup Complex (Hedde *et al.* 1980). The vegetation associations found in the site are shown and described in Figure 7a and 7b of the overarching *Eglinton Local Structure Plan Area (LSP) LWMS* (Coffey 2011), provided in **Appendix B**.

3.6 Current and historical land uses

The site is undeveloped and consists of native bushland, with some firebreaks and access tracks.

3.7 Summary of existing environment

In summary, the environmental investigations conducted to date indicate that:

- The site receives an average of 732 mm of rainfall with the majority falling during winter.
- The site ranges from 27 m AHD to 53 m AHD with a northwesterly aspect.
- Soils of the site are characterised as Safety Bay Sands and Tamala Limestone. This is consistent with regional landform mapping which describes the site as being representative of the Quindalup Formation with undulating dunal landforms.
- Regional ASS risk mapping indicates that the site has no known risk of ASS occurring within 3 m of the natural soil surface.
- There are no surface water features or classified geomorphic wetlands located within the site. This is due to the presence of highly permeable sands and significant depth to groundwater.
- Groundwater levels on site are approximately 1 m AHD.
- The site is within the Quindalup Complex for vegetation.

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- The site is largely covered with remnant vegetation, with the exception of a number of firebreaks and access tracks.

4 Design Criteria and Objectives

This section outlines the objectives and design criteria that this LWMS addendum and future urban water management plans (UWMP) must achieve.

4.1 Integrated water cycle management

The *State Water Strategy* (Government of WA 2003b) endorses the promotion of integrated water cycle management and application of WSUD principles to provide improvements in the management of stormwater, and to increase the efficient use of other existing water supplies.

Integrated water cycle management addresses not only physical and environmental aspects of water resource use and planning, but also integrates other social and economic concerns. Stormwater management design objectives should therefore seek to deliver better outcomes in terms of:

- Water conservation
- Groundwater management
- Flood mitigation
- Stormwater quality management.

The first step in applying integrated water cycle management in urban catchments is to establish agreed environmental values for receiving waters and their ecosystems. The existing environmental context of the site has been discussed in **Section 3** of this document. Guidance regarding environmental values and criteria is provided by a number of National and State policies and guidelines, (detailed in **Sections 1.4**).

The overall objective for preparing integrated water cycle management plans for proposed residential developments is to minimise pollution and maintain the existing hydrological regime. This objective is central to the water management approach for the site.

4.2 Water conservation

Water conservation design criteria have been determined in line with the guidelines presented in *BUWM* (WAPC 2008a). This LWMS proposes the following water conservation criteria:

Criteria WC1 Consumption target of 100 kL/person/year.

Criteria WC2 Maintain an average irrigation rate of 6,750 kL/ha/year in POS areas.

The manner in which these objectives will be achieved is further detailed in **Section 5**.

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4.3 Groundwater management

The principle behind the groundwater management strategy is to maintain the existing groundwater hydrology. The groundwater management criteria include:

Criteria GW1 Maintain groundwater quality leaving the site.

Criteria GW2 Use WSUD approaches to recharge the superficial aquifer.

The manner in which this objective will be achieved is further detailed in **Section 6**.

4.4 Stormwater management

The principle behind stormwater management at the site is to mimic the pre-development hydrological conditions, as described in **Section 3.4**. This principle and the guidance documents discussed in **Section 1.4** have guided the stormwater management criteria.

Criteria SW1 All runoff up to the major rainfall event (1% AEP) is to be retained on site.

Criteria SW2 Finished floor levels must have a minimum of 300 mm clearance above the major rainfall event flood levels in road reserves and 500 mm clearance from the major rainfall event flood levels in surface storage areas.

Criteria SW3 Ensure minor roads remain passable in a minor storm event (20% AEP).

Criteria SW4 Retain and treat the small rainfall event (first 15 mm) as close to source as possible.

Criteria SW5 Reduce nutrient loads by applying appropriate non-structural measures.

Criteria SW6 Size surface treatment areas to be (at least) 2% of the total connected impervious area.

The manner in which these objectives will be achieved is further detailed in **Section 7**.

5 Water Source Allocation, Infrastructure, Fit-for-Purpose and Water Use

5.1 Fit-for-purpose water use

Conservation of water through fit-for-purpose use and best management practices is encouraged so that scheme water is not wasted. Fit-for-purpose describes the use of water that is of a quality suitable for the required use of the water. Fit-for-purpose principles have been utilised in the water conservation strategy for the Eglinton District Centre development and will achieve **Criteria WC1**.

5.1.1 Scheme water

The site is proposed to be connected to the Water Corporations Integrated Water Supply Scheme (IWSS).

5.1.2 Groundwater

The DWER *Online Water Register* (DWER 2018) indicates that the site is located in the Perth groundwater area, within the Eglinton sub-area. Groundwater can be used for irrigation of POS areas and establishment of landscaped areas (including road verges) instead of utilising scheme water.

The site is subject to the requirements of the *North West Corridor Water Supply Strategy (NWCWSS)* (DoW 2014) and supporting licencing schedule and calculation methodology (DoW 2013) which determines the groundwater allocation available for the development based on the provisions within the ACP.

Two groundwater licences have been obtained for the Eglinton Estates developments located to the east of Marmion Avenue (Lot 800, Lot 801 and Lot 803), including:

- GWL202564(1) – establishment irrigation uses up to 92,046 kL/year.
- GWL202567(1) – permanent irrigation uses up to 15,084 kL/year.

The permanent allocation provided for the Eglinton District Centre is 2,910 kL/year.

5.1.3 Waste water reuse

Within the Alkimos Eglinton DWMS (GHD Australia 2011) provision of a non-drinking water (NDW) supply through a dual reticulation (third pipe) network was proposed. The NDW supply was proposed for irrigation uses in the initial stages of development (up to 2015) with the intention of expanding its use to non-potable in-house water uses in the future.

Alternative water sources to supply the NDW network included groundwater, stormwater harvesting and treated wastewater from the adjacent Alkimos WWTP.

The network required the agreement and input of a number of stakeholders across the Alkimos-Eglinton DSP area, including the local government and identification of a long-term service provider.

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As of March 2019, a recycled effluent scheme capable of supplying a third pipe system to dwellings and commercial premises has not been agreed upon.

5.1.4 Rainwater tanks

Collection of runoff from roof surfaces can be undertaken, with this water stored within rainwater tanks (RWT) for later use. Stored rainwater may be used for some irrigation requirements however this will need to be supplemented with scheme water during the lower rainfall months. During the higher rainfall months the majority of the stored rainwater can be used to supplement internal building non-potable uses. The water efficiency strategy recommends that rainwater is used in washing machines, toilets and hot water systems.

The use of rainwater tanks as described in the following sections will not be mandated within the Eglinton District Centre. An average uptake rate for RWT of 9% has been identified by the Australian Bureau of Statistics (ABS (2013)).

The above measures will assist in achieving **Criteria WC1**

5.2 Water conservation measures

The development will utilise groundwater for POS irrigation, active POS irrigation management, RWT, water wise garden (WWG) principles for lot scale gardens and within estate landscaping, and water efficient fixtures and appliances (WEFA) to ensure that the development minimises the use of water. These measures are further discussed in the following Sections.

5.2.1 Water efficient fixtures and appliances

Significant reductions in internal house water uses can be achieved with the use of WEFA. **Table 1** provides an example of the water uses of typical appliances versus water efficient appliances. These water use rates have been used in the water use analysis.

Table 1: Water efficient fixtures and appliances

Appliance	Water Use	
	Standard Device	Water Saving Device
Toilet	12 Litres/Flush	4 Litres/Flush
Washing Machine	130 Litres/Wash	40 Litres/Wash
Dishwashers	50 Litres/Wash	25 Litres/Wash
Shower Head	15-25 Litres/Minute	6-7 Litres/Minute
Taps	15-18 Litres/Minute	5-6 Litres/Minute

(Melbourne Water 2003; Australian Government 2009)

The Eglinton District Centre water conservation strategy proposes that all residential dwellings and commercial buildings use water efficient fixtures and that all residential dwellings use water efficient appliances.

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The *Plumbing Licencing and Plumbing Standard Regulations 2000* mandate the plumbing standards that apply within Western Australia. The regulations which apply include Part B1 of the Plumbing Code of Australia (PCA). Specifically, Parts B1.5 and B1.6 of the PCA prescribe discharge limitations and maximum flow rates for flushing mechanisms and cold water outlets, respectively. The use of water efficient fixtures is therefore mandated during the construction of buildings.

The above measures will assist in achieving **Criteria WC1**.

5.2.2 Water wise gardens

Reductions in water use for irrigation by employing water efficiency measures can significantly reduce the total water usage (WC 2003). The development will undertake a variety of measures to limit water use into the future within POS and road verges, and the private residential landscape works under the control of the proponent.

A variety of methods and approaches will be considered including any or all of the following:

- The adoption of water wise species, with a focus on using local native water wise species or if necessary, species from regions with similar climates.
- Where required, existing site soil may be improved with soil conditioner certified to Australian Standard AS 4454 to a minimum depth of 150 mm where turf is to be planted and a minimum depth of 300 mm for garden beds.
- The irrigation system is proposed to be designed and installed according to best water efficient practices including consideration of hydro zone design solutions.
- Garden beds will be mulched to 75 mm with a product certified to Australian Standard AS 4454.
- The design will cater for efficient water requirements during POS maintenance. This will be achieved by implementing an appropriate management and maintenance program for POS areas that will be further detailed at the UWMP stage.
- Community awareness of water conservation will be promoted at the point of sale and during the project sales lifespan.

WWG principles will be carried out within all POS areas and road reserves, and will be promoted to purchasers on sale of lots.

The above measures will assist in achieving **Criteria WC1** and **WC2**

5.3 Lot water usage

A water use analysis has been undertaken to demonstrate the effectiveness of the water conservation strategy proposed. The analysis considers realistic uptakes of non-mandatory water conservation measures and full uptake of mandated measures as detailed in **Section 5.2**.

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The water use analysis has been based on the rates and calculation methodology presented in the Water Corporation Spreadsheet *AltWaterSupply_Water_Use_Model.xls* (WC 2011). Uptake rates and population assumptions are calculated using data from the ABS (ABS 2013, 2014). The water use analysis assumes an average of 1.8 people per lot, for lots zoned R80, and 2.6 people per lot, for all other residential zoning (ABS 2014). The water use analysis also makes assumptions on the provision and use of water to various commercial uses within the Eglinton District Centre as detailed below:

- 12.18 ha shopping centre with a consumption rate of 1.08 kL/m²/year.
- 3.29 ha light industrial area with a consumption rate of 0.94 kL/m²/year.
- 3.43 ha nursing home with an assumed 15 beds per hectare (based on Perth nursing homes) and a consumption of 144.49 kL/bed/year.
- 10.01 ha school site with 700 students and a consumption rate of 7.06 kL/student/year.

The results of the water use analysis indicate that on average, if households in the development adopt the proposed water conservation measures at typical uptake rates, they will use 65.7 kL/person/year of scheme water. If non-mandatory water conservation measures are not taken up, usage will be 68.1 kL/person/year.

This achieves the state water consumption target of no more than 100 kL/year/person and satisfies **Criteria WC1**.

5.4 Estate scale water use

The water use at an estate scale is determined by the amount of POS provided that requires irrigation, the amount of road verge that will require irrigation and the rates at which these are irrigated. Not all of the POS areas will be irrigated at the same rates as some areas will utilise native vegetation, while others will utilise turf to provide active recreation areas. Irrigation water for POS and road verges will be supplied by groundwater (discussed in **Section 5.1.2**) with only irrigation of turf areas required permanently.

Within the proposed POS for the Eglinton District Centre, there are two areas of active grass that will require permanent irrigation. The area for permanent grass requiring irrigation to the central POS is in the region of 1,000 m², and within the entry POS (Carphin Drive) is 2,150 m² for banks and circular lawn and 1,150m² for the elliptical active area which forms the base of the BRA5 Basin (as indicated in the landscape concept plans provided in **Appendix E**). Kikuyu turf is proposed for all active grassed areas. All other development irrigation within the District Centre will be for establishment purposes only.

Based on a permanent irrigation area of approximately 4,300 m² and a rate of 6,750 kL/ha/year, this equates to 2,905 kL/year allocation required. This is within the groundwater allocation for the site (discussed in **Section 5.1.2**) and meets **Criteria WC2**.

More detailed irrigation requirements will be provided at the landscape design phase and detailed within future UWMPs.

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5.5 Wastewater management

The site will be connected to the Water Corporation main sewer network.

5.6 Water conservation management criteria compliance summary

A summary of the proposed water conservation design criteria, and how these are addressed within the Eglinton District Centre, is provided in **Table 2**.

Table 2: Water conservation criteria compliance summary

Criteria number	Criteria description	Manner in which compliance will be achieved
WC1	Consumption target for water of 100 kL/person/year	Use of RWT within lots of suitable built form
		Provision of advice to lot owners regarding water conservation measures
		Promotion/use of WWG principles
		Promotion/use of water efficient appliances
		Use of water efficient fittings
WC2	Maintain an average irrigation rate of 6,750 kL/ha/year in POS areas	Groundwater to be used for irrigation of POS and road verges
		Harvested rainwater used for irrigation of lot gardens and in lot use for suitable built form (where installed)
		Scheme water for use in lots

6 Groundwater Management Strategy

The development drainage system has been designed to achieve the objectives and criteria stated in **Section 4.3**.

6.1 Groundwater level management

As discussed in **Section 3.4.3**, depth to groundwater varies between 26 m and 52 m below natural surface. Groundwater level management measures are therefore not required, for Eglinton District Centre.

6.2 Groundwater quality management

The main objective for the management of groundwater quality is to maintain or improve the existing groundwater quality. This can be achieved by treating surface runoff prior to infiltration via application of appropriate WSUD measures, thereby reducing the total nutrient load into the groundwater that originates from the development.

The reduction of nutrient load to the groundwater will be achieved in the development by:

- Directing stormwater to vegetated (with native wetland species) bio-retention areas (BRA) (detailed further in **Section 7.3**).
- Fertiliser use to establish and maintain vegetation within POS areas and road verges will be minimised.
- Drought tolerant turf species that require minimal water and nutrients will be used.
- Roll-on turf will be used within the POS areas and road verges, to prevent the high nutrient input requirement during establishment of the turf.
- Garden beds should not be immediately adjacent to the FSAs or BRAs to reduce nutrient transportation into these infiltration areas.

The above measures will improve the quality of the water prior to it infiltrating into the underlying groundwater, and will assist in achieving **Criteria GW1, GW2**.

6.3 Groundwater management criteria compliance summary

A summary of the proposed groundwater quantity design criteria and how these are addressed within the Eglinton District Centre area is provided in **Table 3**.

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Table 3: Groundwater management criteria compliance summary

Criteria number	Criteria description	Manner in which compliance will be achieved
GW1	Maintain or improve groundwater quality leaving the site	Bio-retention areas to treat surface water runoff prior to infiltration to groundwater
		Fertiliser use to establish and maintain vegetation within POS areas and road verges will be minimised through the use of drought tolerant species and roll on turf
GW2	Use water sensitive design approaches to recharge the superficial aquifer	Soakwells within lots sized to infiltrate up to the small rainfall event runoff
		FSAs will be sized to retain and infiltrate flows up to the major rainfall event
		Bio-retention areas sized to retain and infiltrate the small rainfall event runoff from roads

7 Stormwater Management Strategy

The principle behind the stormwater management strategy for the Eglinton Town Centre is to maintain the existing hydrology by retaining surface flows and infiltrating stormwater runoff as close to source as possible. The development drainage system has been designed to achieve the objectives and criteria stated in **Section 4.4** and has been informed by the concept earthworks plan prepared for the ACP (provided in **Appendix C**).

7.1 Residential lot drainage system

All lots will fully retain the major rainfall event runoff on lot in soakwells, infiltration in pervious areas and other detention measures.

The implementation of soakwells will assist in achieving **Criteria SW1**.

7.2 Non-residential lot drainage system

7.2.1 Commercial/business and school lots

Commercial/business and school lots will be required to retain all runoff from all events up to the major rainfall event within lot. This can be achieved within soakwells, surface basins, subsurface storage or alternative storage methods (RWT), and will assist in achieving **Criteria SW1**.

7.2.2 Rail reserve

All rail reserve areas are assumed to fully retain runoff from the major rainfall event within the reserve.

The above measures will assist in achieving **Criteria SW1**.

7.3 Development drainage system

The storm water runoff from the small rainfall event will be retained as close to source as practicably possible. There will be no runoff from the development during a small rainfall event. This is consistent with the pre-development environment and the design criteria (see **Section 4.4**).

The retention storage will be provided via vegetated median swales in road reserve, and BRAs in POS or drainage reserve. The vegetation and the infiltration process within the soil column will remove contaminants (nutrients, gross pollutants, suspended sediments, etc.) within the stormwater runoff.

Rainfall events greater than the small rainfall event will be conveyed by overland flow or a pipe network to FSAs, or sub-surface storage. The size of the FSAs and sub-surface storage will be minimised due to the retention storage provided higher up in the catchment and within lots. The stormwater drainage system for the Eglinton District Centre area (including nominal locations for BRAs and FSAs and sub-surface storage) is shown in **Figure 5**.

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7.3.1 Median swale

A vegetated median swale will be constructed within the Eglinton Drive road reserve. This swale will be used to detain runoff from the Eglinton Drive road reserve from catchments 3b and 4 as detailed in **Section 7.4.1** until it reaches capacity, at which point flows from catchment 3b will be redirected to FSA 3 and flows from catchment 4 will be redirected to FSA 4.

The median swale will be planted with vegetation species suitable for nutrient uptake, consistent with the *Vegetation guidelines for stormwater biofilters in the south-west of Western Australia* (Monash University 2014).

The proposed location of the median swale retention storage in Eglinton Drive is shown in **Figure 5**.

The use of a median swale and its detailed design will assist in achieving **Criteria SW1, SW2, SW4 and SW6, GW1 and GW2**.

7.3.2 Bio-retention areas

Runoff from the small rainfall event from road reserves will be captured and retained within vegetated BRAs located in POS and drainage reserves. The BRAs will be planted with vegetation species suitable for nutrient uptake, consistent with the *Vegetation guidelines for stormwater biofilters in the south-west of Western Australia* (Monash University 2014).

BRAs 1 – 3 and 6 will be co-located with FSAs. BRAs 4 and 5 are sized to retain the first 15 mm with underlying sub-surface storage used for minor and major event runoff (discussed in **Section 7.3.4**).

The infiltration rates used within the hydrological modelling have been based on measurements recorded within soils in the local area and an infiltration rate of 6 m/day has been adopted in the design of storage infiltration structures, with a 50% clogging factor applied for BRAs.

The sizes and spatial requirements for BRAs are further discussed in **Section 7.4.2**. The exact location and configuration of BRAs is subject to confirmation at detailed design stage with any changes made to the assumptions detailed in this LWMS addendum to be indicated in future UWMPs.

The use of BRAs will assist in achieving **Criteria SW1, SW5, SW6, GW1 and GW2**.

7.3.3 Flood storage areas

FSAs will be utilised to infiltrate major event runoff in order to maintain the pre-development hydrological regime. FSAs 1 - 3 and 6 will be collocated with BRAs so that any flows exceeding the small rainfall event will automatically continue to fill into the respective FSAs. The FSAs are not designed to be permanently wet.

The infiltration rates used within the hydrological modelling have been based on measurements recorded within soils in the local area and an infiltration rate of 6 m/day has been adopted in the design of storage infiltration structures.

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The design of FSAs will be such that maximum top water levels within basins will remain at least 500 mm below finished floor levels of adjacent lots to ensure protection from flooding during extreme rainfall events. The sizes and spatial requirements for FSAs are further discussed in **Section 7.4.2**.

The use of FSAs will achieve **Criteria SW1**, while the design of the FSAs will ensure that **Criteria SW2** and **SW6** are achieved.

7.3.4 Sub-surface storage

Sub-surface storage will be used to capture minor and major event runoff in areas where the surface drainage footprint needs to be minimised to ensure a level of usability in POS and efficiency of space considering the overarching needs of a district centre development. Sub-surface storage will be located beneath BRAs with flows above the BRA capacity being directed into the subsurface storage via bubble-down pits. The maximum assumed depth of sub-surface storage is 1.5 m with vertical side slopes. The specific product to be used in sub-surface storage is still to be determined but may include Stormtech cells or Holcim/Humes Stormtrap system.

Sub-surface storage is proposed below BRA4 and BRA5 (labelled FSA4 and FSA5 respectively). The configuration and use of sub-surface storage areas can be reviewed at subdivision if required. The sizes and spatial requirements for sub-surface storage are further discussed in **Section 7.4.2**.

The use of sub-surface storage will assist in achieving **Criteria SW1**.

7.4 Drainage design assessment

As described in **Section 7.3**, this LWMS proposes to utilise soakwells, median swales, BRAs FSAs and sub surface storage to retain runoff from all events up to the major rainfall event onsite. The sizing of these retention areas is best achieved via a computational model. The post-development modelling methodology and parameters are detailed in the *Eglinton District Centre Modelling Assumptions Report* (Emerge Associates 2019) provided in **Appendix D**. Drainage catchments and stormwater management infrastructure is shown in **Figure 5** with concept landscape plans and sections provided in **Appendix E**.

7.4.1 Small rainfall event modelling results

The design volume and inundated areas of the treatment structures are shown in **Table 4**.

Table 4: Small rainfall event retention storage

Bio-retention area	Maximum depth	Side slopes	Top water level surface area (m ²)	Volume (m ³)
BRA1	0.11	1:4	143	15
BRA2	0.11	1:4	120	13
BRA3	0.29	1:6	440	110
BRA4	0.5	n/a	325	128

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Table 4: Small rainfall event retention storage (continued)

Bio-retention area	Maximum depth (m)	Side slopes	Top water level surface area (m ²)	Volume (m ³)
BRA5	0.5	n/a	1,195	530
BRA6	0.28	1:6	1,228	312
Swale 3b	0.25	1:6	400	50
Swale 4	0.25	1:6	510	35

The total size of the bio-retention system, achieved through at-source retention storage provided by BRAs and the median swale, is equal to 3% of the connected impervious area, which achieves **Criteria SW6**.

The location and inundated area within the Eglinton District Centre development for the small rainfall event is shown in **Figure 6**.

7.4.2 Minor and major rainfall event modelling results

The Eglinton District Centre area aims to retain runoff from events up to the major rainfall event, as required under **Criteria SW1**. This is achieved by the use of at-source retention and infiltration storage within soakwells, median swales, BRA's, FSA's and sub-surface storage. The modelled inundated depths and top water level areas for the FSAs and sub-surface storage are provided within **Table 5**.

Table 5: FSA volumes and depths in the minor and major rainfall event

FSA	Storage type	Minor rainfall event			Major rainfall event		
		Depth (m)	Top water level surface area (m ²)	Volume (m ³)	Depth (m)	Top water level surface area (m ²)	Volume (m ³)
FSA1	Surface basin	0.23	167	34	0.5	227	86
FSA2	Surface basin	0.24	142	29	0.5	197	73
FSA3	Surface basin	0.63	625	290	1.2	1,015	750
FSA4	Sub-surface storage	0.37	542	200	1.5	542	813
FSA5	Sub-surface storage	0.32	1,710	555	1.5	1,710	2565
FSA6	Surface basin	0.57	1,486	707	1.2	2,121	1,830

The minor rainfall event inundation areas are shown in **Figure 7**. The major rainfall event inundation areas and flow paths are shown in **Figure 8**.

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Note that the number of BRAs, FSAs, and sub-surface storage can be modified at the detailed design stage, provided the assumed storages detailed in **Table 4** are maintained.

The above measures will help to achieve **Criteria SW1** and **SW6**.

7.5 Non-structural water quality measures

The structural measures proposed within Eglinton District Centre provide both a storage and treatment function to stormwater runoff, as detailed in **Section 7.3**.

A number of non-structural measures will also be implemented across the site to help reduce nutrient loads within stormwater runoff. These measures include:

- Minimising fertiliser use to establish and maintain vegetation within POS areas and road verges.
- Drought tolerant turf species that require minimal water and nutrients will be used.
- Maintenance of treatment areas to remove accumulated sediments and gross pollutants.
- Education of residents regarding fertiliser use and low nutrient requirement vegetation species within lots.

The above measures will assist in achieving **Criteria GW1**.

7.6 Stormwater management criteria compliance summary

A summary of the proposed stormwater design criteria and how these are addressed is given within **Table 6**.

Table 6: Stormwater management criteria compliance summary

Criteria number	Criteria description	Manner in which compliance will be achieved
SW1	All runoff from the major rainfall event to be retained on site	All rail reserve areas are assumed to fully retain runoff from the major rainfall event within the reserve
		Commercial/business and school lots to retain major rainfall events onsite
		Road runoff will be retained within median swales, BRAs, FSAs and sub-surface storage within POS and drainage reserves
SW2	Finished floor levels of lots shall have a minimum 300 mm clearance to the major rainfall event flood levels in road reserves and 500 mm clearance from the major rainfall event flood levels in surface storage	Clearances to flood levels will be achieved and described during the detailed design phase and contained in the later UWMP
SW3	Ensure minor roads remain passable in the minor storm event	The pipe network will be designed to convey the minor rainfall event which will ensure roads remain passable

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Table 6: Stormwater management criteria compliance summary (continued)

Criteria number	Criteria description	Manner in which compliance will be achieved
SW4	Retain and treat the small rainfall event (i.e. first 15 mm of rainfall) as close to source as possible	All lots to retain small event runoff in soakwells and pervious garden areas
		Road runoff will be retained within treatment areas within road medians, POS and drainage reserves
SW5	Reduce nutrient loads by applying appropriate non-structural measures	Drought tolerant species that require minimum nutrients will be selected
		Promotional materials will be provided to residents
		Minimal fertiliser will be used in the establishment and maintenance of POS area and road verges
		Gross pollutants and sediments will be periodically removed from treatment structures
SW6	Size surface treatment areas to be (at least) 2% of the connected impervious area	Treatment area are sized to be 3% of the connected impervious area

8 Subdivision and Urban Water Management Plans

The requirement to undertake preparation of more detailed water management plans to support subdivision is generally imposed as a condition of subdivision. The development of any future UWMP should follow the guidance provided in *Urban Water Management Plans: Guidelines for Preparing Plans and for Complying with Subdivision Conditions* (DoW 2008).

While strategies have been provided within this LWMS that address planning for water management within the site, it is a logical progression that future subdivision designs and the supportive UWMP will clarify details not provided within the LWMS. The main areas that will require further clarification within future UWMPs include:

- Drainage calculations
- Implementation of water conservation strategies
- Non-structural water quality improvement measures
- Management and maintenance requirements
- Construction period management strategy
- Monitoring and evaluation program
- Status of groundwater abstraction license
- Infiltration assumptions.

These are further detailed in the following sections.

8.1 Drainage calculations

It is acknowledged that the drainage strategies documented in this LWMS are based upon broad-scale assumptions and regional data. These assumptions are considered adequate for development of the proposed drainage strategy and are of an appropriate level of detail. However, verification of proposed subdivision drainage designs within the ACP area will be undertaken once the specific basin designs are confirmed.

8.2 Implementation of water conservation strategies

A number of potential measures to conserve water have been presented within this LWMS. These water conservation strategies will be incorporated into the design and the ongoing maintenance of all POS areas. Landscape design measures that will be incorporated into the water conservation strategy will be further detailed within the future UWMPs produced for the development. The manner in which the developer intends to promote water conservation measures discussed in this LWMS to future lot owners will also be discussed within the future UWMPs.

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8.3 Non-structural water quality improvement measures

Guidance for the development and implementation of non-structural water quality improvement measures is provided within the *Stormwater Management Manual for Western Australia* (DoW 2007). Some measures will be more appropriately implemented at a local government level, such as street sweeping, however many can be implemented relatively easily within the design and maintenance of the subdivision and the POS areas.

It is expected that the future UWMP will provide reference to measures such as public education (through measures such as signage that may be implemented to raise awareness).

8.4 Management and maintenance requirements

The management measures to be implemented to address surface water quality, such as the use of vegetation within swales, BRAs and FSAs will require ongoing maintenance. It is therefore expected that the future UWMP will detail management and maintenance procedures that will set out required maintenance actions (e.g. gross pollutant removal), timing (e.g. how often it will occur), locations (e.g. exactly where it will occur) and responsibilities (e.g. who will be responsible for carrying out the actions). Given that approval from the CoW and DWER will be sought for the proposed measures, it is anticipated that consultation with these agencies will be undertaken and referral to guiding policies and documents will be made.

8.5 Construction period management strategy

It is anticipated that the construction stage will require some management of various aspects (e.g. dust, surface runoff, noise, traffic etc.). The management measures undertaken for construction management will be addressed either in the future UWMP or a separate Construction Management Plan (CMP).

8.6 Monitoring and evaluation program

It will be necessary to confirm that the management measures that are implemented are able to fulfil their intended management purpose, and are in a satisfactory condition at a point of management hand-over to the CoW. A post-development monitoring program will be developed to provide this confirmation, and it will include details of objectives of monitoring, relevant issues and information, proposed methodology, monitoring frequency and reporting obligations. These monitoring programs are discussed in **Section 9** of this LWMS and will be further detailed at the UWMP stage.

8.7 Groundwater licence status

There are a number of current groundwater licences for the Eglinton estates. It is expected that future UWMPs will demonstrate that the landscape designs and irrigation requirements are consistent with the approved allocations available at the time of preparation.

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8.8 Infiltration assumptions

The infiltration rates used within the hydrological modelling have been based on measurements recorded within soils in the local area. A detailed geotechnical study, including measurement of site-specific infiltration rates, is required to inform further modelling for future UWMPs. Assumed infiltration rates to be used for detailed design of all infiltration basins (BRAs, FSAs and sub-surface storage) should be based on site-specific measurements plus an allowance for clogging, to be agreed with the CoW.

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9 Monitoring

9.1 Condition monitoring

It is proposed that the overall condition of the development will be monitored on a bi-annual basis. This monitoring will be implemented after the completion of the civil and landscaping works and will continue for a period of two years.

A visual assessment will be undertaken to monitor the overall condition of the development, with the aim to ascertain that the maintenance activities are achieving the overall management objectives for the development. The parameters that will be monitored include:

- Gross pollutants
- Terrestrial weeds
- Irrigation
- Vegetation density
- Paths, benches, walkways and other infrastructure.

The management and maintenance objectives will be detailed within future UWMPs along with details of the corresponding monitoring program.

9.2 Water monitoring

Given that there will be no surface water discharge from the site during small events (the first 15 mm) it will be very difficult to collect a water quality sample for treated surface runoff. Post-development surface water monitoring is therefore not proposed.

Due to the significant depth to groundwater across the site, groundwater quality is not representative of the management practices of the site above. Groundwater monitoring would provide an indication of quality and management of the wider area and not the ACP area specifically. As such, post-development groundwater monitoring is not proposed.

9.3 Infiltration testing

Ongoing infiltration testing may be required post construction and prior to handover. The manor and location of the testing will be detailed within future UWMPs.

9.4 Reporting

A post-development monitoring report will be prepared on conclusion of the two year monitoring period, and will be provided to CoW and DWER. Interim results (spreadsheet) can be provided to either CoW or DWER on request during the monitoring program.

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10 Implementation

10.1 Roles and responsibility

The LWMS provides a framework that the proponent can utilise to assist in establishing stormwater management methods that have been based upon site-specific investigations, are consistent with relevant state and local government policies and have been endorsed by DWER and CoW. The responsibility for working within the framework established within the LWMS rests with the proponent, although it is anticipated that future UWMPs will be developed in consultation with DWER and CoW and in consideration of other relevant policies and documents.

10.2 Funding

The site is owned by Eglinton Estates Pty Ltd and so all costs will be funded by the proponent, with the exception of within lot drainage infrastructure which will be the responsibility of the lot owner.

10.3 Review

It is not anticipated that this LWMS will be reviewed unless the Eglinton District Centre ACP undergoes significant change post-lodgement of the LWMS. If the Eglinton District Centre ACP is substantially modified, the surface runoff calculations undertaken for this LWMS may need to be reviewed and the criteria revised to ensure that all are still appropriate.

The next stage of water management is UWMP preparation. The UWMP is largely an extension of the LWMS, as it should provide detail to the designs proposed within this LWMS, and will demonstrate compliance with the criteria proposed in **Section 4**.

The next stage of development following the UWMP is single lot or multiple dwelling developments. It is recognised that certain elements of the LWMS and the UWMP will not be implemented until this late stage, and that there is little or no statutory control that can be applied to ensure the implementation of any remaining measures. While the remaining measures are unlikely to be enforced at this stage their implementation could be encouraged by the CoW through policy (or modification of these where necessary), building licence or awareness programs (such as the Water Corporation Waterwise program).

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Eglinton District Centre



Department of Water and Environmental Regulation (DWER) 2017, *Perth Groundwater Map*, viewed December 2018 <<https://maps.water.wa.gov.au/#/webmap/gwm>>.

Department of Water and Environmental Regulation (DWER) 2017, *Water Register*, viewed December 2018 <<https://maps.water.wa.gov.au/#/webmap/register>>.

Local Water Management Strategy Addendum

Eglinton District Centre



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Figure 4: Public drinking water source areas and wellhead protection zones

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Figure 7: Minor rainfall event (20% AEP) inundation areas

Figure 8: Major rainfall event (1% AEP) inundation areas and flow paths

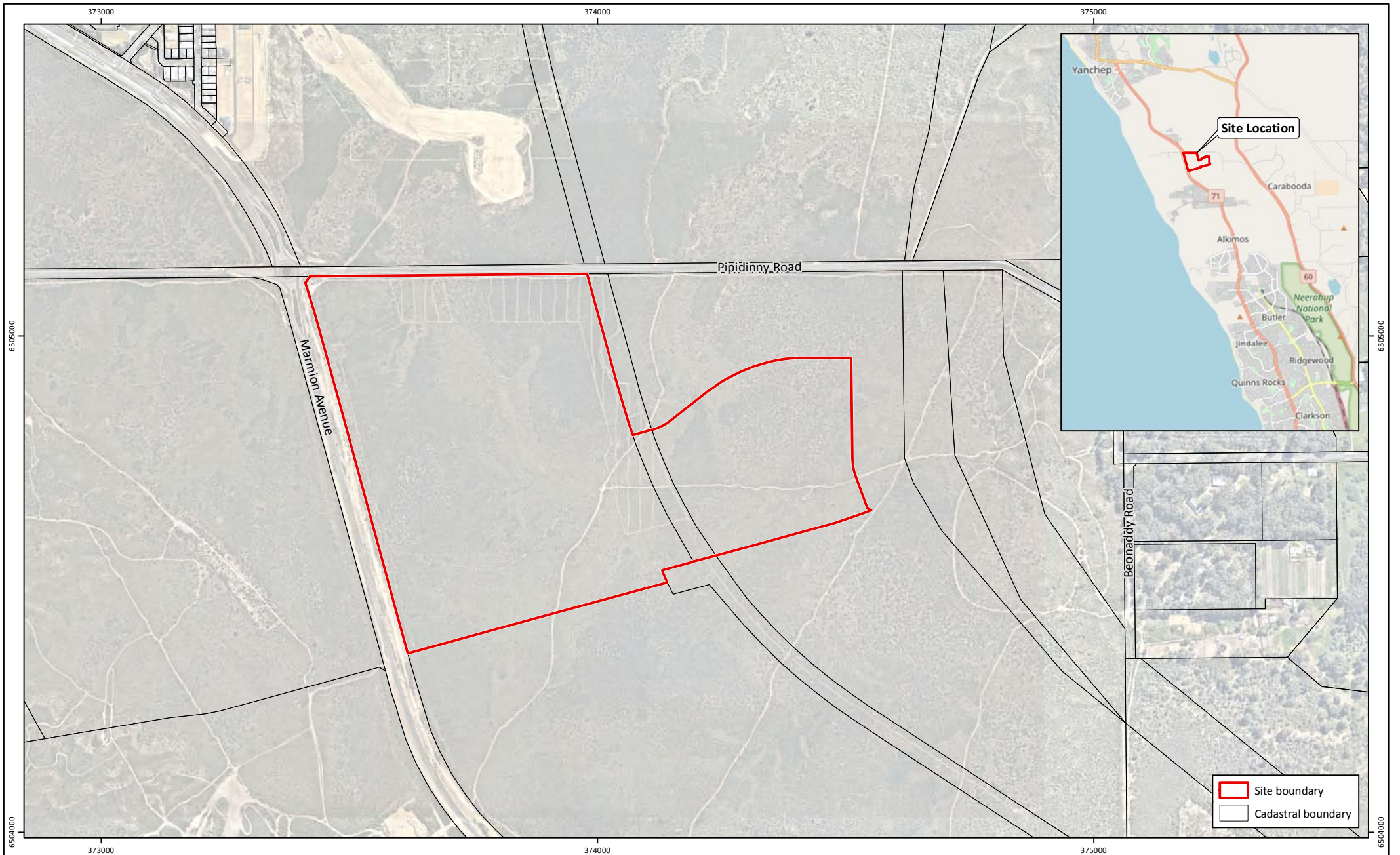


Figure 1: Site Location

Project: Local Water Management Strategy
Eglinton District Centre Addendum
Client: Eglinton Estates Pty Ltd

Plan Number:
EP18-100(02)-F02
Drawn: KNM
Date: 06/03/2019
Checked: NJC
Approved: RLE
Date: 06/03/2019



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Scale: 1:10,000@A4
GDA 1994 MGA Zone 50



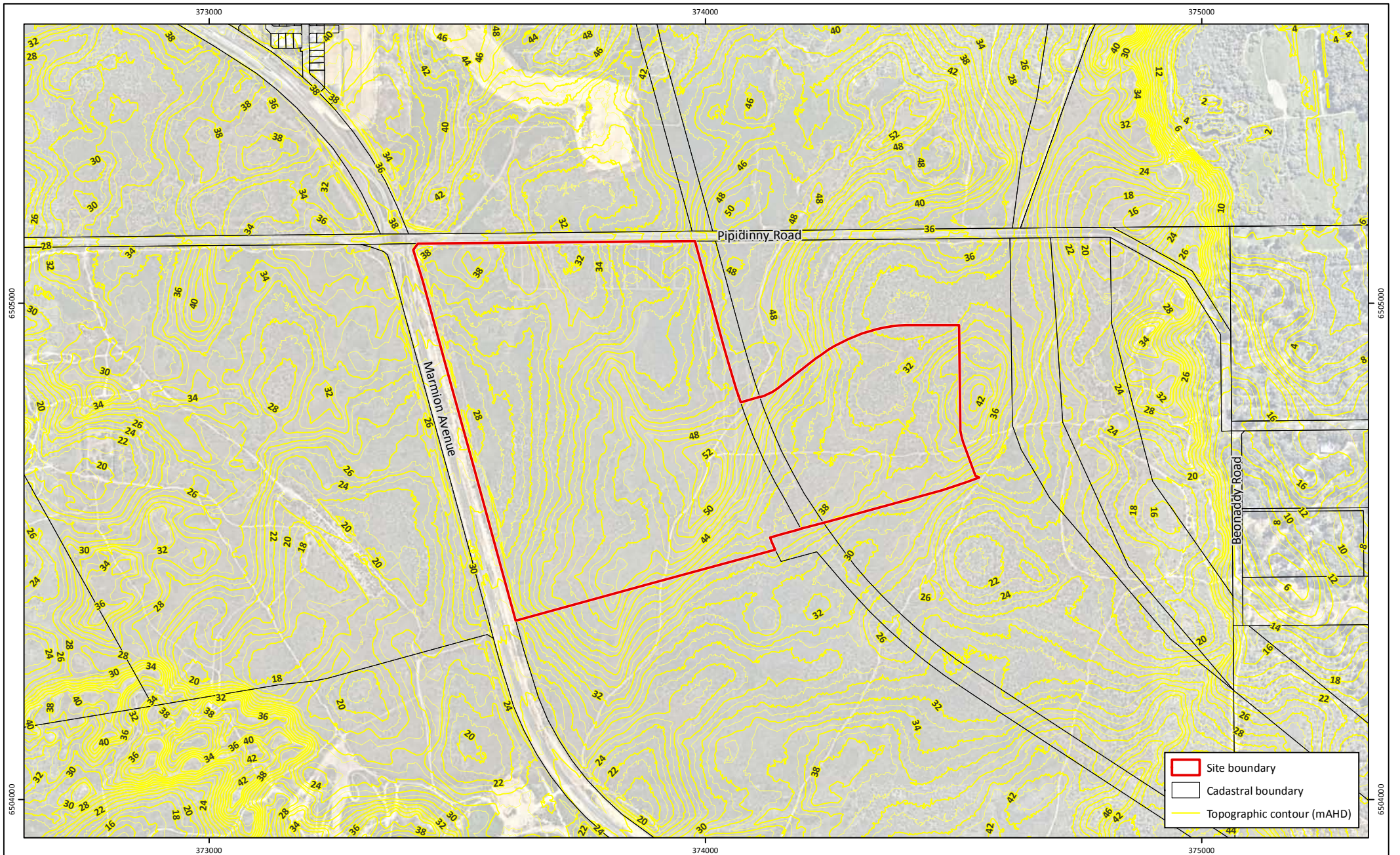


Figure 2: Topography

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Eglinton District Centre Addendum
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Plan Number:
EP18-100(02)-F03
Drawn: KNM
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Date: 06/03/2019



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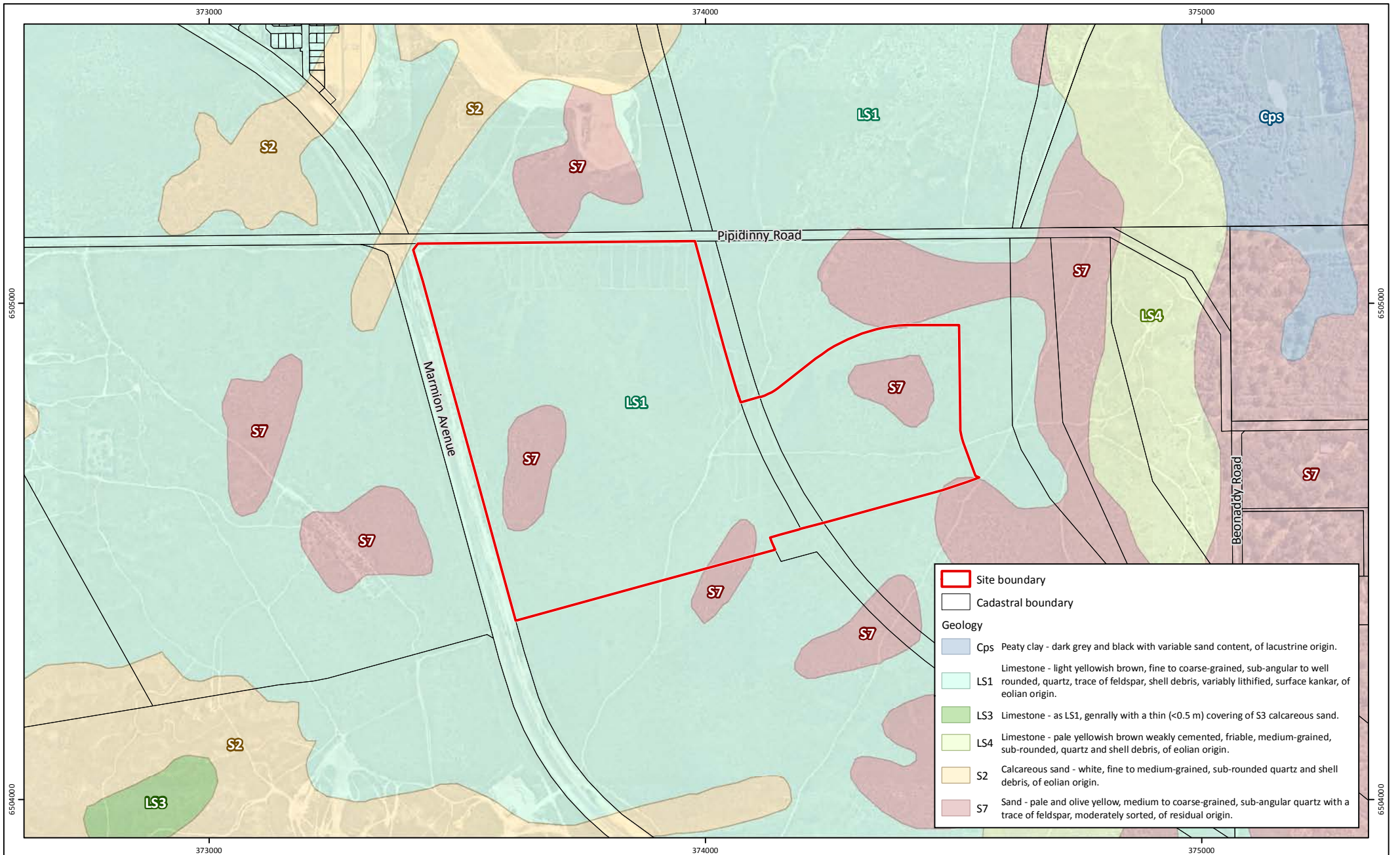


Figure 3: Geological Mapping

Project: Local Water Management Strategy
Eglinton District Centre Addendum
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Plan Number:
EP18-100(02)-F04
Drawn: KNM
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Approved: RLE
Date: 06/03/2019



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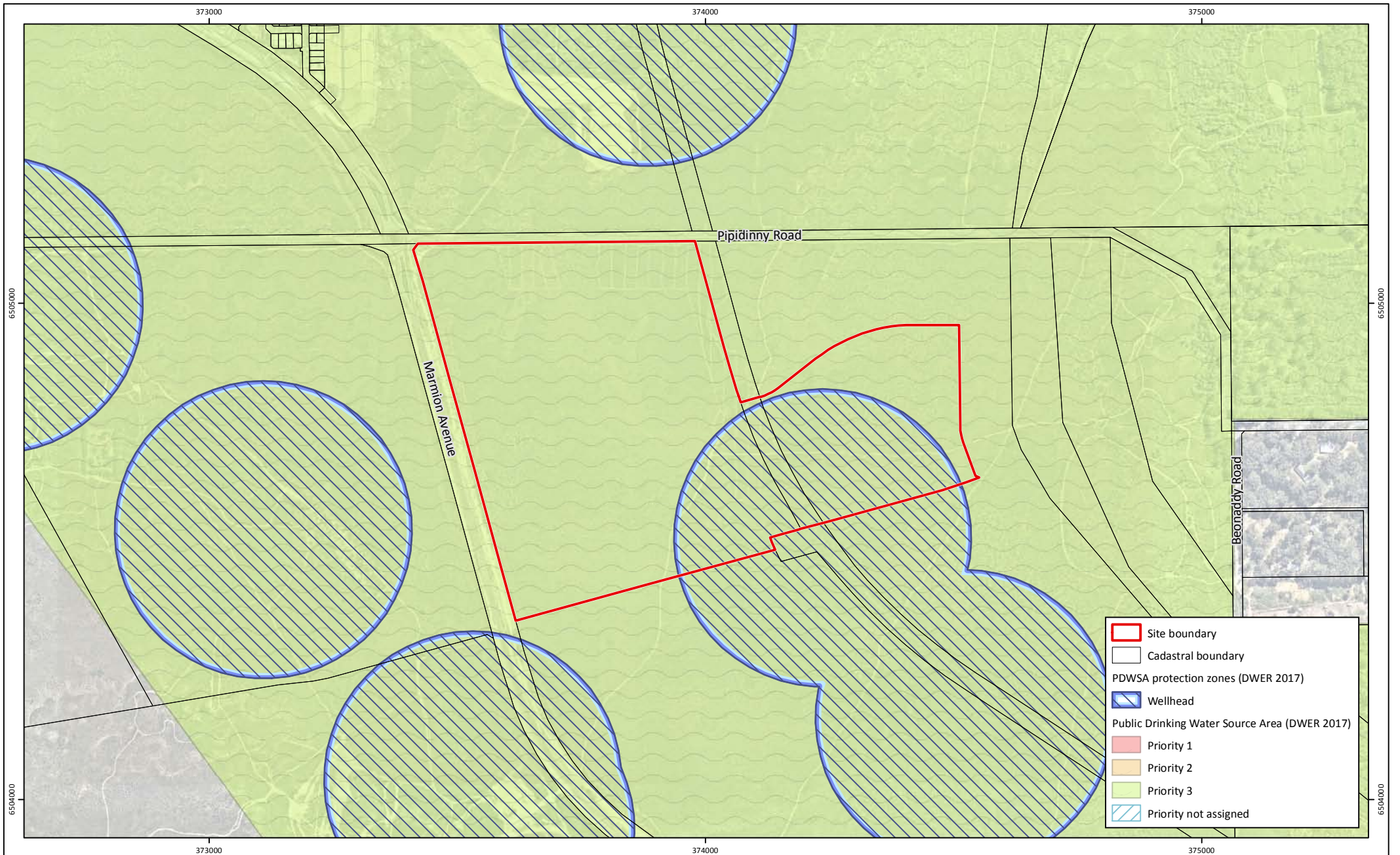


Figure 4: Public Drinking Water Source Areas and Wellhead Protection Zones

Project: Local Water Management Strategy
Eglinton District Centre Addendum

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Plan Number:
EP18-100(02)-F05

Drawn: KNM
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Date: 06/03/2019

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GDA 1994 MGA Zone 50



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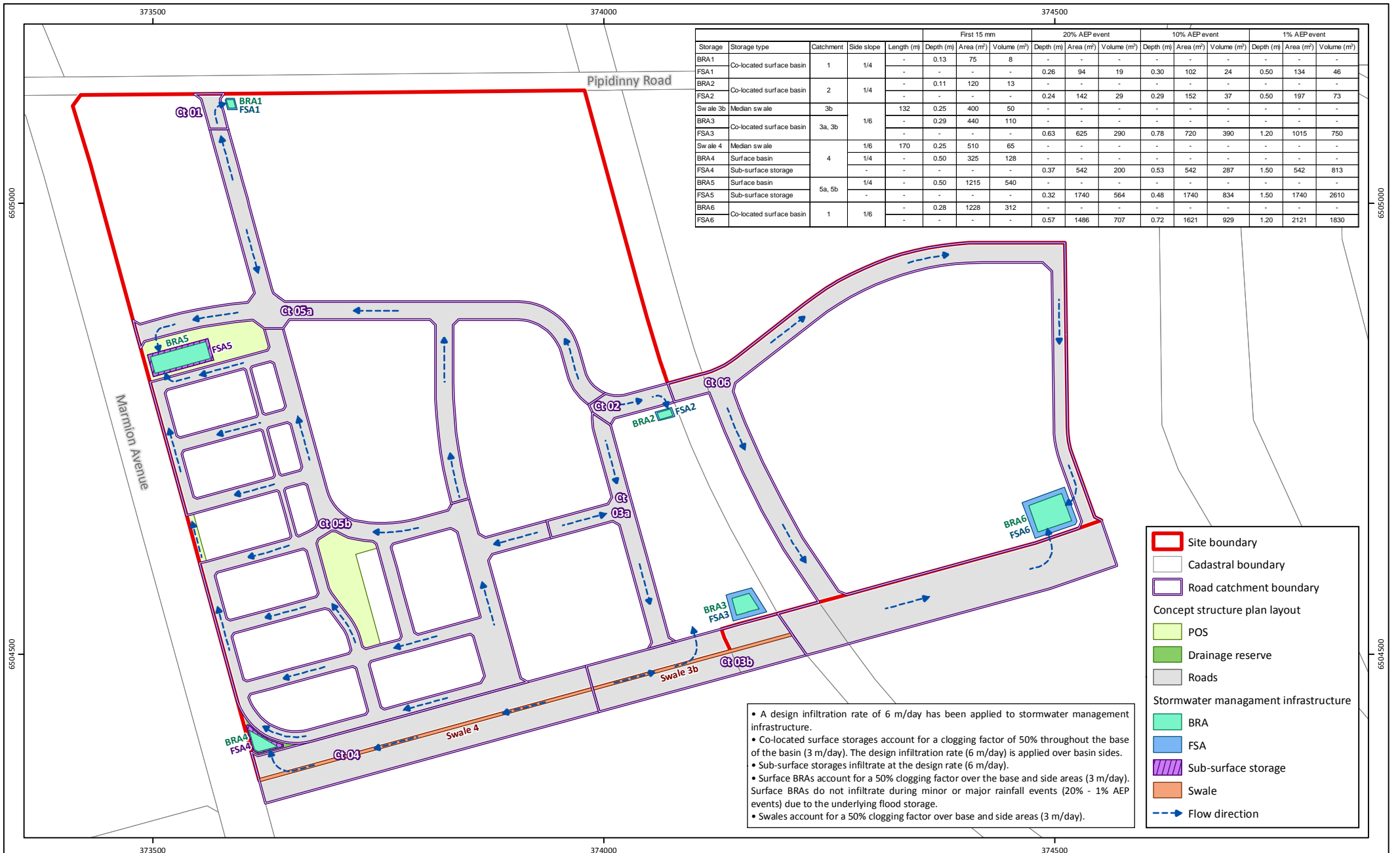
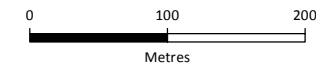


Figure 5: Stormwater Management Plan

Project: Local Water Management Strategy
Eglinton District Centre Addendum
Client: Eglinton Estates Pty Ltd

Plan Number:
EP18-100(02)-F07
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Date: 08/03/2019



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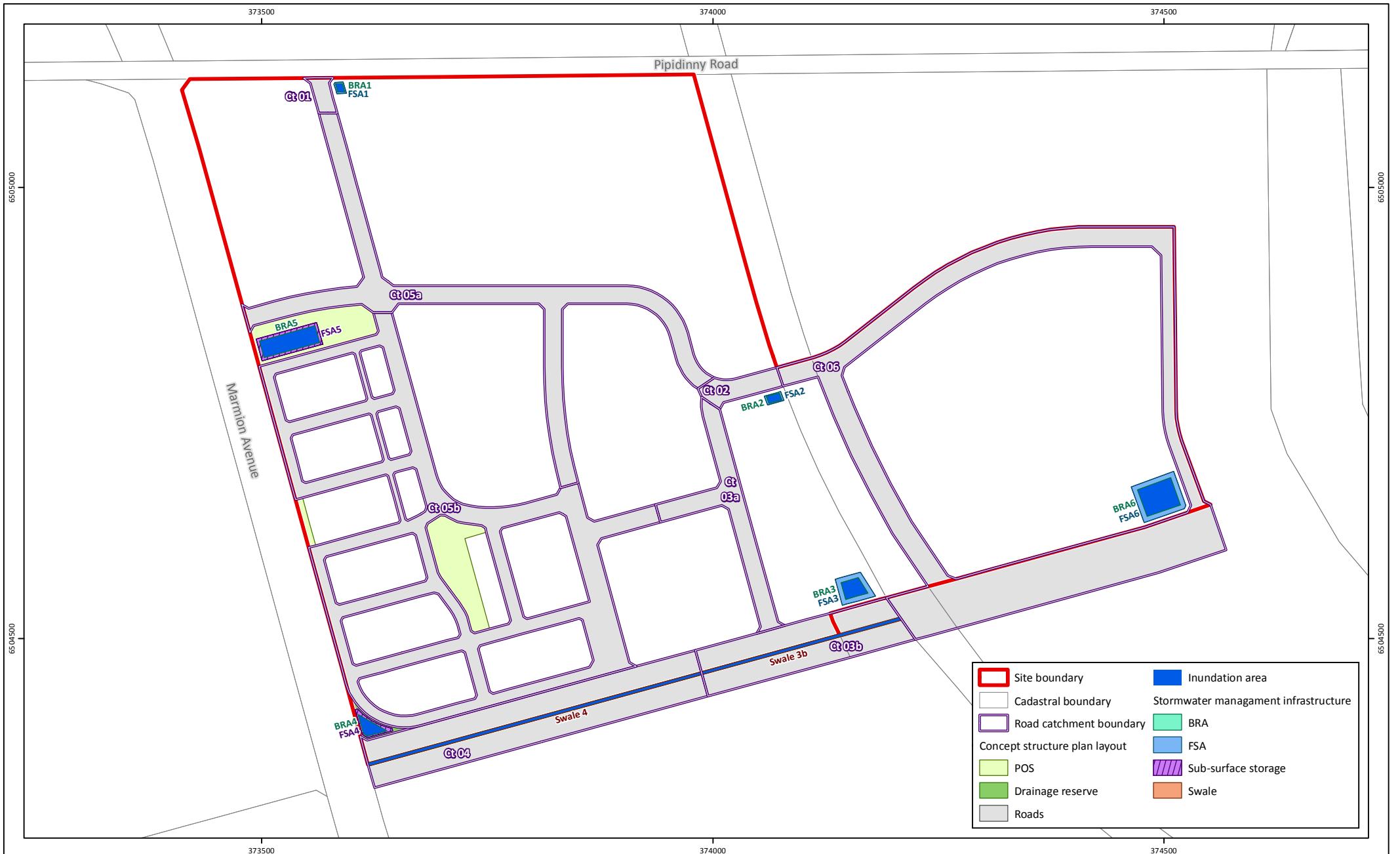


Figure 6: Small Rainfall Event (First 15 mm) Inundation Areas

Project: Local Water Management Strategy
Eglinton District Centre Addendum
Client: Eglinton Estates Pty Ltd

Plan Number:
EP18-100(02)--F08
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Date: 08/03/2019



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GDA 1994 MGA Zone 50



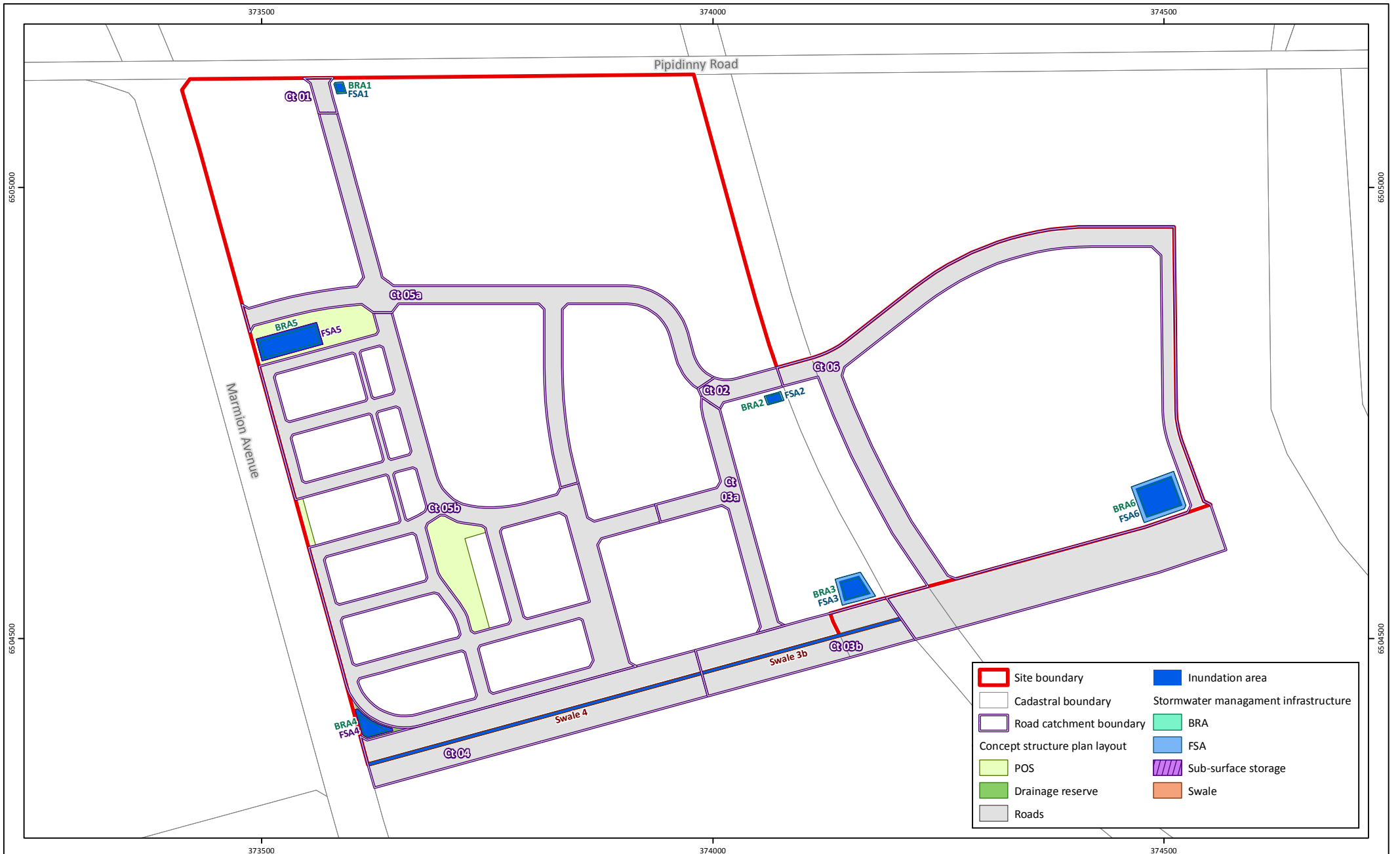


Figure 7: Minor Rainfall Event (20% AEP) Inundation Areas

Project: Local Water Management Strategy
Eglinton District Centre Addendum
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Plan Number:
EP18-100(02)-F09
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Approved: RLE
Date: 08/03/2019



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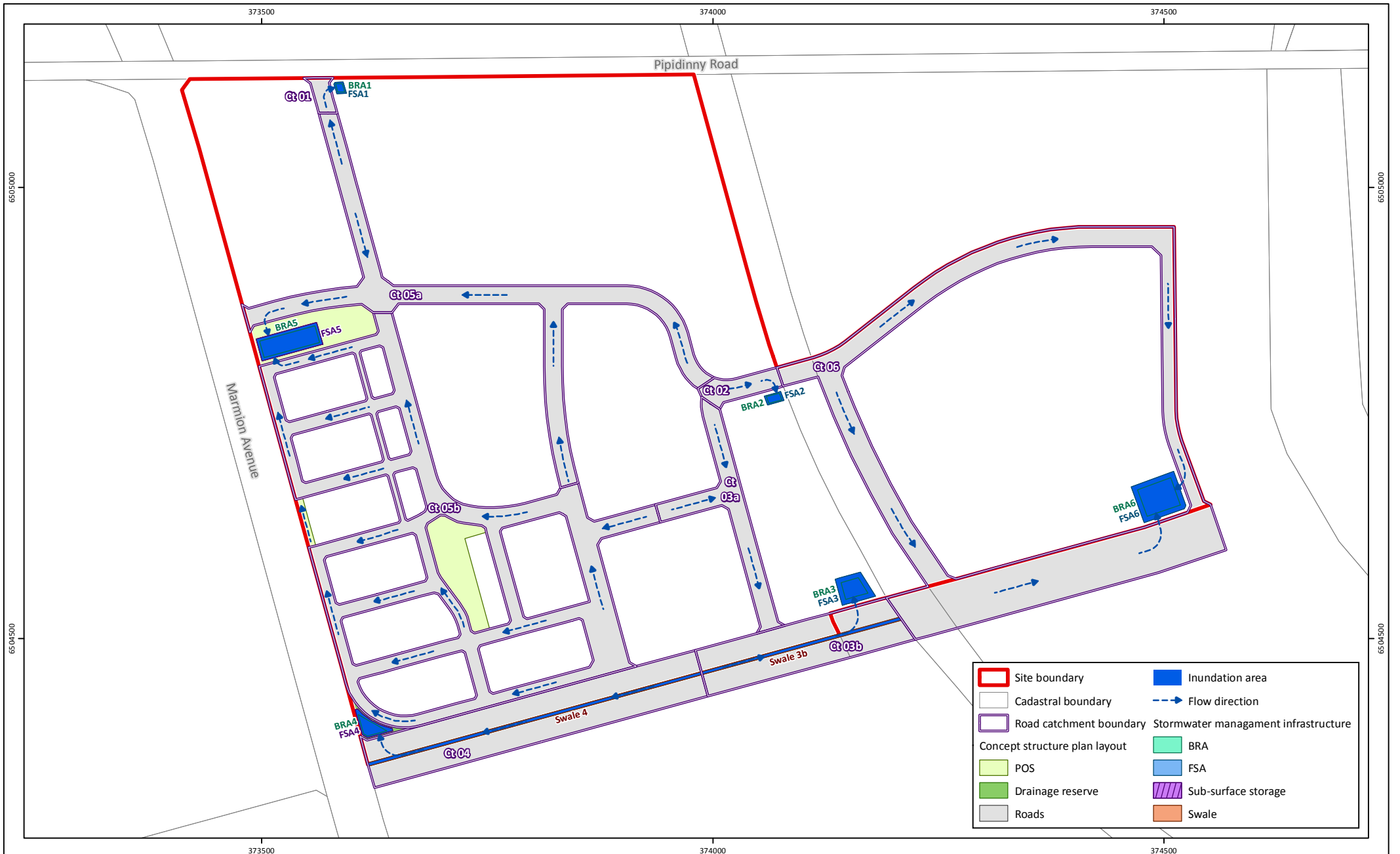
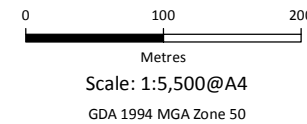


Figure 8: Major Rainfall Event (1% AEP) Inundation Areas and Flow Paths

Project: Local Water Management Strategy
Eglinton District Centre Addendum
Client: Eglinton Estates Pty Ltd

Plan Number:
EP18-100(02)-F10
Drawn: KNM
Date: 08/03/2019
Checked: NJC
Approved: RLE
Date: 08/03/2019



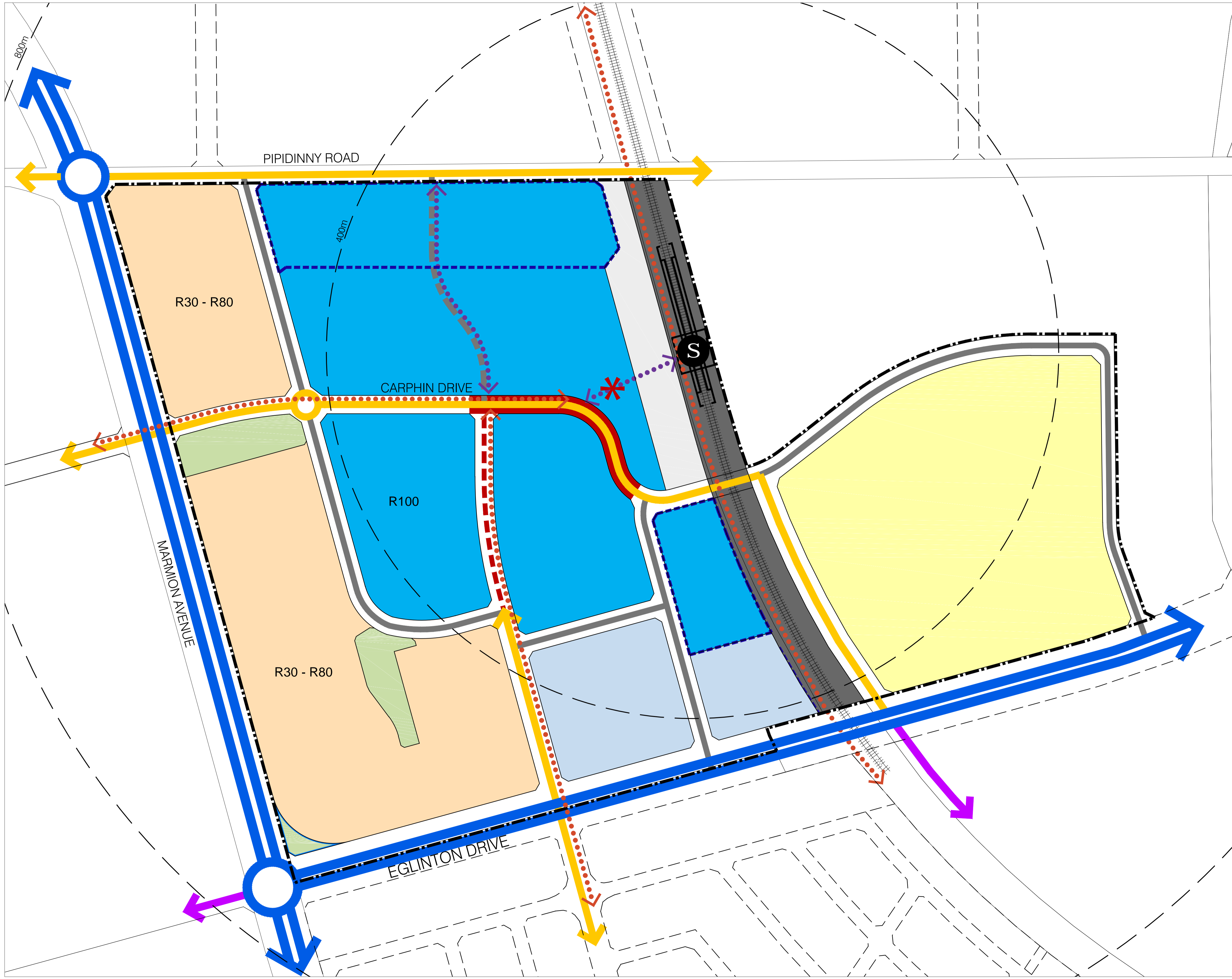
While Emerge Associates makes every attempt to ensure the accuracy and completeness of data, Emerge accepts no responsibility for externally sourced data used

Appendix A

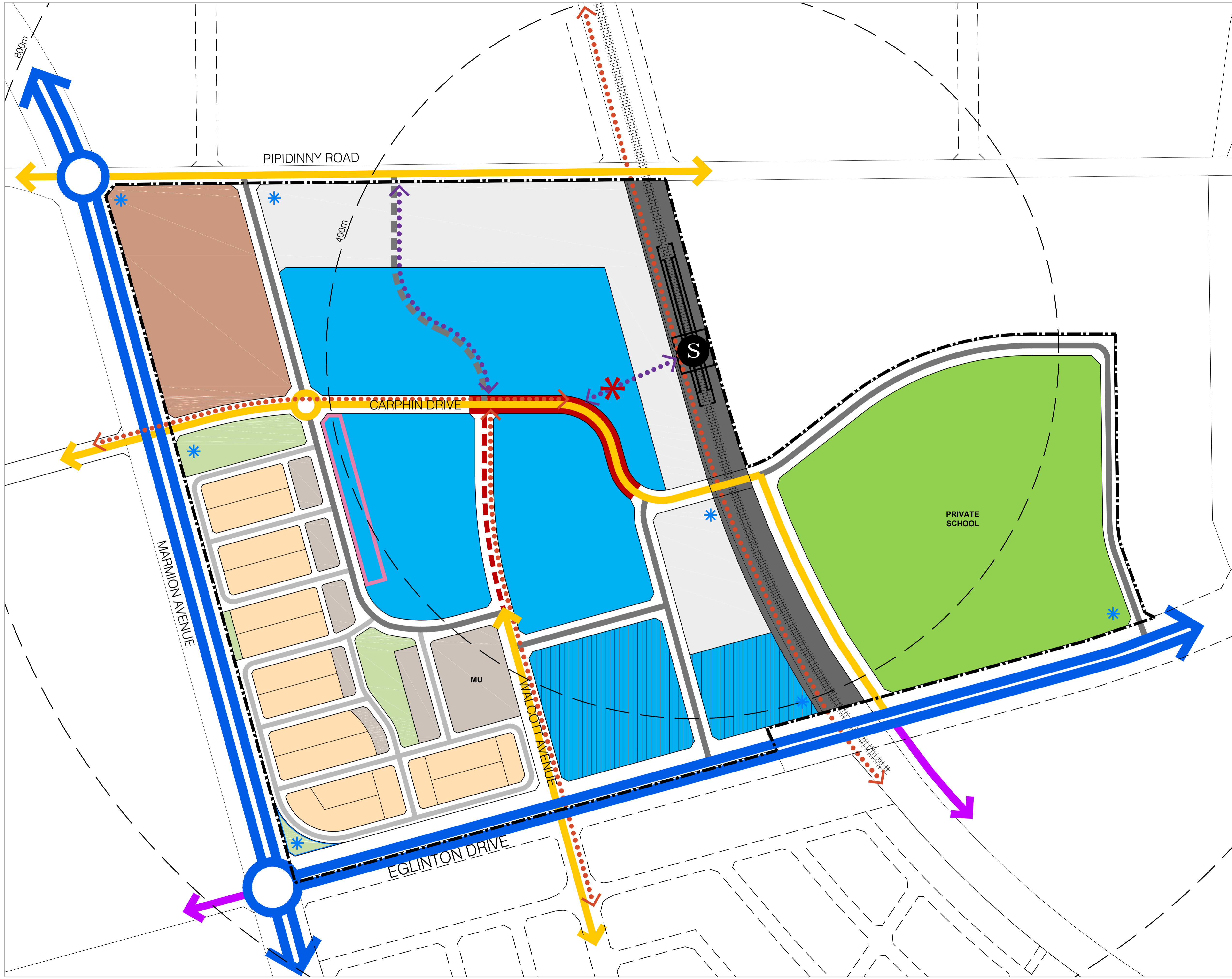
Activity Centre Plan and concept Structure Plan



Prepared by Urbis (2019)



LEGEND	
	APPLICATION AREA
ZONES	
	RESIDENTIAL
	COMMERCIAL
	SERVICE COMMERCIAL
	EDUCATION
RESERVES	
	PUBLIC OPEN SPACE AND DRAINAGE
	DRAINAGE RESERVE
	INTEGRATOR ROAD A
	INTEGRATOR ROAD A NEIGHBOURHOOD CONNECTOR ROAD
	NEIGHBOURHOOD CONNECTOR ROAD
	MAJOR ACCESS ROAD
	RAILWAY RESERVE
	TRANSFER STATION
OTHER	
	RAILWAY STATION
	WALKABLE CATCHMENT 400/800M
	TEMPORARY ACCESS ROAD
	MAIN STREET
	SHARED STREET
	SHARED PATH
	KEY PEDESTRIAN LINKAGES
	STATION SQUARE
	DRAINAGE LOCATIONS
	PARK AND RIDE FACILITIES



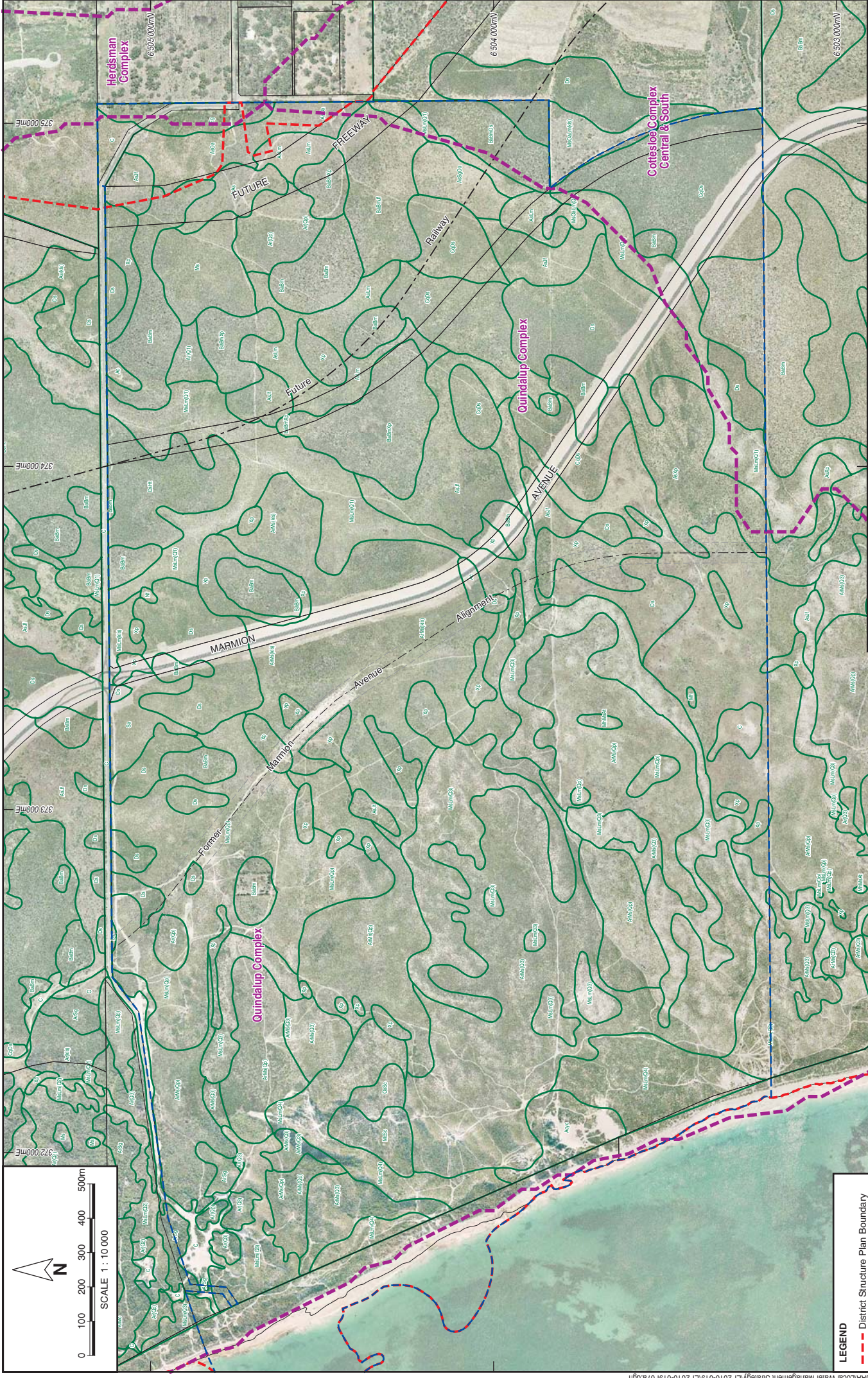
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	APPLICATION AREA
ZONES	
	RESIDENTIAL R30-R40
	RESIDENTIAL R60-R80
	RESIDENTIAL R80 MULTI-UNIT
	RETIREMENT R60-R80
	RESIDENTIAL R100/MIXED USE
	COMMERCIAL
	BUSINESS
	PRIVATE CLUB AND RECREATION
RESERVES	
	PUBLIC OPEN SPACE AND DRAINAGE
	DRAINAGE RESERVE
	INTEGRATOR ROAD A
	INTEGRATOR ROAD A NEIGHBOURHOOD CONNECTOR ROAD
	MAJOR ACCESS ROAD
	MINOR ACCESS ROAD
	RAILWAY RESERVE
	PTA INFRASTRUCTURE/PARK AND RIDE FACILITIES
OTHER	
	RAILWAY STATION
	WALKABLE CATCHMENT 400/800M
	TEMPORARY ACCESS ROAD
	MAIN STREET
	SHARED STREET
	SHARED PATH
	KEY PEDESTRIAN LINKAGES
	STATION SQUARE
	DRAINAGE LOCATIONS

Appendix B

Eglinton Local Structure Plan Area LWMS Figure 7a and 7b



Prepared by Coffey (2010)



Eglington Estates
 LOCAL WATER MANAGEMENT STRATEGY
 EGLINTON LOCAL STRUCTURE PLAN AREA

Drawn:	C. Reeves
Checked:	M. Price
Date:	9 Jun 2010
Projection:	MG4 z650
Scale:	1: 10 000 at A3

coffey
 environments
 SPECIALISTS IN ENVIRONMENTAL
 SOCIAL AND SAFETY PERFORMANCE

LEGEND

- - - District Structure Plan Boundary
- - - Eglington Local Structure Plan Area
- Cadastral Boundary
- - - Vegetation Complex Boundary
- Vegetation Type Boundary

VEGETATION COMPLEX SOURCE: Heide et al., 1990.
 AERIAL PHOTOGRAPH SOURCE: Landgate, flown December 2009.

Figure 7a

ATA Environmental Vegetation Associations Legend

QUINDALUP DUNES

- S** Vegetation of the Strand
- Vegetation of the Q4 Age Quindalup Dunes**
- ScA1** *Scaevola crassifolia*, *Acacia truncata* Low Open Heath
- ScOa** *Scaevola crassifolia*, *Olearia axillaris* Open to Closed Heath
- SnOa** *Scaevola nitida*, *Olearia axillaris* Dense Low Heath
- MSg** *Myoporum insulare*, *Spyridium globulosum* Shrubland
- SgMSLm** *Spyridium globulosum*, *Melaleuca systena*, *Lomandra maritima* Low Open Heath
- Sg** *Spyridium globulosum* Shrubland
- SgSc** *Spyridium globulosum*, *Scaevola crassifolia* Shrubland
- Lm** *Lomandra maritima* Herbland with *Acacia truncata*, *Olearia axillaris* Low Heath
- Lg** *Lepidosperma glaberrimum* Sedgeland*
- Vegetation of the Q4 Age Stabilised Blowout**
- Sn** *Scaevola nitida* Low Closed Heath to Closed Heath
- Al** *Acacia truncata*, *Acrotriche cordata*, *Melaleuca systena*, *Pimelea ferruginea* Low Open Shrubland to Low Shrubland
- Ap** *Acanthocarpus preissii*, *Hemianandra pungens* Low Open Heath

- Vegetation of the Q1, Q2 and Q3 Age Quindalup Dunes**
- QaSn** *Olearia axillaris*, *Scaevola nitida* Open Shrubland
- SnA1** *Scaevola nitida*, *Acacia truncata* Closed Heath*
- Ar** *Acacia rostellifera* Closed Scrub/Heath
- ArSg** *Acacia rostellifera*/*Spyridium globulosum* Closed Scrub
- ArMs** *Acacia rostellifera*, *Melaleuca systena* Low Open Heath
- AcAr** *Acacia cochlearis*, *Acacia rostellifera* Low Open Heath
- AcLm** *Acacia cochlearis*, *Lomandra maritima* Low Open Heath
- AcMSLm** *Acacia cochlearis*, *Melaleuca systena*, *Lomandra maritima* Low Open Heath
- Ms** *Melaleuca systena* Low Shrubland to Shrubland
- MSLc** *Melaleuca systena*, *Lysinera ciliatum* Low Closed Heath*
- MSLm** *Melaleuca systena*, *Lomandra maritima* Low Open Heath*
- MSQaLm** *Melaleuca systena*, *Olearia axillaris*, *Lomandra maritima* Open Heath*
- BpMSLm** *Banksia attenuata*, *Melaleuca systena*, *Lomandra maritima* Low Open Heath*
- AIMs** *Allocasuarina lehmanniana*, *Melaleuca systena* Closed Heath*
- AI** *Allocasuarina lehmanniana* Closed Heath*
- Lm** *Lomandra maritima* Herbland
- Ac** *Acacia cochlearis* Closed Heath*
- AcOaMs** *Acacia cochlearis*, *Olearia axillaris*, *Melaleuca systena* Open Heath*
- Acyc** *Acacia cyclops* Shrubland
- AlSn** *Allocasuarina*, *Scaevola nitida* Low Heath with *Lomandra maritima*
- Sa** *Sarcocornu acuminatum* Heath
- Ta** *Tetrarrhena*, *Acacia lasiocarpa*, *Neraris rotundifolia*, *Melaleuca systena* Low Open Heath
- Nf** *Nyctea floribunda* Low Woodland
- AsLm** *Acacia saligna*, *Lomandra maritima* Shrubland
- AsMs** *Acacia saligna*, *Melaleuca systena* Shrubland
- AsOa** *Acacia saligna*, *Olearia axillaris* Shrubland
- AsSg** *Acacia saligna*, *Spyridium globulosum* Heath
- AsSgOa** *Acacia saligna*, *Spyridium globulosum*, *Olearia axillaris* Heath

SPEARWOOD DUNES

- Sand Surface of the Spearwood Dunes**
- BaBm** *Banksia attenuata*, *B. menziesii* Low Woodland
- BaBmAs** *Banksia attenuata*, *B. menziesii*, *Acacia saligna* Low Woodland
- BaBmCq** *Banksia attenuata*, *B. menziesii* Low Woodland over *Calothamnus quadrifidus*
- BaBmDs** *Banksia attenuata*, *B. menziesii* Low Woodland over *Dryandra sessilis*
- BaBmXp** *Banksia attenuata*, *B. menziesii* Low Woodland over *Xanthorrhoea preissii*
- BaBmJf** *Banksia attenuata*, *B. menziesii* Low Woodland over *Juvakaria turcullata*
- Ba** *Banksia attenuata* Low Woodland
- BaXp** *Banksia attenuata* Low Woodland over *Xanthorrhoea preissii*
- BaAsJs** *Banksia attenuata*, *Allocasuarina fraseriana* Low Open Forest over *Jacksonia sternbergiana* High Shrubland

Landform Source: McArthur and Bartle, 1980.

- EuBaBm** *Eucalyptus todtiana*, *Banksia attenuata*, *B. menziesii* Low Open Woodland
- EmBAJs** *Eucalyptus todtiana*, *Banksia attenuata*, *B. menziesii*, *Allocasuarina fraseriana* Low Woodland over *Jacksonia sternbergiana* High Shrubland*
- Ar** *Acacia rostellifera* Low Closed Forest
- Al** *Allocasuarina fraseriana*, *Banksia spp.*, *E. todtiana* Low Open Forest to Open forest
- Eg** *Eucalyptus gomphocephala* (Tuart) Open Woodland to Woodland over *Banksia attenuata*, *Acacia saligna* and *Xanthorrhoea preissii*.
- Eg(m)** *Eucalyptus gomphocephala* (Tuart)(Mallee form)
- BaBmEgE1** *Banksia attenuata*, *Banksia menziesii*, *Eucalyptus todtiana* Low Open Woodland with emergent *Eucalyptus gomphocephala* (Tuart) Open Woodland to Woodland over *Melaleuca systena* Heath
- EgMs** *Acacia rostellifera* Low Closed Woodland includes a small admixture of *Banksia attenuata*, *Hardenbergia comptoniana* with a very open understorey.
- ArBa** *Lomandra maritima* Low Heath
- Lm** *Lomandra maritima* Low Heath
- ArAs** *Acacia rostellifera*/*Acacia saligna* Open Shrubland
- ArJf** *Acacia rostellifera*/*Jacksonia turcullata* Open Shrubland
- As(2)** *Acacia saligna* Scrub
- AsXp** *Acacia saligna*, *Xanthorrhoea preissii* Shrubland

Limestone Surface of the Spearwood Dunes

- Ds** *Dryandra sessilis* Open to Closed Heath
- DsHt** *Dryandra sessilis*, *Hakea trifurcata* Open to Closed Heath
- DsMhA1** *Dryandra sessilis* with *Melaleuca huegelii* or *Acacia truncata* Closed Heath
- DsCqAp** *Dryandra sessilis*/*Calothamnus quadrifidus*/*Acacia pulchella* Closed Heath
- DsCqMs** *Dryandra sessilis*/*Calothamnus quadrifidus*/*Melaleuca systena* Closed Heath
- DsXp** *Dryandra sessilis*/*Xanthorrhoea preissii* Closed Heath
- MhA1** *Melaleuca huegelii*, *Acacia truncata*, *Trymallium albicans* Low Open Heath*
- MhAlMc** *Melaleuca huegelii*, *Acacia truncata*, *Melaleuca cardiophylla* Low Open Heath to Low Closed Heath*
- MhMSA1** *Melaleuca huegelii*, *Melaleuca systena*, *Acacia truncata* Low Open Heath*
- MhTa** *Melaleuca huegelii*, *Trymallium albicans*, *Brachyloma huegelii* Heath
- MhDs** *Melaleuca huegelii*, *Dryandra sessilis* Open Heath to Heath
- HI** *Hakea trifurcata* Open to Closed Heath
- HIDs** *Hakea trifurcata*, *Dryandra sessilis* Open Heath to Closed Heath*
- Cq** *Calothamnus quadrifidus* Open Heath to Closed Heath
- CqDs** *Calothamnus quadrifidus*, *Dryandra sessilis* Open Heath to Closed Heath*
- Mc** *Melaleuca cardiophylla* Closed Heath
- McSc** *Melaleuca cardiophylla*/*Scaevola crassifolia* Closed Heath
- McDs** *Melaleuca cardiophylla*/*Dryandra sessilis* Closed Heath
- McDSA1** *Melaleuca cardiophylla*/*Dryandra sessilis*/*Acacia truncata* Closed Heath
- ArMc** *Acacia rostellifera*, *Melaleuca cardiophylla* Closed Heath*
- AsJf** *Acacia saligna* and *Jacksonia turcullata* Open Scrub
- SnA1** *Scaevola nitida*, *Acacia truncata* Open to Closed Heath
- Xp** *Xanthorrhoea preissii* Shrubland
- XpDsHt** *Xanthorrhoea preissii*, *Dryandra sessilis*, *Hakea trifurcata* Closed Heath*
- XpHh** *Xanthorrhoea preissii*, *Hibbertia hypericoides* Open Heath*
- TIMs** *Trymallium leucifolium*, *Melaleuca systena* Open Heath
- Soak** Karri Spring wetland
- C** Cleared

Note: * Indicates vegetation types not previously identified by Trudgen (1990)

- (Q1) Vegetation on Q1 landform
- (Q2) Vegetation on Q2 landform
- (Q3) Vegetation on Q3 landform
- (Q4) Vegetation on Q4 landform
- (Qd) Vegetation on Qd landform
- (Qs) Vegetation on Qs landform
- (Ky) Vegetation on Ky landform

RPS Vegetation Units

- ArSg** *Acacia rostellifera* and *Spyridium globulosum* Tall Open Scrub over *Melaleuca systena* Low Open Shrubland over a mixed Open Herbland/Grassland
- MSa1** *Melaleuca systena* and *Acacia lasiocarpa* var. *lasiocarpa* Open Low Heath over *Lomandra maritima*, *Desmocladius asper* and *Lepidosperma pubisquamum* Herbland
- ArOa** *Acacia rostellifera* and *Olearia axillaris* Shrubland over *Melaleuca systena* Low Open Shrubland over *Lomandra maritima* Very Open Herbland
- SnAp** *Scaevola nitida*, *Acanthocarpus preissii* and *Melaleuca systena* Low Open Heath over mixed Very Open Grassland with *Desmocladius asper* Very Open Sedgeland
- ArMs** *Acacia rostellifera*, *Melaleuca systena* Open Low Heath over *Lomandra maritima*, *Desmocladius asper* and *Lepidosperma pubisquamum* Herbland
- MSg** *Melaleuca systena* and *Scaevola globulifera* Open Heath over *Lomandra maritima* and *Lepidosperma pubisquamum* Herbland
- OaSg** Scattered *Olearia axillaris* over *Scaevola globulifera* and *Melaleuca systena* Low Open Shrubland over *Lomandra maritima*, *Poa porphyroclados* and *Austrostipa flavescens* Very Open Grassland/ Herbland
- ArMO** *Acacia rostellifera* Open Shrubland with *Melaleuca systena* and *Scaevola globulifera* Open Heath over *Lomandra maritima* and *Lepidosperma pubisquamum* Herbland
- #ArO5** *Olearia axillaris* and *Acacia rostellifera* Open Shrubland with *Scaevola globulifera* and *Melaleuca systena* Low Open Shrubland over *Lomandra maritima*, *Poa porphyroclados* and *Austrostipa flavescens* Very Open Grassland/ Herbland
- #Acyc** *Acacia cyclops* Shrubland
- #Xp** *Xanthorrhoea preissii* Shrubland

Vegetation units obtained from Bennett (2004) survey as presented in ATA Environment (2005)

Drawn: C. Reeves
 Checked: M. Price
 Date: 30 Jun 2010
 Projection: N/A
 State: AQ

Eglington Estates and Oceanscape Alliance
 EGLINTON DRAFT LOCAL STRUCTURE PLAN
 LOCAL WATER MANAGEMENT STRATEGY

VEGETATION AND FLORA
 Figure 7b



Appendix C

Concept Earthworks plan



Prepared by Tabecc (2019)



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A1

No.	DATE	DRAWN	APPROVED	AMENDMENT	No.	DATE	DRAWN	APPROVED	AMENDMENT
B	27.02.19	RDE	BMS	EARTHWORKS AMENDED.					
A	23.07.18	RDE	BMS	ISSUED FOR INFORMATION					

This plan shall not be used for construction unless issued as rev 0 and signed as approved.

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RDE		
DRAWN	CHECKED	DATE
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Woodsome Management

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PROJECT	EGLINTON - SKETCHES	ISSUE	B
TITLE	Preliminary Earthworks Design Contours (Town Centre)		
DRAWING NUMBER	2380-SK-006A		

Appendix D

Eglinton District Centre Modelling Assumptions Report



Prepared by Emerge Associates (2019)

Eglinton District Centre

Modelling Assumptions Report

Project No: EP18-100(02)

**Prepared for Eglinton Estates Pty Ltd
March 2019**



Eglinton District Centre

Modelling Assumptions Report



Document Control

Doc name:	Eglinton District Centre Modelling Assumptions Report				
Doc no.:	EP18-100(02)--008 MGB				
Version	Date	Author		Reviewer	
1	March, 2019	Marley Butler	MGB	Rachel Evans	RLE
	For inclusion in LWMS addendum				

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1 Modelling Assumptions

XPSWMM hydrologic and hydraulic modelling software (v18.1) was used to calculate the surface water runoff volumes associated with the Eglinton District Centre development (Lot 800 and Lot 803 on plan 404604).

The hydrologic component of the software uses the Laurenson non-linear runoff-routing method to simulate runoff from design storm events. Key assumptions regarding the hydrologic model include:

- Runoff is proportional to slope, area, infiltration and percentage of imperviousness of a catchment.
- Sub-catchment areas and slopes are determined from available topographical data and earthworks plans.
- Infiltration rates and percentage imperviousness have been selected based on experience with model preparation for similar soil conditions and land use.

Runoff from each sub-catchment is routed through the catchment using the hydraulic component of XPSWMM. Generally, assumptions associated with the hydraulic component of the model include:

- Virtual links (i.e. purely for model construction, not equivalent to flow path onsite) between nodes within a sub-catchment are given the length of 10 m and slope of 0.05 to minimise the lag time of conveying the water from a sub-catchment node to a 'storage' node, a 'dummy intermediate' node or a conduit/link.
- Links between sub-catchment storages act as conveyance channels (e.g. sheet flow within roads in a 1% annual exceedance probability (AEP)). These links are given lengths and slopes that are representative of the site conditions and actual pathway lengths between catchments.
- All channels are designed with a width of 5 m, roughness of 0.014 (Manning's n) and are trapezoidal in shape. This allows for easy conveyance and represents concrete pipes and road surfaces within the model.
- Where relevant, median swales, bio-retention areas (BRAs), and flood storage areas (FSAs) are modelled as nodal-reservoirs with infiltration depth-rating curves to account for differential infiltration rates with changing depth.

2 Post-development Model

2.1 Post development catchments

The post-development model uses an "initial loss - continual loss" infiltration model. The post-development catchment area and land types within the site were informed by the preliminary earthworks contours provided by civil engineers and the concept plan, shown in Figure 2 of the *Eglinton District Centre Local Water Management Strategy Addendum* (the LWMS Addendum) (Emerge Associates 2019). **Table 1** provides the loss parameters used within the post-development model.

Table 1 Post-development loss assumption and roughness parameters

Land type	Initial loss (mm)	Continual loss (mm)	Roughness
Road surface	1	0.1	0.02
Road verge	9	1.5	0.05

A summary of post-development catchment information is provided in **Table 2**, with the catchments and basin locations shown in Figure 5 of the LWMS Addendum.

Table 2 Post-development catchment areas

Catchment	Slope	Area (ha)			
		Total area	Road reserve	Road pavement	Road verge
Ct 1	0.050	0.141	0.141	0.112	0.028
Ct 2	0.050	0.211	0.211	0.169	0.042
Ct 3a	0.050	0.676	0.676	0.541	0.135
Ct 3b	0.050	1.219	1.219	0.975	0.244
Ct 4	0.050	2.030	2.030	1.624	0.406
Ct 5a	0.050	1.926	1.926	1.541	0.385
Ct 5b	0.050	4.168	4.168	3.334	0.834
Ct 6	0.050	4.149	4.149	3.320	0.830
Total		14.519	14.519	11.615	2.904

An average gradient of 5% is assumed for all catchments based on preliminary earthworks contours.

2.2 Critical duration

A critical duration stage analysis was carried out for the 1%, 10% and 20% AEP events with durations ranging from 30 minutes to 3 days. The result of the analysis for the six FSAs within the site are summarised in **Table 3**.

Eglinton District Centre

Modelling Assumptions Report



Table 3: Critical duration analysis summary (basin stage)

FSA	Basin type	Critical duration (mins)		
		1% AEP	10% AEP	20% AEP
FSA 1	Co-located	120	60	180
FSA 2	Co-located	120	60	60
FSA 3	Co-located	360	360	360
FSA 4	Sub-surface	360	360	360
FSA 5	Sub-surface	360	360	360
FSA 6	Co-located	360	360	360

2.3 Infiltration loss assumptions

The infiltration rates used were predominantly based upon the following assumptions:

- Lot assumptions
 - All lots will fully retain the 1% AEP event runoff on lot in soakwells, infiltration in pervious areas and other retention measures.
- Road reserve assumptions
 - There will be no infiltration on roads, pavements and driveways. There will however be some minor absorption storage loss which is accounted for in the initial and continuing loss values.
 - Road reserve contains 20% pervious verge and 80% impervious bitumen areas.
- Basin catchments assumptions
 - Basin catchment areas (basin footprint and contributing open space) are assumed to be 100% pervious.
 - Basin catchment areas will likely contain landscaped or remnant vegetation.
 - For the reasons above, basin catchment areas are assumed to negligibly contribute to stormwater runoff.
- Storage assumptions
 - FSAs retain runoff from events up to and including the 1% AEP event.
 - BRAs retain runoff from events up to and including the small event (i.e. first 15 mm).
 - Co-located BRA/FSAs have between 1 in 4 and 1 in 6 side slopes with depths between 500 mm and 1.2 m.
 - Median swales are designed with 3 m top width, 250 mm depth and 1 in 6 side slopes.
 - Sub-surface FSAs have a maximum depth of 1.5 m and vertical walls.
- Storage infiltration assumptions
 - Design infiltration rate of 6 m/day.
 - BRA (including those collocated with FSAs) bases are to be vegetated and used for treatment, therefore a 50% clogging factor is accounted for in the base of the basin (negligible clogging on side slopes).
 - Infiltration through base area and side slopes of the basins are considered in the overall infiltration rating curve for these areas.
 - Infiltrations rate within sub-surface FSAs has no clogging factor accounted for (i.e. full design rate of 6 m/day)
- Volumes leaving the system through evapotranspiration were assumed to be negligible when compared to the total runoff volume and since the duration of the model run was comparatively short. XPSWMM default evapotranspiration assumptions are therefore used.

3 References

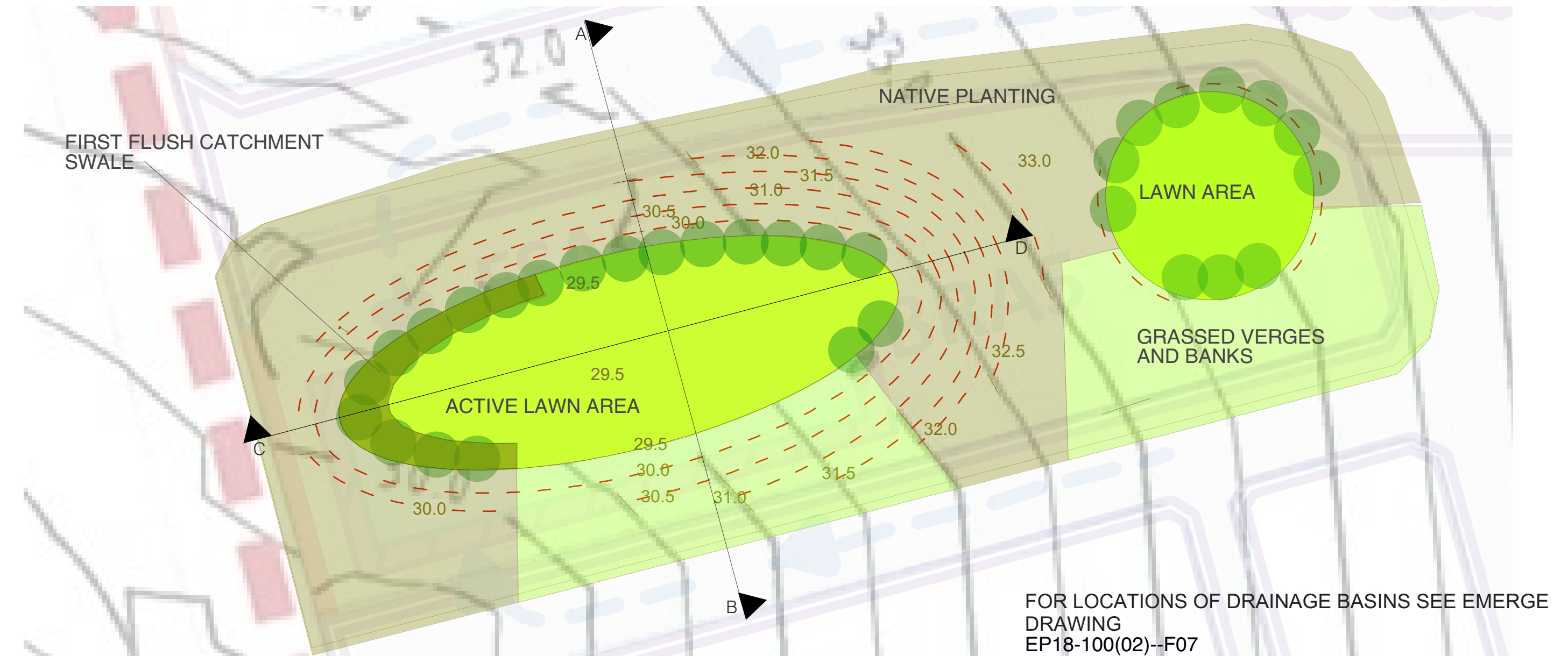
Emerge Associates 2019, *Eglinton District Centre Local Water Management Strategy Addendum*, EP18-100(02)--008 NJC, Rev 1.

Appendix E

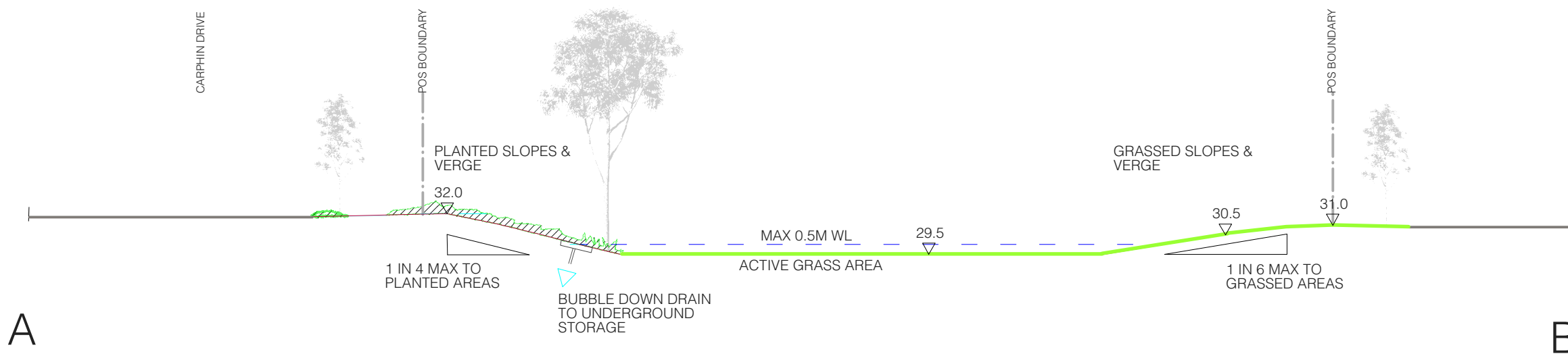
Concept landscape plans and section



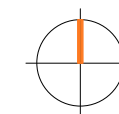
Prepared by Peter Woodward (2019).



CONCEPT PLAN POS BRA5 ACTIVE AREA/ BASIN 1:500



CROSS SECTION THROUGH ACTIVE AREA/ BASIN 1:250
FOR LONG SECTION OF BRA5 (SECTION C-D) SEE WD SK07



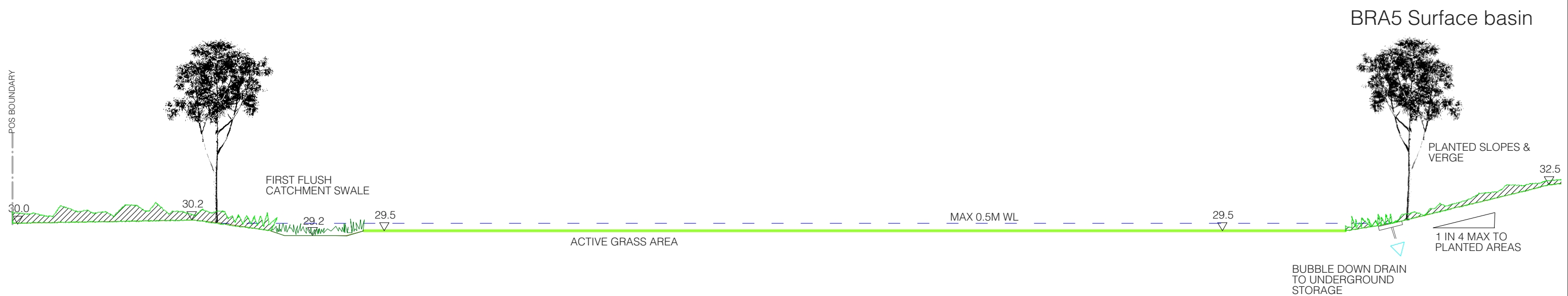
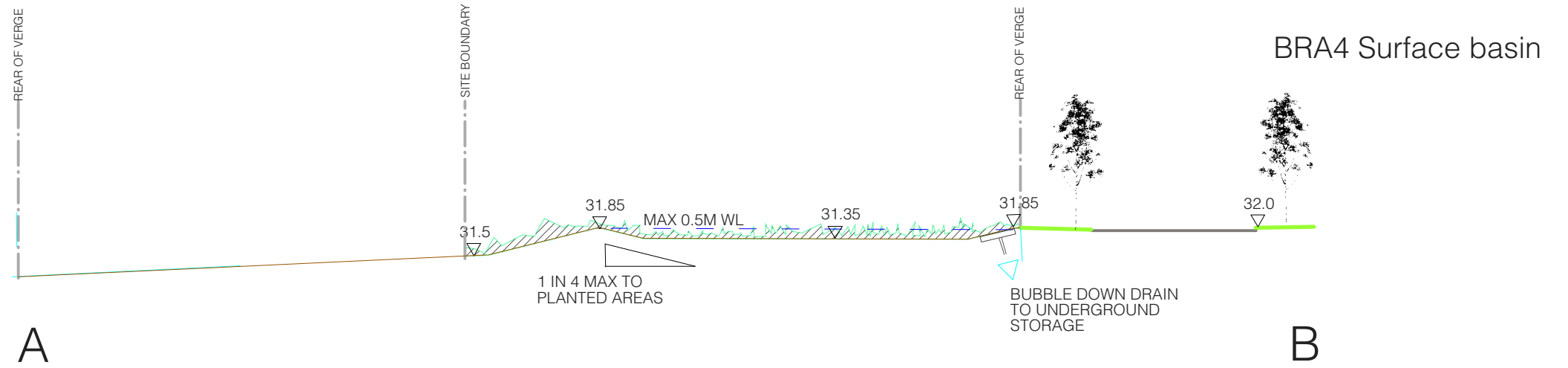
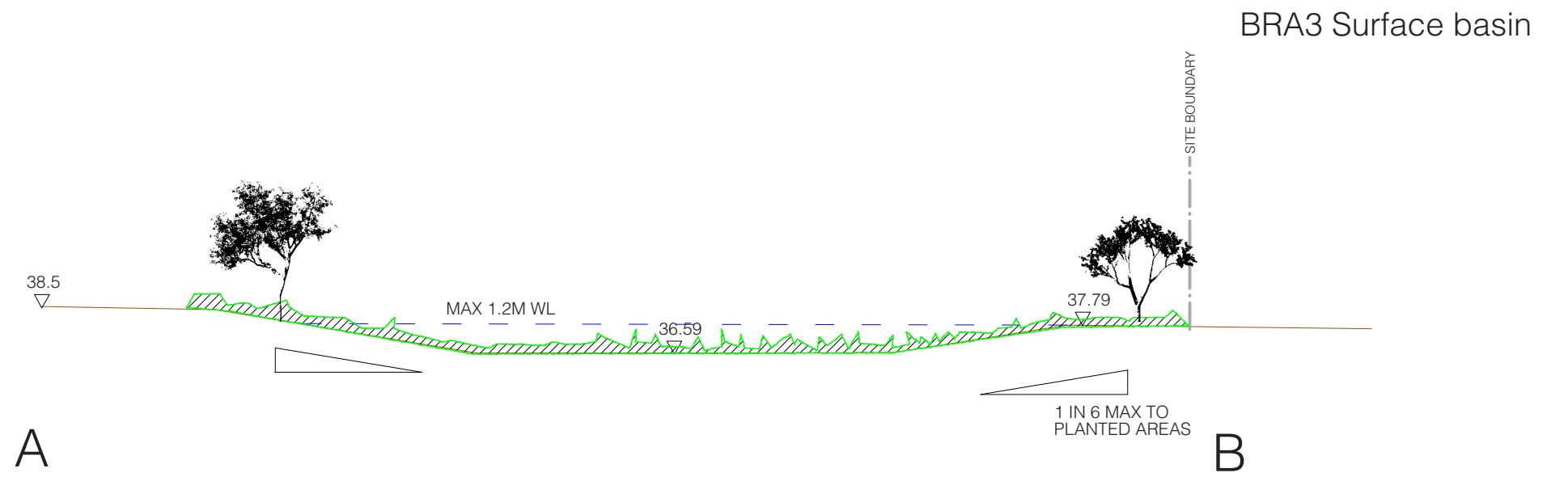
woodward
design

DATE	REVISION	PROJECT #
		1808
PROJECT	Eglinton District Centre	DWG #
CLIENT	Woodsome Eglinton Estate	DATE # 22/03/18
DWG	Carphin Drive POS	SCALE @ A1 as shown
		DRAWN pm
		DWG
		REVISION

woodward design ply ltd 3/22 Pakenham Street Fremantle
PO Box 306 Claremont Australia T 0437 33 88 33 E info@woodwardesign.com.au

All Sections 1:250@ A3

FOR LOCATIONS OF DRAINAGE BASINS SEE EMERGE DRAWING EP18-100(02)--F07



C LONG SECTION OF BRA5 FOR CROSS SECTION (SECTION A-B) SEE WD SK06

woodward design

ISSUE	DATE	REVISION	PROJECT #
PROJECT	Eglinton District Centre		1808
CLIENT	Woodsome Eglinton Estate	DATE # 23/03/18	DWG # SK07
DWG	DRAINAGE BASINS SECTIONS		SCALE @ A3 AS SHOWN
			DRAWN PWW
			REVISION

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APPENDIX F ACOUSTIC ASSESSMENT

EGLINTON TOWN CENTRE

ACOUSTIC ASSESSMENT

MARCH 2019

OUR REFERENCE: 24118-2-18172

DOCUMENT CONTROL PAGE

ACOUSTIC ASSESSMENT
EGLINTON TOWN CENTRE

Job No: 18172

Document Reference: 24118-2-18172

FOR

WOODSOME MANAGEMENT PTY LTD

DOCUMENT INFORMATION

Author:	Tim Reynolds	Checked By:	Geoff Harris
Date of Issue :	19 March 2019		

REVISION HISTORY

Revision	Description	Date	Author	Checked
1	Draft	18/03/19	TR	GW
2	For update Activity Centre Plan	25/07/19	TR	GW

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APPENDICIES

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B	Road Traffic Noise - $L_{Aeq(16hr)}$ Day Period Noise Contours
C	Rail Noise - $L_{Aeq(16hr)}$ Day Period Noise Contours
D	Lots Requiring Quiet House Design / Notifications on Titles
E	Quiet House Design Packages

1. INTRODUCTION

Herring Storer Acoustics was commissioned by Urbis on behalf of Eglinton Estates to undertake a noise assessment for the activity centre associated with proposed development of the Eglinton Town Centre. The acoustic review has been undertaken with respect to State Planning Policy 5.4 *“Road and Rail Transport Noise and Freight Considerations in Land Use Planning”* (SPP5.4).

For this activity centre, the assessment was undertaken with respect to road traffic noise associated with vehicles travelling along Marmion Avenue and Eglinton Drive; and the proposed future extensions of the Perth passenger rail system.

As part of this this assessment, the following was carried out:

- Determine by modelling, the noise that would be received at residences within the residential development from vehicles travelling along Marmion Avenue and Eglinton Drive.
- Determine by modelling, the noise that would be received at residences within the residential development from passing passenger trains.
- Assess the predicted noise levels for compliance with the appropriate criteria.
- If exceedances are predicted, comment on possible noise amelioration options for compliance with the appropriate criteria.

For reference, the concept plan is attached in Appendix A.

2. SUMMARY

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 *“Road and Rail Transport Noise and Freight Considerations in Land Use Planning”* the following external criteria are listed:

“Noise Target”

$L_{Aeq(Day)}$ of 55 dB(A);
 $L_{Aeq(Night)}$ of 55 dB(A);

“Noise Limits”

$L_{Aeq(Day)}$ of 60 dB(A).
 $L_{Aeq(Night)}$ of 55 dB(A).

As external noise levels exceed the “Noise Target” noise levels, then the residential premises should be designed to comply with the following internal noise levels:

INTERNAL

$L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
 $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

We also note that under the SPP5.4, noise mitigation measures should be implemented with a view to achieve, in at least one outdoor area, the “Noise Target”.

The results of the acoustic assessment indicate that noise received at the ground floor level of residences located adjacent to Marmion Avenue and Eglinton Drive would exceed the “Noise Limit” with the level of exceedance in the worst case location being around 8 and 6 dB(A), respectively. Thus, for these residences, noise received at residences would exceed the “Noise Limits” criteria and notifications on Titles and a “Quiet House” design would be required for at least the first row of residences.

For residences located adjacent to Marmion Avenue, we do not believe that for the entire length of the development it would be practicable or desirable to construct noise barriers at the edge of the Marmion Avenue road reserve. Therefore, the following is recommended:

1. Where lots back on to Marmion Avenue, the construction of a 2.2 metre barrier wall is recommended. Locations are shown on Figure D1 attached in Appendix D.
2. Where possible, minor access streets be located between Marmion Avenue and residential premises. This then allows the front of the residences to face the major roads and ensures that the residences themselves provide a barrier to an outdoor living area located at the rear of the residence. Noise received at the outdoor living areas would then comply with the “Noise Target” as required under SPP5.4.

With the construction of a 2.2 metre high barrier, noise received at the ground floor would be reduced to below the “Noise Limit” criteria. Therefore, with regards to “Quiet House” design, the following would apply:

Ground floor with barrier wall	-	Package A
Residence fronting Marmion Avenue with access road	-	Package B

For residences located adjacent to Eglinton Drive, there are minor access roads between this road and the residences. Again, this allows the front of the residences to face the major roads and ensuring that the residence themselves provide a barrier to an outdoor living area located at the rear of the residence. Noise received at the outdoor living areas would then comply with the “Noise Target” as required under SPP5.4. Therefore, with regards to “Quiet House” design, Package B would be required for the first row of residence.

Additional, to the above, depending on the final sub-divisional plan, some additional residence may require “Quiet House” design. All residences receiving noise levels of an $L_{Aeq(Day)}$ of 55 dB(A) or above, require Notifications on Titles.

With regards to noise received at the noise received from the extension of the northern suburbs passenger rail, it is noted that under the current proposed structure plan there would be no noise sensitive within the $L_{Aeq(Day)}$ 55 dB(A) noise contour. Therefore, in relation to the railway, nothing is required.

Areas requiring “Quiet House” design and Notifications on Titles are shown in Figure D1 in Appendix D.

Information regarding “Quiet House” design Package as outlined in the Implementation Guidelines, is contained in Appendix E.

Notes:

- 1 To refine the “Quiet House” design requirements and the residences requiring Notifications, it is recommended that additional noise modelling be undertaken at subdivision stage when lots and the internal road network have been finalised.
- 2 It is noted that Quiet House Design Packages attached are “Deemed to Satisfy” constructions and alternative constructions would be acceptable, provided they are supported by an acoustic report prepared by a suitably qualified acoustic consultant. Additionally, for multiple storey residences, it is recommended that specialist acoustic advice be sort.
- 3 The buildings associated with the educational facility are under State Planning Policy 5.4 considered as a Noise Sensitive Premises. Thus, depending on the location of the building, “Quiet House” design may be required. Under State Planning Policy 5.4, the internal noise levels within an education facility need to comply with the noise levels as listed in Table 1 of AS 2107 : 2016 - “Acoustics – Recommended design sound levels and reverberation times for building interiors”.

3. CRITERIA

3.1 STATE PLANNING POLICY 5.4

The Western Australian Planning Commission (WAPC) released on 22 September 2009 State Planning Policy 5.4 “Road and Rail Transport Noise and Freight Considerations In Land Use Planning” (SPP 5.4). Section 5.3 – Noise Criteria, outlines the acoustic criteria and states:

“5.3 - NOISE CRITERIA

Table 1 sets out the outdoor noise criteria that apply to proposals for new noise-sensitive development or new major roads and railways assessed under this policy.

These criteria do not apply to—

- *Proposals for redevelopment of existing major roads or railways, which are dealt with by a separate approach as described in section 5.4.1; and*
- *Proposals for new freight handling facilities, for which a separate approach is described in section 5.4.2.*
- *The outdoor noise criteria set out in Table 1 apply to the emission of road and rail transport noise as received at a noise-sensitive land use. These noise levels apply at the following locations—*
- *For new road or rail infrastructure proposals, at 1m from the most exposed, habitable façade of the building receiving the noise, at ground floor level only; and*
- *For new noise-sensitive development proposals, at 1m from the most exposed, habitable façade of the proposed building, at each floor level, and within at least one outdoor living area on each residential lot.*

Further information is provided in the guidelines.

TABLE 1: OUTDOOR NOISE CRITERIA

Time of day	Noise Target	Noise Limit
Day (6 am–10 pm)	$L_{Aeq(Day)} = 55 \text{ dB(A)}$	$L_{Aeq(Day)} = 60 \text{ dB(A)}$
Night (10 pm–6 am)	$L_{Aeq(Night)} = 50 \text{ dB(A)}$	$L_{Aeq(Night)} = 55 \text{ dB(A)}$

The 5 dB difference between the outdoor noise target and the outdoor noise limit, as prescribed in Table 1, represents an acceptable margin for compliance. In most situations in which either the noise-sensitive land use or the major road or railway already exists, it should be practicable to achieve outdoor noise levels within this acceptable margin. In relation to greenfield sites, however, there is an expectation that the design of the proposal will be consistent with the target ultimately being achieved. Because the range of noise amelioration measures available for implementation is dependent upon the type of proposal being considered, the application of the noise criteria will vary slightly for each different type. Policy interpretation of the criteria for each type of proposal is outlined in sections 5.3.1 and 5.3.2.

The noise criteria were developed after consideration of road and rail transport noise criteria in Australia and overseas, and after a series of case studies to assess whether the levels were practicable. The noise criteria take into account the considerable body of research into the effects of noise on humans, particularly community annoyance, sleep disturbance, long-term effects on cardiovascular health, effects on children's learning performance, and impacts on vulnerable groups such as children and the elderly. Reference is made to the World Health Organization (WHO) recommendations for noise policies in their publications on community noise and the Night Noise Guidelines for Europe. See the policy guidelines for suggested further reading.

5.3.1 Interpretation and application for noise-sensitive development proposals

In the application of these outdoor noise criteria to new noise-sensitive developments, the objective of this policy is to achieve –

- *acceptable indoor noise levels in noise-sensitive areas (for example, bedrooms and living rooms of houses, and school classrooms); and*
- *a reasonable degree of acoustic amenity in at least one outdoor living area on each residential lot¹.*

If a noise-sensitive development takes place in an area where outdoor noise levels will meet the noise target, no further measures are required under this policy.

In areas where the noise target is likely to be exceeded, but noise levels are likely to be within the 5dB margin, mitigation measures should be implemented by the developer with a view to achieving the target levels in a least one outdoor living area on each residential lot¹. Where indoor spaces are planned to be facing any outdoor area in the margin, noise mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces. In this case, compliance with this policy can be achieved for residential buildings through implementation of the deemed-to-comply measures detailed in the guidelines.

In areas where the outdoor noise limit is likely to be exceeded (i.e. above $L_{Aeq(Day)}$ of 60 dB(A) or $L_{Aeq(Night)}$ of 55 dB(A)), a detailed noise assessment in accordance with the guidelines should be undertaken by the developer. Customised noise mitigation measures should be implemented with a view to achieving the noise target in at least one outdoor living or recreation area on each noise-sensitive lot or, if this is not practicable, within the margin. Where indoor spaces will face outdoor areas that are above the noise limit, mitigation measures should be implemented to achieve acceptable indoor noise levels in those spaces, as specified in the following paragraphs.

¹ For non residential noise-sensitive developments, (e.g. schools and child care centres) consideration should be given to providing a suitable outdoor area that achieves the noise target, where this is appropriate to the type of use.

For residential buildings, acceptable indoor noise levels are $L_{Aeq(Day)}$ of 40 dB(A) in living and work areas and $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms². For all other noise-sensitive buildings, acceptable indoor noise levels under this policy comprise noise levels that meet the recommended design sound levels in Table 1 of Australian Standard AS 2107:2000 Acoustics—Recommended design sound levels and reverberation times for building interiors.

These requirements also apply in the case of new noise-sensitive developments in the vicinity of a major transport corridor where there is no existing railway or major road (bearing in mind the policy’s 15-20 year planning horizon). In these instances, the developer should engage in dialogue with the relevant infrastructure provider to develop a noise management plan to ascertain individual responsibilities, cost sharing arrangements and construction time frame.

If the policy objectives for noise-sensitive developments are not achievable, best practicable measures should be implemented, having regard to section 5.8 and the guidelines.”

4. MODELLING

To determine the noise received within the area of the activity centre from vehicles travelling along Marmion Avenue, noise modelling was carried out using SoundPlan, in accordance with the “Implementation Guidelines” for the State Planning Policy 5.4.

The ground contours used in the modelling were the current design contours for the project.

Noise modelling was undertaken based on the Structure Plan attached in Appendix A.

The traffic volume for Marmion Avenue, was as used for previous assessment, with the traffic volume for Eglinton Drive being extrapolated to 2036 from 2031 data contained within the Traffic report. The data is used in the model was as listed in Table 5.1

TABLE 5.1 - NOISE MODELLING INPUT DATA FOR ROAD TRAFFIC

Parameter	Value	
	Marmion Avenue	Eglinton Drive
Traffic Flow (vpd)	42000	37500
Speed (km/hr)	80	70
Future Heavy Vehicles (%)	6	4
Road Surface	Dense Graded Asphalt	Dense Graded Asphalt

In this situation where the road will undergo a major upgrade, noise modelling should be based on the DEFRA requirements. Using the DEFRA publication, the difference between the $L_{Aeq,16hr}$ (i.e day period) and the $L_{Aeq,8hr}$ (i.e night period) would be greater the 5 dB(A).

With regards to train movements, from previous projects in this area, the number of train movements are as listed in Table 5.2.

TABLE 5.2 – TRAIN MOVEMENTS

DAY	NIGHT
75 north bound	22 North bound
75 South bound	22 South bound

² For residential buildings, indoor noise levels are not set for utility spaces such as bathrooms. This policy encourages effective “quiet house” design, which positions these non-sensitive spaces to shield the more sensitive spaces from transport noise (see guidelines for further information).

Note: All trains are 6 car sets.

Based on the number of train movements, the difference between the $L_{Aeq,16hr}$ and the $L_{Aeq,8hr}$ would be greater than 5 dB(A). Hence, again the day period would be the critical period for compliance.

Notes :

- 1 As outlined in the Implementation Guidelines, when using DEFRA for the basis of the noise modelling, the standard correction of -1.7 dB has been applied to the noise model. However, based on our experience, we believe that noise modelling undertaken using this correction, would still be conservative.

For this development within the activity centre plan, it is anticipated that the majority of residences would be single storey. Thus, the following modelling was undertaken to the ground floors:

Road Traffic Noise

- Figure B1 - Base calculation (No noise mitigation) to Ground floor.
- Figure B2 - With 2.2 metre high fence to lots backing on to Marmion Avenue (North west R60-80 retirement section).

Rail Noise

- Figure C1 - No Mitigation.

5. DISCUSSION / RECOMMENDATIONS

This development fronts both Marmion Avenue and Eglinton Drive; and an extension to the northern suburbs passenger railway. Thus, under State Planning Policy 5.4, acoustic assessments for both these transport corridors are required.

For both Marmion Avenue and Eglinton Drive, the variation between the current road usage and design compared to that of the future, as per the Implementation Guidelines for State Planning Policy 5.4, noise modelling was undertaken using the DEFRA and standard parameters. Using this parameter, the day period is the critical period for compliance. For the passenger trains, with the variation in train movements between the day and night periods, the day period is also the critical period for compliance. Thus, noise modelling and the assessment were based on the day period ($L_{Aeq,16hr}$).

Under the Western Australian Planning Commission (WAPC) Planning Policy 5.4 *“Road and Rail Transport Noise and Freight Considerations in Land Use Planning”* the following external criteria are listed:

“Noise Target”

$L_{Aeq(Day)}$ of 55 dB(A);
 $L_{Aeq(Night)}$ of 55 dB(A);

“Noise Limits”

$L_{Aeq(Day)}$ of 60 dB(A).
 $L_{Aeq(Night)}$ of 55 dB(A).

As external noise levels exceed the “Noise Target” noise levels, then the residential premises should be designed to comply with the following internal noise levels:

INTERNAL

- $L_{Aeq(Day)}$ of 40 dB(A) in living and work areas; and
- $L_{Aeq(Night)}$ of 35 dB(A) in bedrooms.

We also note that under the SPP5.4, noise mitigation measures should be implemented with a view to achieve, in at least one outdoor area, the L_{Aeq} of 50 dB(A) noise level for the night period.

For this activity centre plan, it is anticipated that the majority of residences would be single storey. Therefore, the assessments have been undertaken for ground floors. The results of the noise modelling for traffic noise associated with Marmion Avenue and Eglinton Drive are shown in Appendix B, with the passenger rail noise attached in Appendix C.

Note : For multiple storey residences, it is recommended that specialist acoustic advice be sought.

For residences located adjacent to Marmion Avenue, we do not believe that for the entire length of the development it would be practicable or desirable to construct noise barriers at the edge of the Marmion Avenue road reserve. Therefore, the following is recommended:

1. Where lots back on to Marmion Avenue, the construction of a 2.2 metre barrier wall is recommended. Locations are shown on Figure D1 attached in Appendix D.
2. Where possible, minor access streets be located between Marmion Avenue and residential premises. This then allows the front of the residence to face the major roads and ensuring that the residences themselves provide a barrier to an outdoor living area located at the rear of the residence. Noise received at the outdoor living areas would then comply with the “Noise Target” as required under SPP5.4.

With the construction of a 2.2 metre high barrier, noise received at the ground floor would be reduced to below the “Noise Limit” criteria. Therefore, with regards to “Quiet House” design, the following would apply:

Ground floor with barrier wall	-	Package A
Residence fronting Marmion Avenue with access road	-	Package B

For residences located adjacent to Eglinton Drive, there are minor access roads between this road and the residences. Again, this allows the front of the residences to face the major roads and ensuring that the residence themselves provide a barrier to an outdoor living area located at the rear of the residence. Noise received at the outdoor living areas would then comply with the “Noise Target” as required under SPP5.4. Therefore, with regards to “Quiet House” design, Package B would be required for the first row of residence.

Additional, to the above, depending on the final subdivision plan, some additional residences may require “Quiet House” design. All residences receiving noise levels of an $L_{Aeq(Day)}$ of 55 dB(A) or above, require Notifications on Titles.

With regards to noise received from the extension of the northern suburbs passenger rail, it is noted that under the current proposed activity centre plan there would, with a road running along the eastern side of the railway reserve, be no noise sensitive premise within the $L_{Aeq(Day)}$ 55 dB(A) noise contour and in relation to the railway, nothing is required.

Finally, it is noted that buildings associated with the educational facility are under State Planning Policy 5.4 considered as a Noise Sensitive Premises. Thus, depending on the location of the building, “Quiet House” design may be required. Under State Planning Policy 5.4, the internal noise levels within an education facility need to comply with the noise levels as listed in Table 1 of AS 2107 : 2016 - “Acoustics – Recommended design sound levels and reverberation times for building interiors”.

The lot requirements with regards to “Quiet House” design Package and Notifications on Titles, as outlined in the Implementation Guidelines, are shown in Figure D1 in Appendix D.

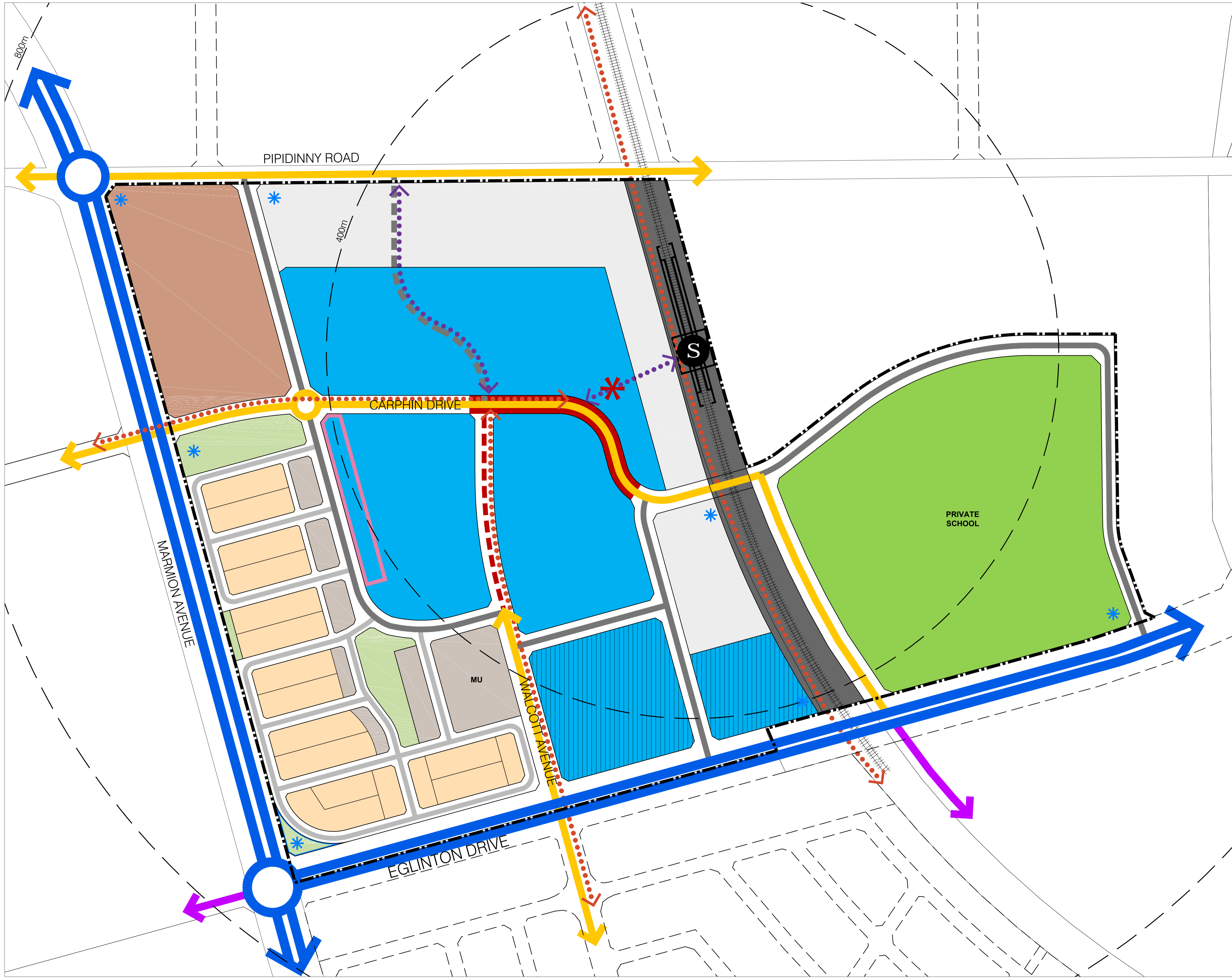
Information regarding “Quiet House” design Package, as outlined in the Implementation Guidelines, is contained in Appendix E.

Notes:

- 1 To refine the “Quiet House” design requirements and the residence requiring Notifications, it is recommended that additional noise modelling be undertaken at Sub-divisional stage when lots ground levels and the internal road network have been finalised.
- 2 It is noted that Quiet House Design Packages attached are “Deemed to Satisfy” constructions and alternative constructions would be acceptable, provided they are supported by an acoustic report prepared by a suitably qualified acoustic consultant. Additionally, for multiple storey residences, it is recommended that specialist acoustic advice be sort.

APPENDIX A

STRUCTURE PLAN

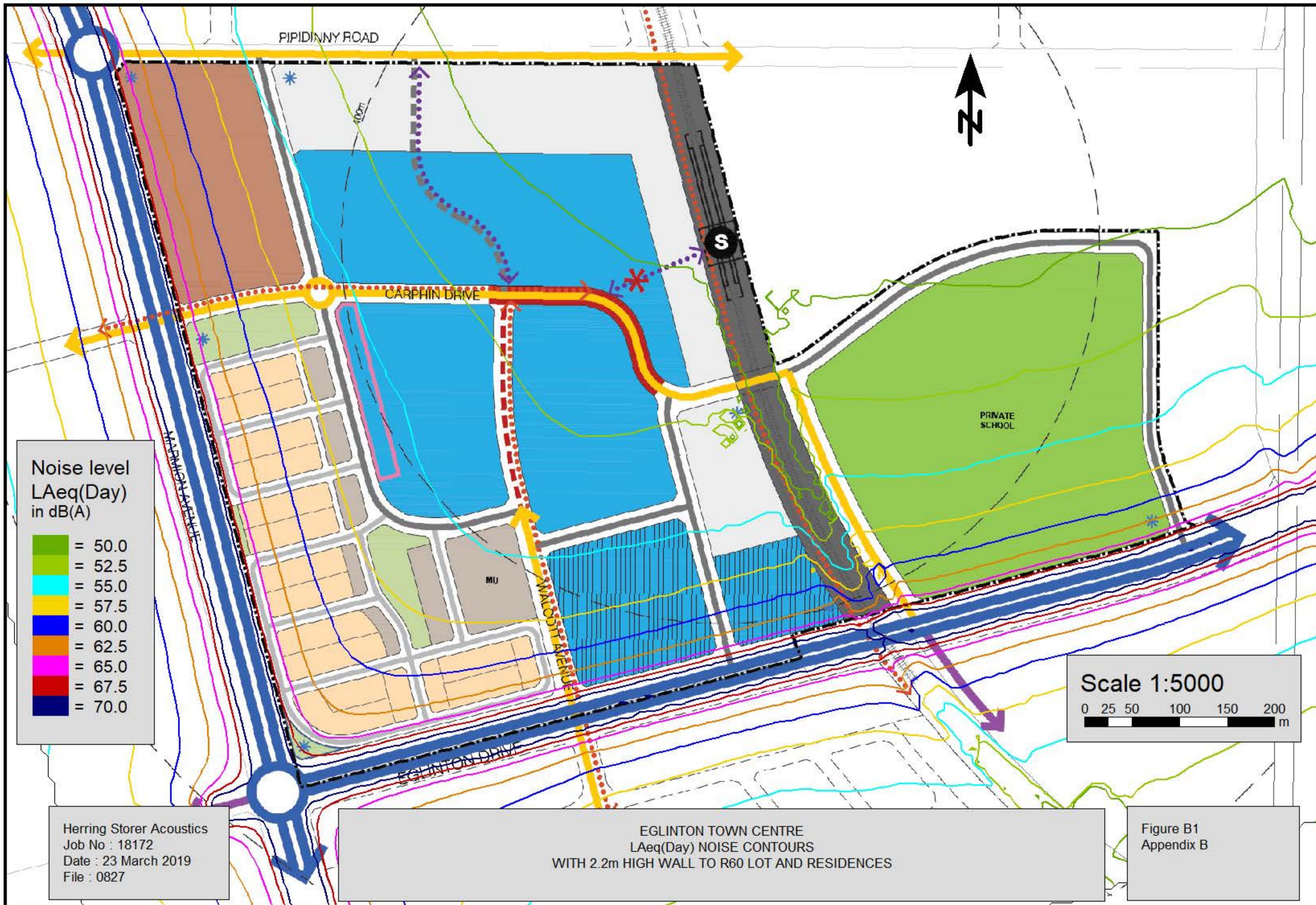


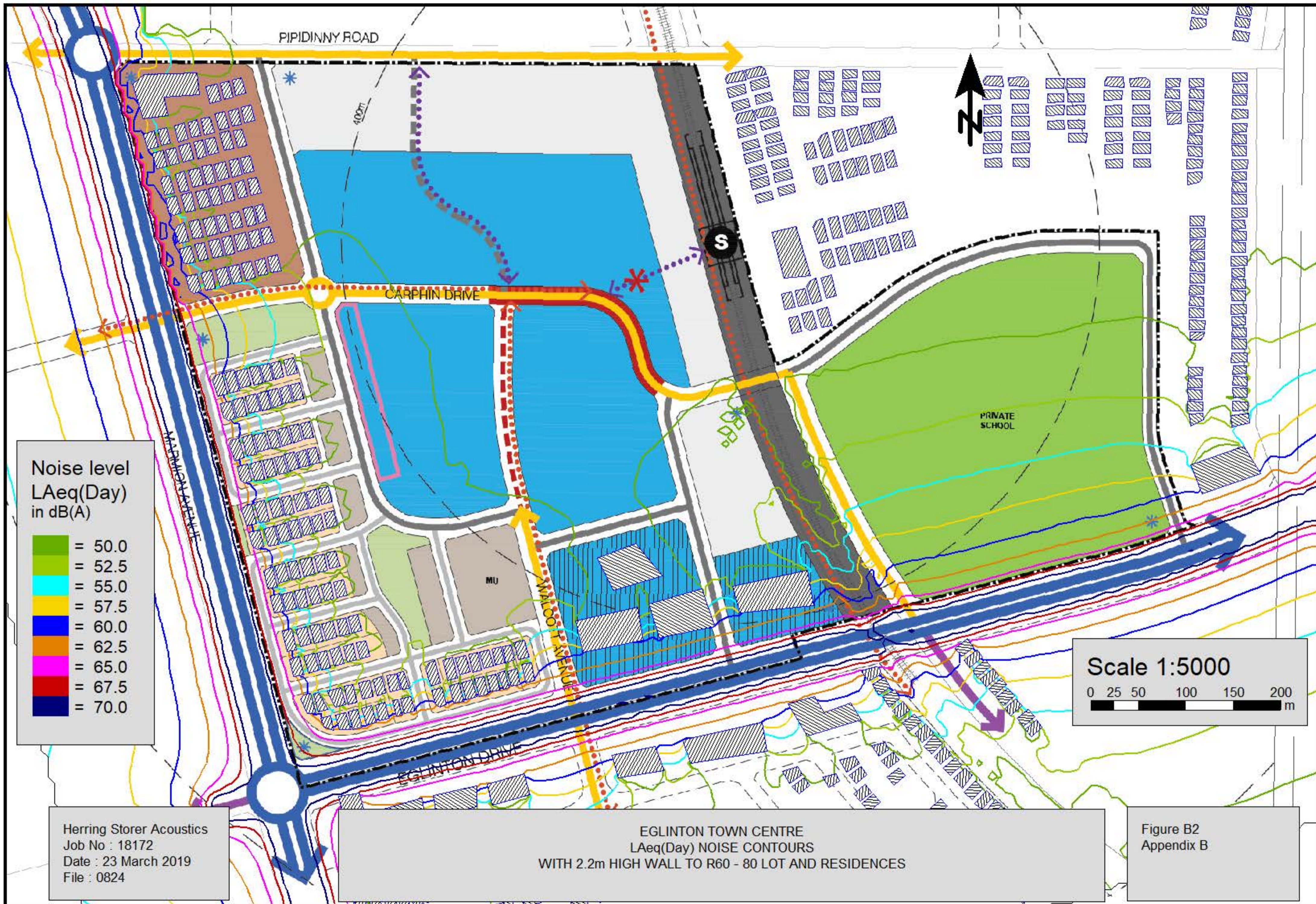
LEGEND	
	APPLICATION AREA
ZONES	
	RESIDENTIAL R30-R40
	RESIDENTIAL R60-R80
	RESIDENTIAL R80 MULTI-UNIT
	RETIREMENT R60-R80
	RESIDENTIAL R100/MIXED USE
	COMMERCIAL
	BUSINESS
	PRIVATE CLUB AND RECREATION
RESERVES	
	PUBLIC OPEN SPACE AND DRAINAGE
	DRAINAGE RESERVE
	INTEGRATOR ROAD A
	NEIGHBOURHOOD CONNECTOR ROAD
	MAJOR ACCESS ROAD
	MINOR ACCESS ROAD
	RAILWAY RESERVE
	PTA INFRASTRUCTURE/PARK AND RIDE FACILITIES
OTHER	
	RAILWAY STATION
	WALKABLE CATCHMENT 400/800M
	TEMPORARY ACCESS ROAD
	MAIN STREET
	SHARED STREET
	SHARED PATH
	KEY PEDESTRIAN LINKAGES
	STATION SQUARE
	DRAINAGE LOCATIONS

APPENDIX B

ROAD TRAFFIC NOISE

$L_{Aeq(16hr)}$ DAY PERIOD NOISE CONTOURS

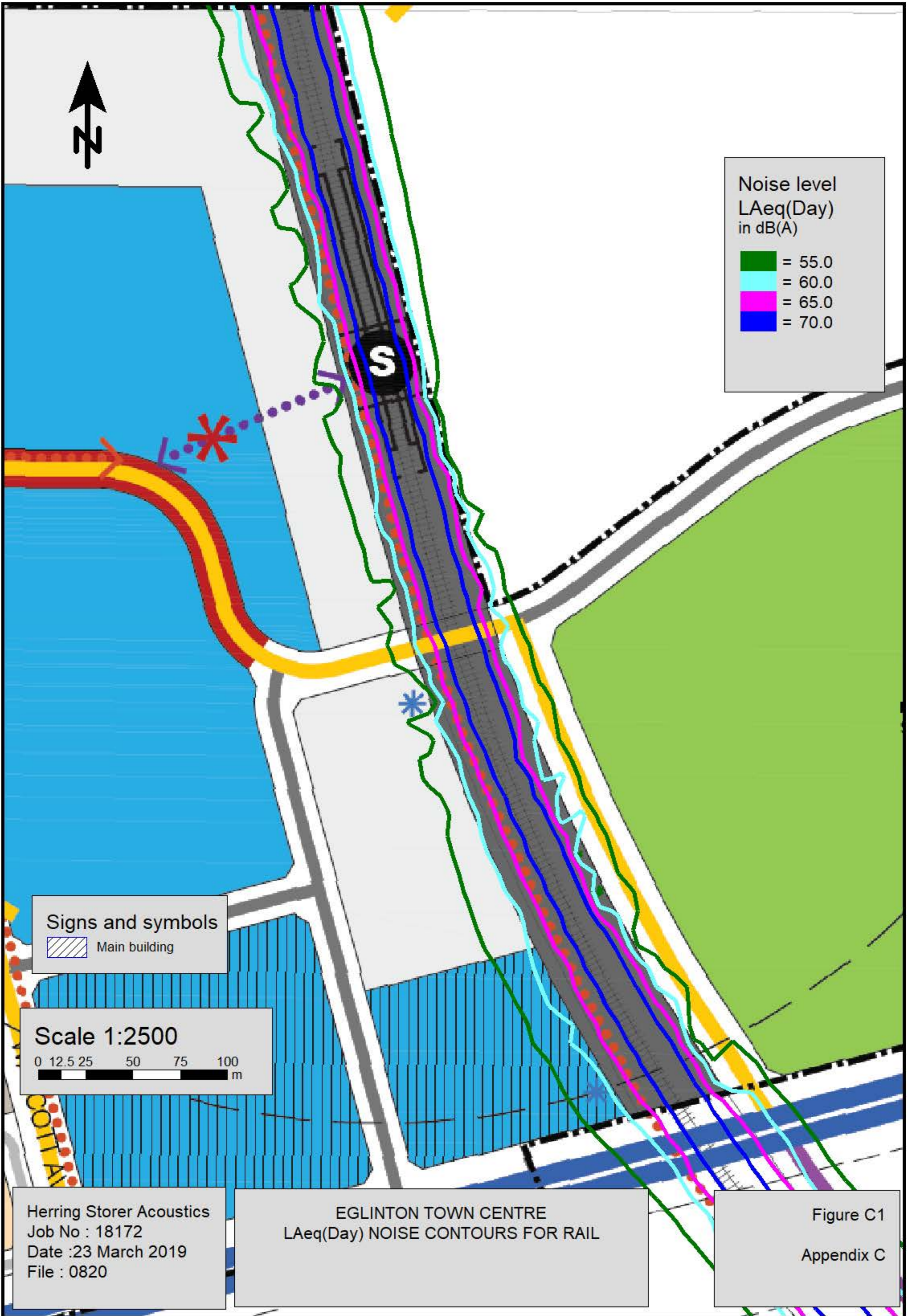




APPENDIX C

RAIL NOISE

$L_{Aeq(16hr)}$ DAY PERIOD NOISE CONTOURS



Noise level
 LAeq(Day)
 in dB(A)

Green	= 55.0
Cyan	= 60.0
Magenta	= 65.0
Blue	= 70.0

Signs and symbols

	Main building
--	---------------

Scale 1:2500

0 12.5 25 50 75 100 m

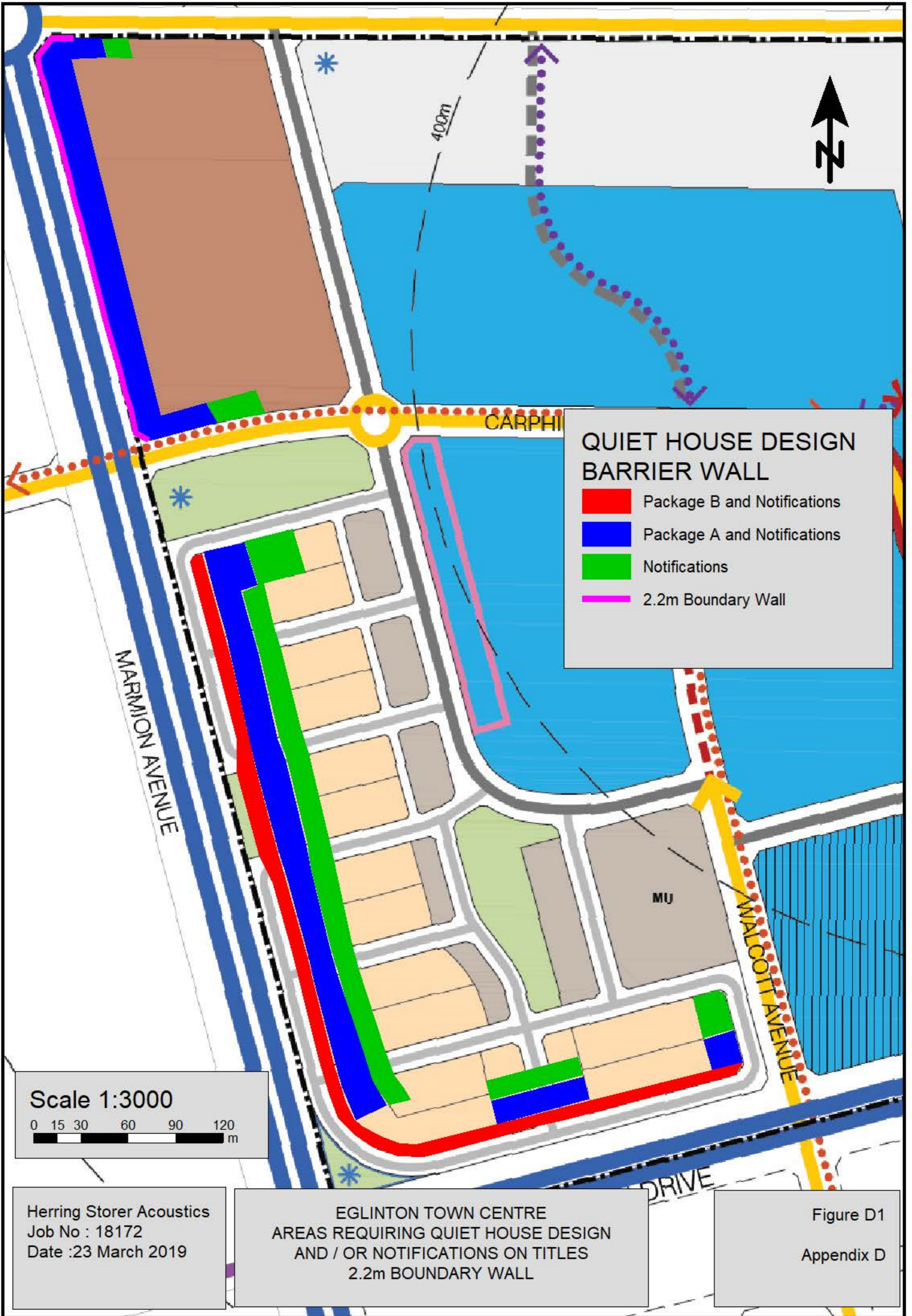
Herring Storer Acoustics
 Job No : 18172
 Date :23 March 2019
 File : 0820

EGLINTON TOWN CENTRE
 LAeq(Day) NOISE CONTOURS FOR RAIL

Figure C1
 Appendix C

APPENDIX D

LOTS REQUIRING QUIET HOUSE DESIGN
NOTIFICATION ON TITLES



APPENDIX E

QUIET HOUSE DESIGN PACKAGES

Area	Orientation to road or rail corridor	Package A	Package B	Package C
		L _{Aeq} ,Day up to 60dB L _{Aeq} ,Night up to 55dB	L _{Aeq} ,Day up to 63dB L _{Aeq} ,Night up to 58dB	L _{Aeq} ,Day up to 65dB L _{Aeq} ,Night up to 60dB
Bedrooms	Facing	<ul style="list-style-type: none"> Walls to R_w+C_{tr} 45dB Windows and external door systems: Minimum R_w+C_{tr} 28dB (Table 6.4), total glazing area up to 40% of room floor area. [if R_w+C_{tr} 31dB: 60%] [if R_w+C_{tr} 34dB: 80%] Roof and ceiling to R_w+C_{tr} 35dB (1 layer 10mm plasterboard) Mechanical ventilation as per Section 6.3.1 	<ul style="list-style-type: none"> Walls to R_w+C_{tr} 50dB Windows and external door systems: Minimum R_w+C_{tr} 31dB (Table 6.4), total glazing area up to 40% of room floor area. [if R_w+C_{tr} 34dB: 60%] Roof and ceiling to R_w+C_{tr} 35dB (1 layer 10mm plasterboard) Mechanical ventilation as per Section 6.3.1 	<ul style="list-style-type: none"> Walls to R_w+C_{tr} 50dB Windows and external door systems: Minimum R_w+C_{tr} 34dB (Table 6.4), total glazing area limited to 40% of room floor area [if 20% of floor area or less, R_w+C_{tr} 31dB] Roof and ceiling to R_w+C_{tr} 40dB (2 layers 10mm plasterboard) Mechanical ventilation as per Section 6.3.1
	Side-on	•As above, except glazing R _w +C _{tr} values for each package may be 3dB less, or max % area increased by 20%		
	Opposite	• No requirements	• As per Package A 'Side On'	• As per Package A 'Facing'
Indoor living and work Areas	Facing	<ul style="list-style-type: none"> Walls to R_w+C_{tr} 45dB Windows and external door systems: Minimum R_w+C_{tr} 25dB (Table 6.4), total glazing area limited to 40% of room floor area. [if R_w+C_{tr} 28dB: 60%] [if R_w+C_{tr} 31dB: 80%] External doors other than glass doors to R_w+C_{tr} 26dB (Table 6.4) Mechanical ventilation as per Section 6.3.1 	<ul style="list-style-type: none"> Walls to R_w+C_{tr} 50dB Windows and external door systems: Minimum R_w+C_{tr} 28dB (Table 6.4), total glazing area up to 40% of room floor area. [if R_w+C_{tr} 31dB: 60%] [if R_w+C_{tr} 34dB: 80%] External doors other than glass doors to R_w+C_{tr} 26dB (Table 6.4) Mechanical ventilation as per Section 6.3.1 	<ul style="list-style-type: none"> Walls to R_w+C_{tr} 50dB Windows and external door systems: Minimum R_w+C_{tr} 31dB (Table 6.4), total glazing area up to 40% of room floor area. [if R_w+C_{tr} 34dB: 60%] External doors other than glass doors to R_w+C_{tr} 30dB (Table 6.4) Mechanical ventilation as per Section 6.3.1
	Side-on	• As above, except the glazing R _w +C _{tr} values for each package may be 3dB less, or max % area increased by 20%		
	Opposite	• No requirements	• As per Package A 'Side On'	• As per Package A 'Facing'
Other indoor areas	Any	• No requirements	• No requirements	• No requirements
Outdoor living areas	Any (Section 6.2.3)	<ul style="list-style-type: none"> As per Package C, and/or At least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2 metres height above ground level 	<ul style="list-style-type: none"> As per Package C, and/or At least one ground level outdoor living area screened using a solid continuous fence or other structure of minimum 2.4 metres height above ground level 	<ul style="list-style-type: none"> At least one outdoor living area located on the opposite side of the building from the transport corridor

Alternative constructions are acceptable, provided they are supported by an report prepared by an suitably qualified Acoustical Consultant.

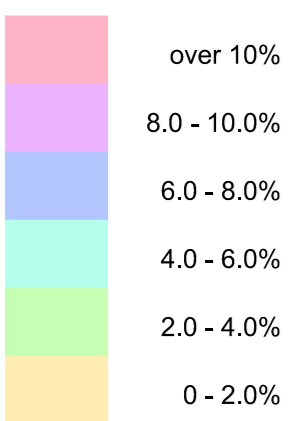
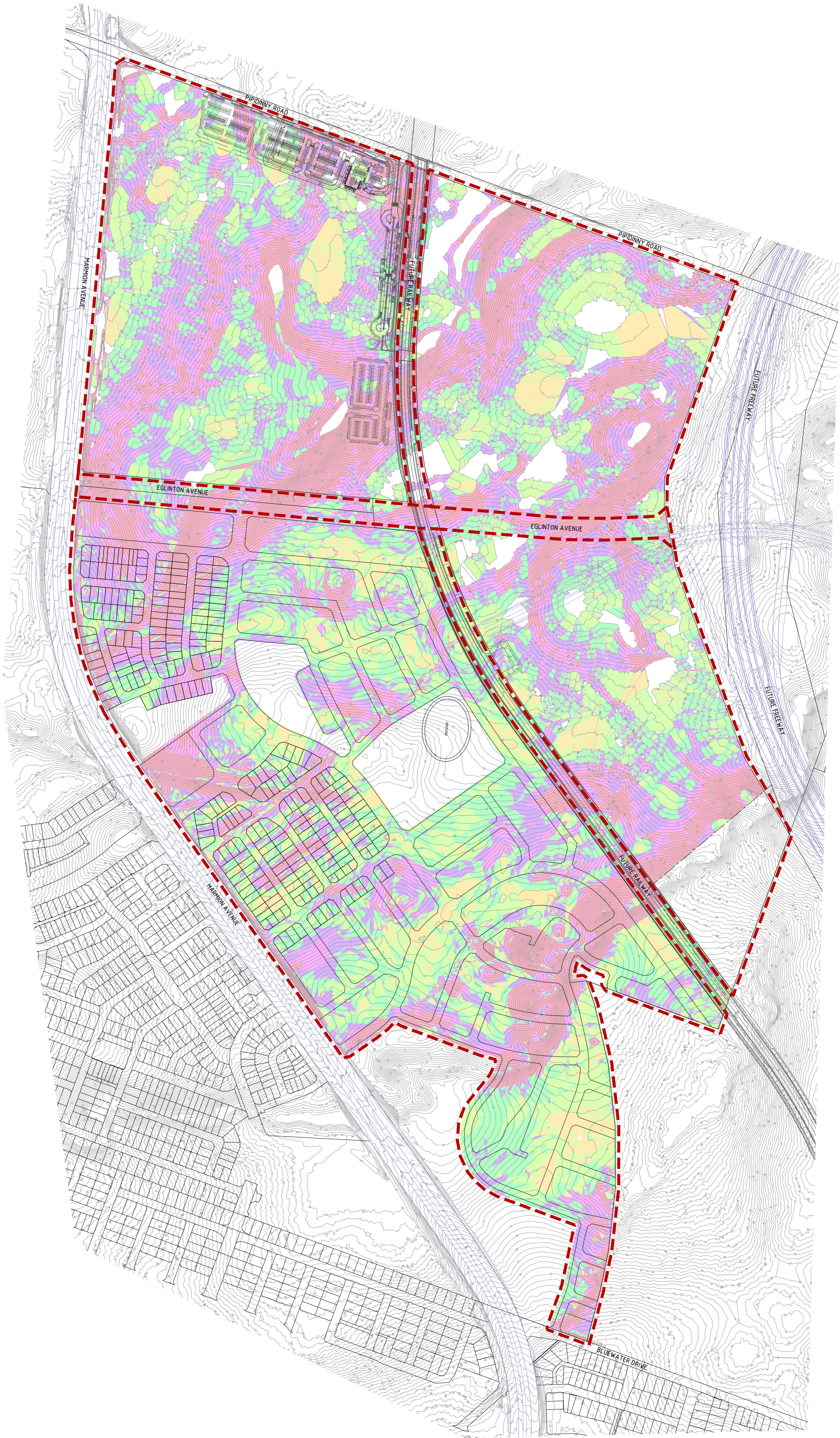
MINIMUM ACOUSTIC RATING OF SELECTED EXTERNAL BUILDING EXTERIOR WALLS

Building Element	Type	$R_w + C_{tr}, dB$	Example Constructions
External wall	Steel framed	45	One row of 92mm studs at 600mm centres with – <ul style="list-style-type: none"> • resilient steel channels fixed to the outside of the studs; and • 9.5mm hardboard or 9mm fibre cement sheeting or 11mm fibre cement weatherboards fixed to the outside of the channels; and • 75mm thick glass or mineral wool insulation with a density of 11kg/m³ or • 75mm thick polyester insulation with a density of 14kg/m³, positioned between the studs; and • two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs.
			One row of 92mm studs at 600mm centres with – <ul style="list-style-type: none"> • resilient steel channels fixed to the outside of the studs; and • one layer of 19mm board cladding fixed to the outside of the channels; and • 6mm fibre cement sheets fixed to the inside of the channels; and • 75mm thick glass or mineral wool insulation with a density of 11 kg/m³ or • 75mm thick polyester insulation with a density of 14 kg/m³, positioned between the studs; and • two layers of 16mm fire-protective grade plasterboard fixed to the inside face of the studs.
	Single leaf masonry, brick veneer	45	<ul style="list-style-type: none"> • Single leaf of 150mm brick masonry with 13mm cement render on each face.
		50	Single leaf of 90mm clay brick masonry with – <ul style="list-style-type: none"> • a row of 70mm x 35mm timber studs or 64mm steel studs at 600mm centres; and • a cavity of 25mm between leaves; and • 75mm thick glass or mineral wool insulation with a density of 11kg/m³ or 75mm thick polyester insulation with a density of 14kg/m³ positioned between studs; and • one layer of 10mm plasterboard fixed to the inside face.
			Single leaf of 220mm brick masonry with 13mm cement render on each face.
			150mm thick unlined concrete panel. 200mm thick concrete panel with one layer of 13mm plasterboard or 13mm cement render on each face.
	Double brick	45	Two leaves of 90mm clay brick masonry with a 20mm cavity between leaves.
		50	Two leaves of 90mm clay brick masonry with – <ul style="list-style-type: none"> • a 50mm cavity between leaves; and • 50mm thick glass wool insulation with a density of 11kg/m³ or 50mm thick polyester insulation with a density of 14 kg/m³ in the cavity; and • Where wall ties are required to connect leaves, the ties are of the resilient type.
	Two leaves of 110mm clay brick masonry with – <ul style="list-style-type: none"> • a 50mm cavity between leaves; and • 50mm thick glass wool insulation with a density of 11kg/m³ or 50mm thick polyester insulation with a density of 14 kg/m³ in the cavity. 		

MINIMUM ACOUSTIC RATING OF GLAZED ELEMENTS

Building Element	Type	Airborne weighted sound reduction rating with traffic correction R_w+C_{tr}, dB	Building element Type Airborne weighted sound
Window, uPVC, aluminium or timber frame	Sliding or double hung opening	23	<ul style="list-style-type: none"> • 4mm monolithic glass
		26	<ul style="list-style-type: none"> • Single pane glazing to R_w 33dB • 6mm monolithic or laminated glass • 6mm toughened safety glass • '6-12-6' double insulated glass unit (IGU)
		29	<ul style="list-style-type: none"> • Single pane glazing to R_w 36dB • 10mm monolithic (aka float) glass • 10mm laminated or toughened safety glass • 6mm-12mm-10mm double insulating
	Fixed sash, awning or casement type opening	26	<ul style="list-style-type: none"> • 4mm monolithic glass
		31	<ul style="list-style-type: none"> • Single pane glazing to R_w 33dB • 6mm monolithic or laminated glass • 6mm toughened safety glass • '6-12-6' double insulated glass unit (IGU)
		34	<ul style="list-style-type: none"> • Single pane glazing to R_w 36dB • 10mm monolithic (a.k.a. float) glass • 10mm laminated or toughened safety glass • 6mm-12mm-10mm double insulated glass unit (IGU)
Single external door, aluminium uPVC or timber frame	Fully glazed sliding door	24	<ul style="list-style-type: none"> • 6mm monolithic or laminated • 5 or 6mm toughened safety glass
		27	<ul style="list-style-type: none"> • 10mm monolithic or laminated • 10mm toughened safety glass
	Fully glazed hinged door	28	<ul style="list-style-type: none"> • Certified R_w 31dB acoustically rated door and frame including seals • 6mm monolithic or laminated • 5 or 6mm toughened safety glass
		31	<ul style="list-style-type: none"> • Certified R_w 34dB acoustically rated door and frame including seals • 10mm monolithic or laminated • 10mm toughened safety glass
	Solid core timber frame, side hinged	26	<ul style="list-style-type: none"> • Certified R_w 28dB acoustically rated door and frame system including seals • 35mm solid core timber
		30	<ul style="list-style-type: none"> • Certified R_w 32dB acoustically rated door and frame system including seals • 40mm solid core timber without glass insert • 40mm solid core timber with not less than 6mm

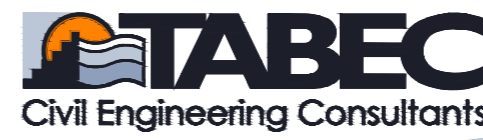
APPENDIX G EARTHWORKS PLANS



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DESIGNED	CHECKED	APPROVED
DRAWN	CHECKED	DATE
RDE		

PROJECT EGLINTON - SKETCHES

TITLE Preliminary Earthworks Existing Slope Analysis (Overall)

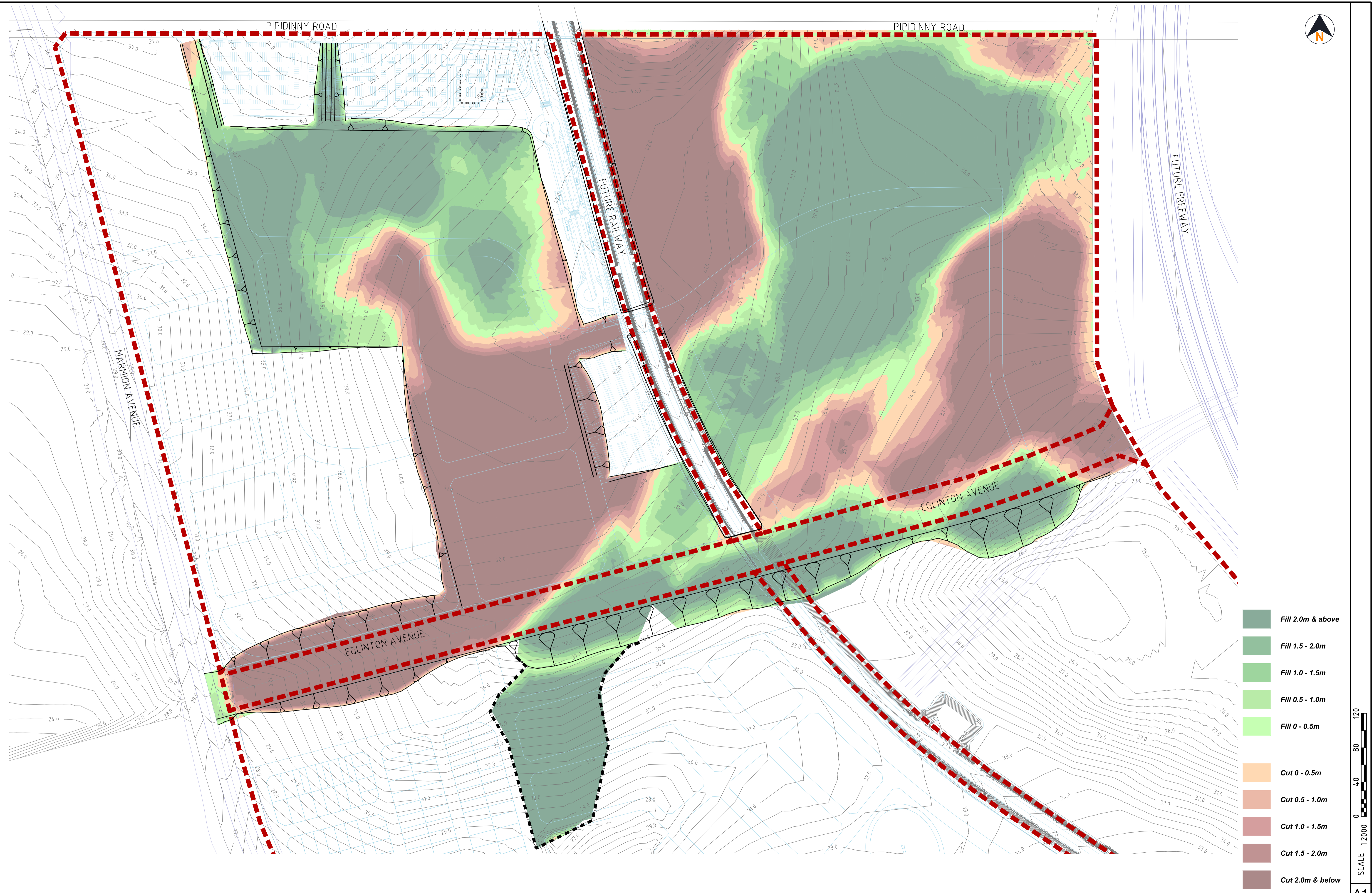
DRAWING NUMBER 2380-SK-008C

ISSUE B

No.	DATE	DRAWN	APPROVED	AMENDMENT
B	25.03.19	RDE	BMS	EXTENT OF SLOPE ANALYSIS REDUCED TO BOUNDARY.
A	23.07.18	DWP	BMS	ISSUED FOR INFORMATION.

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- Fill 2.0m & above
- Fill 1.5 - 2.0m
- Fill 1.0 - 1.5m
- Fill 0.5 - 1.0m
- Fill 0 - 0.5m
- Cut 0 - 0.5m
- Cut 0.5 - 1.0m
- Cut 1.0 - 1.5m
- Cut 1.5 - 2.0m
- Cut 2.0m & below

SCALE 1:2000
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A1

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No.	DATE	DRAWN	APPROVED	AMENDMENT
C	25.03.19	RDE	BMS	TEMPORARY BATTERS & DEPTH BANDING ADDED.
B	27.02.19	RDE	BMS	EARTHWORKS AMENDED.
A	23.07.18	DWP	BMS	ISSUED FOR INFORMATION.

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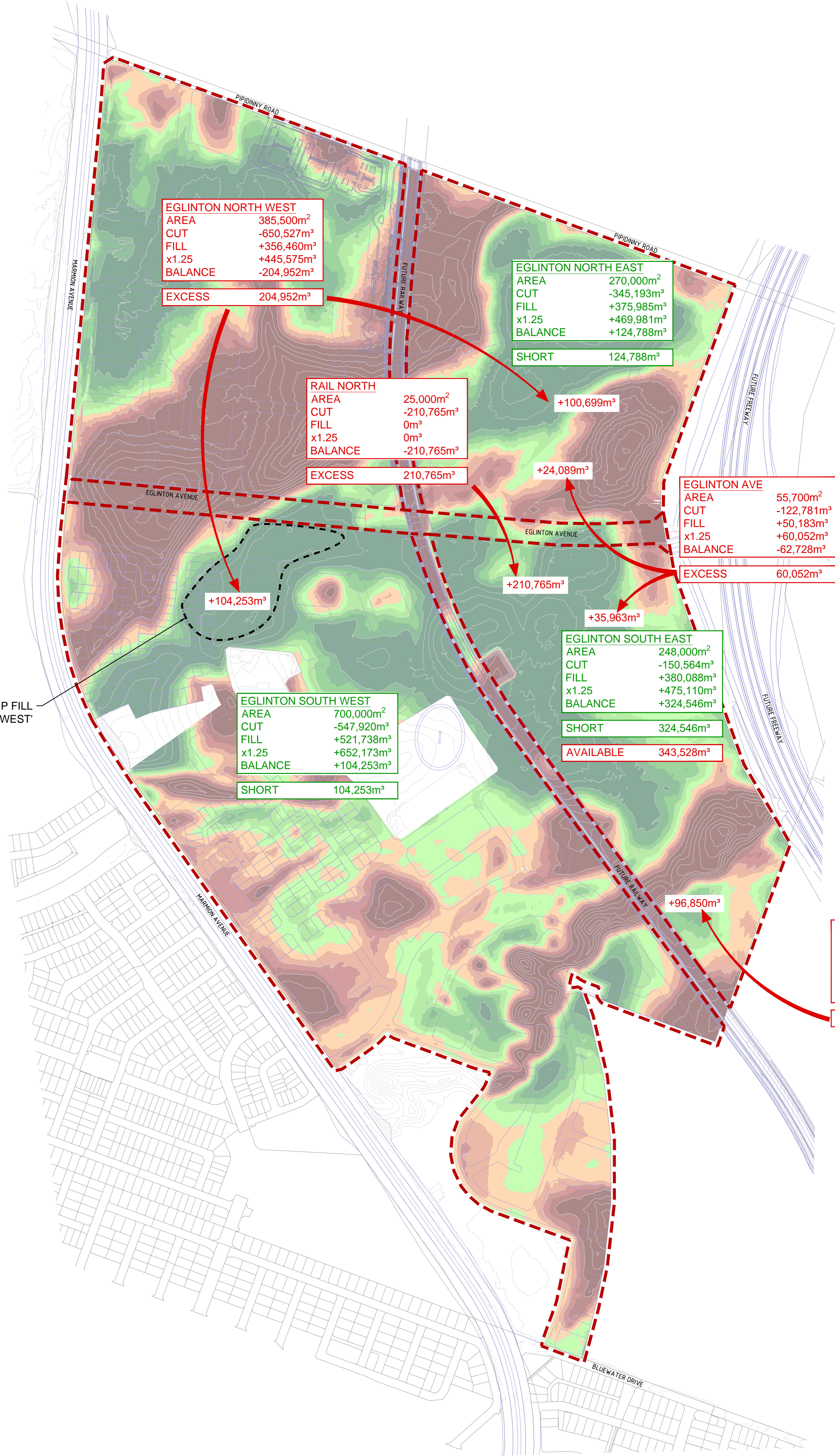
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PROJECT	EGLINTON - SKETCHES	
TITLE	Preliminary Earthworks Design Contours (Town Centre Stage 1)	
DRAWING NUMBER	2380-SK-006A	ISSUE
		C



EGLINTON NORTH WEST

AREA	385,500m ²
CUT	-650,527m ³
FILL	+356,460m ³
x1.25	+445,575m ³
BALANCE	-204,952m ³
EXCESS	204,952m ³

EGLINTON NORTH EAST

AREA	270,000m ²
CUT	-345,193m ³
FILL	+375,985m ³
x1.25	+469,981m ³
BALANCE	+124,788m ³
SHORT	124,788m ³

RAIL NORTH

AREA	25,000m ²
CUT	-210,765m ³
FILL	0m ³
x1.25	0m ³
BALANCE	-210,765m ³
EXCESS	210,765m ³

EGLINTON AVE

AREA	55,700m ²
CUT	-122,781m ³
FILL	+50,183m ³
x1.25	+60,052m ³
BALANCE	-62,728m ³
EXCESS	60,052m ³

EGLINTON SOUTH WEST

AREA	700,000m ²
CUT	-547,920m ³
FILL	+521,738m ³
x1.25	+652,173m ³
BALANCE	+104,253m ³
SHORT	104,253m ³

EGLINTON SOUTH EAST

AREA	248,000m ²
CUT	-150,564m ³
FILL	+380,088m ³
x1.25	+475,110m ³
BALANCE	+324,546m ³
SHORT	324,546m ³
AVAILABLE	343,528m ³

RAIL SOUTH

AREA	40,200m ²
CUT	-120,972m ³
FILL	+19,298m ³
x1.25	+24,123m ³
BALANCE	-96,850m ³
EXCESS	96,850m ³

APPROX. EXTENT OF DEEP FILL FROM 'EGLINTON NORTH WEST'

- Fill 2.0m & above
- Fill 1.5 - 2.0m
- Fill 1.0 - 1.5m
- Fill 0.5 - 1.0m
- Fill 0 - 0.5m
- Cut 0 - 0.5m
- Cut 0.5 - 1.0m
- Cut 1.0 - 1.5m
- Cut 1.5 - 2.0m
- Cut 2.0m & below

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PROJECT	EGLINTON - SKETCHES
TITLE	Preliminary Earthworks Cut to Fill Analysis (Overall)
DRAWING NUMBER	2380-SK-007C
ISSUE	B

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