great places_

ellenbrook district centre stage 2 development plan_

PREPARED BY ROBERTSDAY
IN ASSOCIATION WITH COSSILL & WEBLEY AND JACOBS

OCTOBER 2014

ENDORSEMENT PAGE

This structure plan is prepared under the provisions of the City of Swan Local Planning Scheme No.17

IT IS CERTIFIED THAT THIS STRUCTURE PLAN WAS APPROVED BY RESOLUTION OF THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

27 SEPTEMBER 2013

In accordance with Schedule 2, Part 4, Clause 28 (2) and refer to Part 1, 2. (b) of the *Planning and Development (Local Planning Schemes) Regulations 2015*.

Date of Expiry: **19 OCTOBER 2030**

Contents

01 **Overview**

The District Centre will grow over the next 5 -7 years to become a key recreation, education, retail and residential node for Ellenbrook.

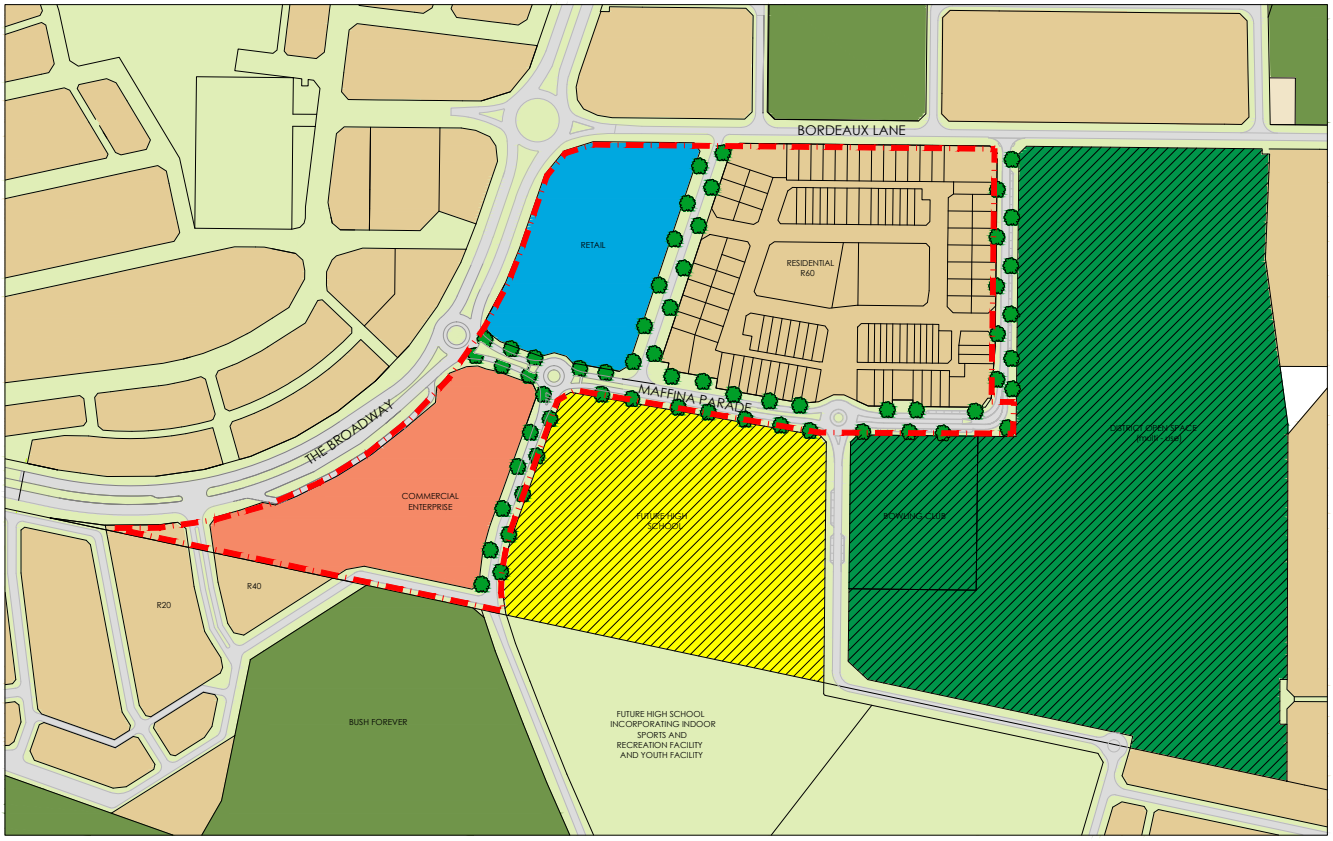
This Development Plan provides a planning framework to guide the future development and use of the District Centre (Stage 2). This Devlopment Plan is an update to the endorsed District Centre (Stage 2) Development Plan. The Stage 2 development area comprises of the following sites:

- Medium Density Residential Site (R60);
- Retail site; and a
- Commercial Enterprise Site

The medium density residential development site has been located as a result of the sites proximity to the proposed facilities within the District Centre, including retail, educational and recreation development.

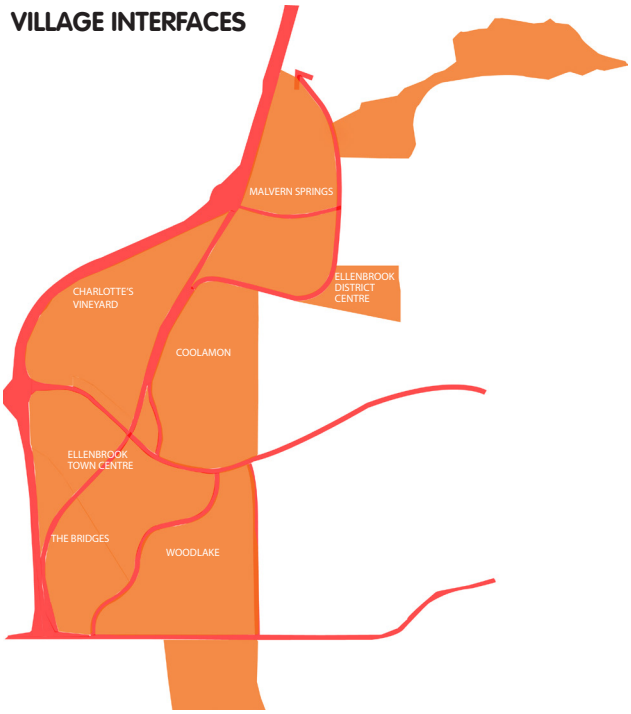
The retail site is in accordance with the City of Swan's Commercial Centres Strategy (2004), which proposes the provision of between 4,500m2 and 6,500m2 of retail floor space. The commercial enterprise site has been proposed to provide for service commercial and commercial uses.

The proposed Development Plan satisfies the requirements of Schedule 4 – Special Use Zones of the City of Swan Local Planning Scheme No. 17, for the preparation of Development Plans. A Development Plan for the High School, District Open Space and Bowling Club site within the District Centre has already been approved by the City of Swan and endorsed by the Western Australian Planning Commission. The proposed uses are generally in accordance with the original Ellenbrook Structure Plan which was endorsed by the WAPC in 1994.



Stage 2 Development Plan Boundary

01 **Overview**



1.1 Location

The Ellenbrook project is located within the City of Swan and is approximately 20km north east of the Perth CBD and within 10km of the Midland Town Centre.

The District Centre is located at the eastern boundary of Ellenbrook, between Malvern Springs and The Vines. It is north of the Vale development and on the southern boundary of Bordeaux Lane.

1.2 Land Description

The District Centre is contained within two titles being; Lot 9162 on Deposited Plan 59330 (Volume 2967 Folio 881) and Lot 9165 on Deposited Plan 59330 (Volume 2967 Folio 882) (refer Appendix A for copies).

1.3 Statutory Planning Structure

All land with the Ellenbrook project, including the District Centre, is zoned 'Special Use Zone – Ellenbrook' in the City of Swan Local Planning Scheme No. 17 (LPS 17). This zoning establishes the following two – tiered planning framework for the implementation of subdivision and development within Ellenbrook;

- Structure Plan – broad planning framework covering all of Ellenbrook (Approved); and
- Development Plan – prepared for each Village/Town Centre/District Centre to refine the structure plan and provide a framework for subsequent subdivision and development.

A condition on the approved stage 2 - Development Plan states:

i. Prior to subdivision of the General Commercial and Mixed Use sites, the Development Plan is to be modified in accordance with the requirements of the City of Swan's Local Planning Scheme No. 17.

ii. A future modification to the Development Plan, in relation to the Mixed Use site, is to address potential land use conflict and built form interface with the Residential R40 land on the southern boundary.

This Development Plan satisfies the requirements set out in LPS No 17 for the second tier of the planning framework.

The treatment of the interface with the adjoining residential R40 area is detailed in section 2.2.

1.4 Statement Of Intent

The District Centre (Stage 2) development will comprise:

- Medium density (R60) residential development (already approved and being constructed);
- Retail site; and
- Commercial Enterprise Site

The Development Plan area is strategically located in close proximity to the proposed recreation and education facilities within the District Centre.

The residential site provides for medium density development in close proximity to the amenity and convenience of the District Centre. The residential lots have been created and sold with houses currently being constructed. There are two undeveloped lots being Lots 8495 + 8497. Both lots are designated for residential apartments based upon on R60 code. The Department of Housing has engaged on Architect who is currently preparing a deisgn for the two sites.

The retail site has been identified in the City's Commercial Centres Strategy (2004) and a Neighbourhood Centre with a retail floor area of between 4,500m^2 and 6,500m^2.

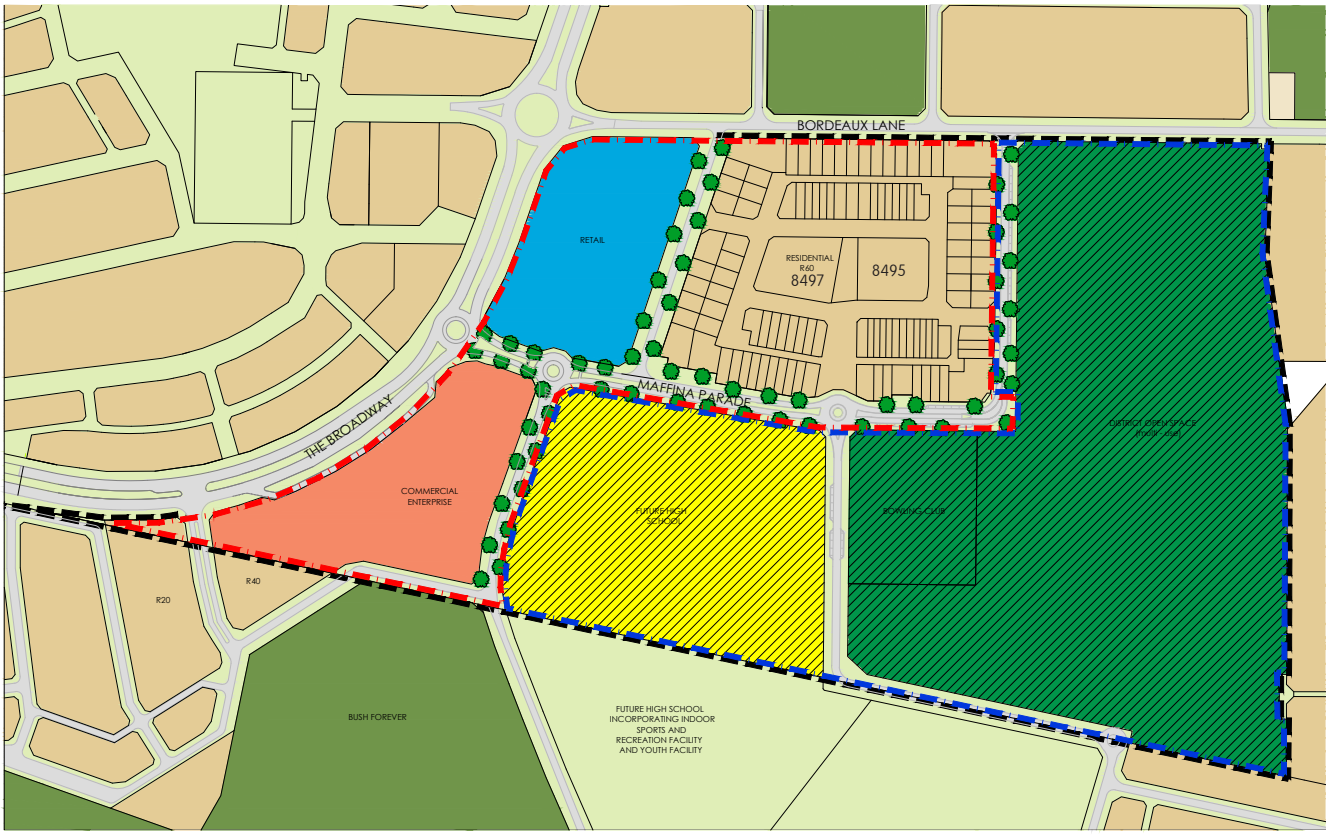
The commerical enterprise site has a flexible zoning with a variety of permissible uses. It is anticipated that service commercial and commercial uses will be developed.

1.5 The Site

The District Centre (Stage 2) comprises approximately 10 hectares and is bordered by Bordeaux Lane on the northern boundary, District Open Space on its eastern boundary, the proposed bowling club and high school on its southern boundary and the proposed District Centre retail site on its western boundary.

The site is wholly owned by the Ellenbrook Joint Venture, which allows a large degree of control over the planning of the District Centre to ensure a co-ordinated and high quality development outcome.

The site is currently vacant and has previously been cleared in accordance with approvals for bulk earthworks associated with the Ellenbrook development.



Ellenbrook District Centre Boundary

Stage 2 Development Plan Boundary

Stage 1 Development Plan Boundary

02 **Stage 2 Development**

2.1 Guiding Principles

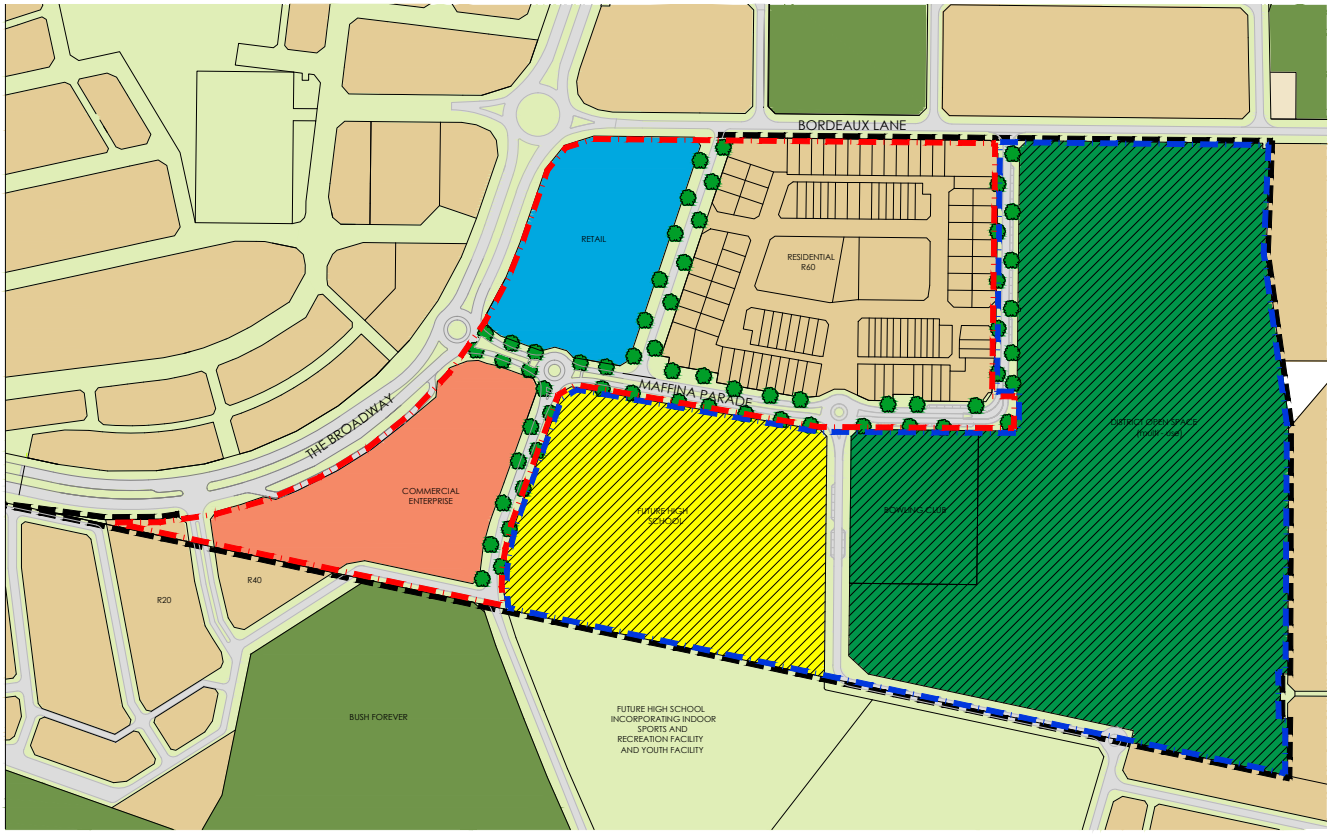
The key principles guiding future development and operation of the District Centre include:

- Integration with surrounding land uses and development;
- High standard of built form; and
- Shared pedestrian/vehicle environment achieved through quality landscaping, street trees and slow vehicle speeds.

2.2 Integration with surrounding land uses and development

The site is surrounded by a variety of approved uses including district recreation, high school and residential. Below is an indicative final layout of the District Centre. It is considered important to integrate the proposed development with the surrounding land uses. Appropriate integration can be achieved by orienting development frontages to the surrounding roads, encouraging passive surveillance and siting particular buildings and uses to avoid potential land use conflicts.

The integration of the residential area and the retail site is of particular importance due to the potential for land use conflict resulting from refuse areas, loading docks and traffic. Given the emerging Ellenbrook Town Centre, there is little short-term demand for retail floorspace in the District Centre. For this reason, the residential area has been developed ahead of other sites within this area. The final layout of the retail site is yet to be finalised, however an indicative layout has been designed which has due regard to the siting of service and refuse areas and access points in relation to the location of the residential area and its amenities. The north-south road separating the residential area and retail site will be well landscaped with street trees and other vegetation to soften the outlook from the residential development.



Ellenbrook District Centre Boundary

Stage 2 Development Plan Boundary

Stage 1 Development Plan Boundary

02 **Stage 2 Development**

The interface with the adjoining residential R40 area to the south is defined by a retaining wall, approximately 4.0m high. The retaining wall provides for the creation of service commercial lots which will front The Broadway. The large level change between The Broadway (44m AHD) and R40 site (39.5m AHD) can be accommodated via the construction of the retaining wall. This vertical separation of the rear boundary of the lots will provide for a compatible use transition, in accordance with the principles set out in 'Liveable Neighbourhoods'.

Built Form Interface - The project engineers Cossill and Webley have prepared a plan which shows a design for the proposed retaining wall and relative height to the adjoining R40 Residential cell. (Refer attachment). Given the height of the proposed retaining wall relative to the adjacent R40 site, future residents in the residential dwellings:

- Will have a limited/restricted view line to the proposed service - commercial development fronting The Broadway.
- Will benefit from the future service commercial development and retaining wall as it will provide an acoustic barrier to the vehicle traffic along The Broadway.

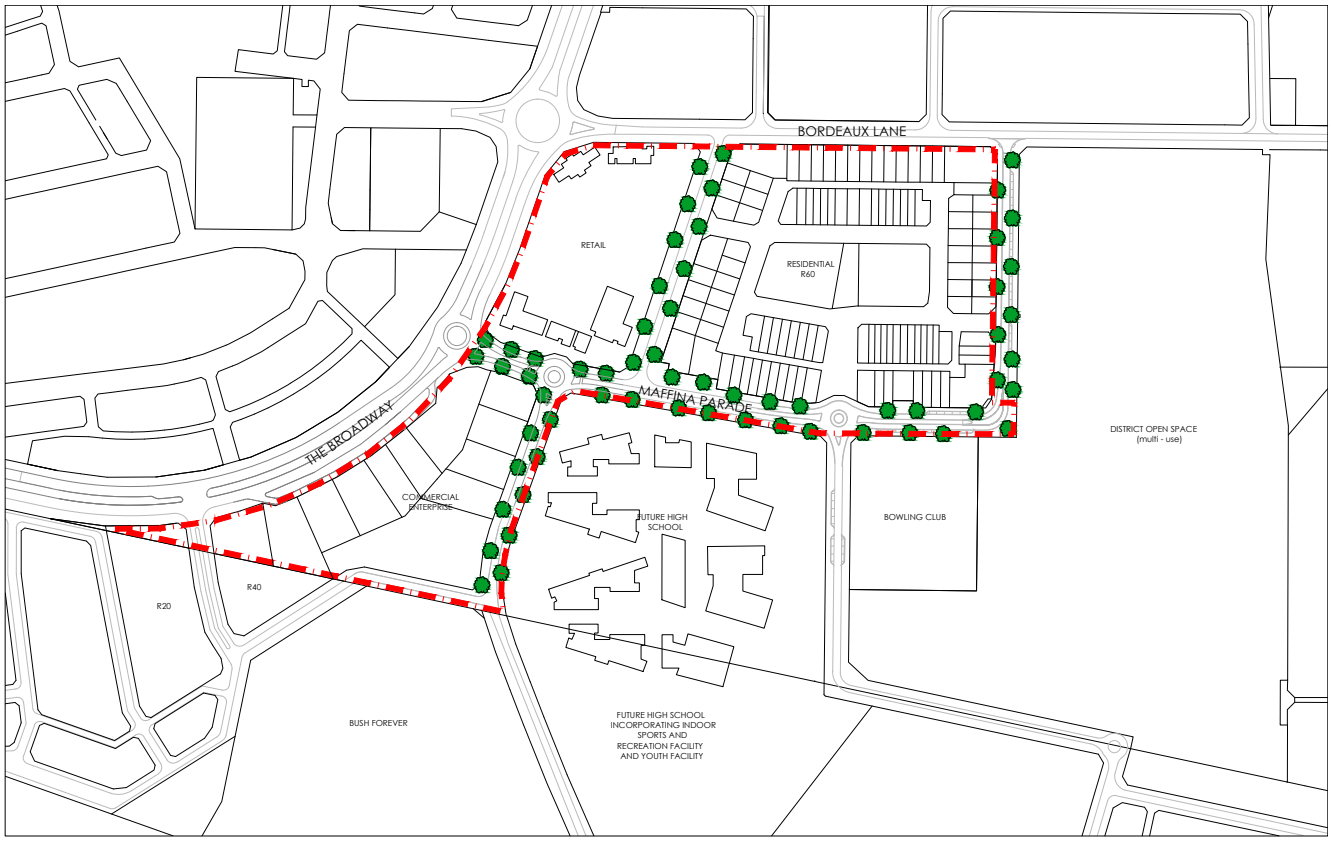
2.3 High standard of built form

The intent is to create an urban and vibrant place where creative touches and visual interest enhance the overall sense of place and identity of the District Centre.

Dwellings within the residential site incorporate elements which reflect the active and lively surrounds of the District Centre. Utilising the signature material of metal in the dwelling facades, providing substantial porches and verandahs to the front of homes and adding touches of contemporary highlight colours will create a cohesive neighbourhood.

The east-west road is proposed to be developed using 'main street' principles. Built form with active frontages will be constructed to the street boundary.

Detailed Area Plans (DAPs), which require approval from the City of Swan, will be prepared for each of the sites. Any development will have to comply with these DAPs. These DAPs will include specific requirements on building setbacks, building orientation, parking, refuse areas, fencing and landscaping.



INDICATIVE DISTRICT CENTRE LAYOUT

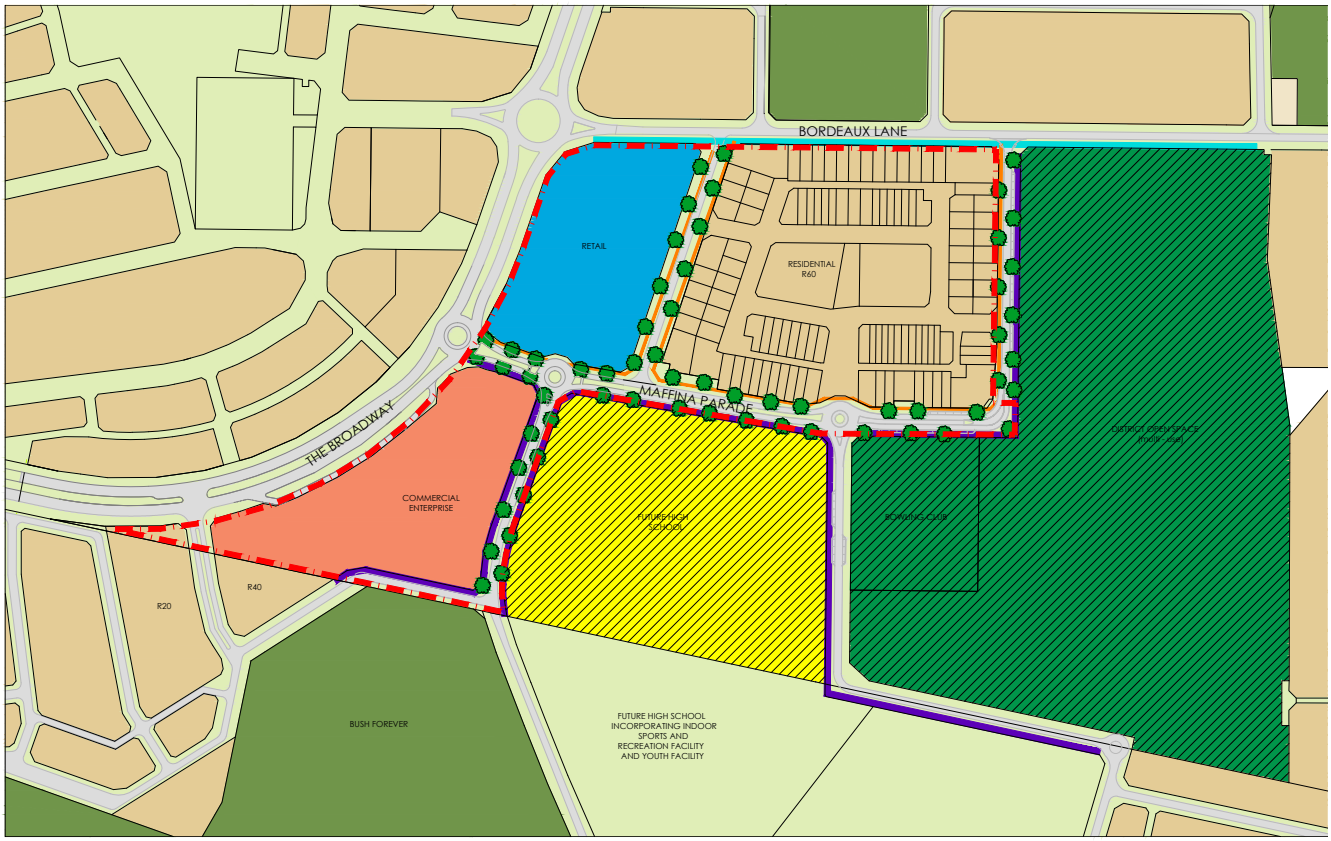
2.4 Shared pedestrian/vehicle environment achieved through quality landscaping, street trees and slow vehicle speeds

It is acknowledged that the pedestrian traffic (generated by the residential area, retail site, high school and the surrounding land uses) to and from the District Centre will be high. It is therefore considered important to design and construct roads in a pedestrian friendly manner. This can be achieved via the provision of wide verges and footpaths, medians, street trees, slow points, etc. (Refer section 2.11 Road Profiles).

2.5 Pedestrian/Cycle Network

A pedestrian/cycle network plan has been prepared which depicts the location of dual-use paths and footpaths for the District Centre. A dual-use path will provide off road access to the future high school and district recreation facilities. Footpaths will be provided on the other side of the street to provide for pedestrian access to the retail site and the medium density residential area (footpaths have already been constructed in the residential area). A hike and bike trail has been constructed on the southern portion of Bordeaux Lane.

The Development Plan site is considered to be adequately serviced by the proposed pedestrian/cycle network.



PEDESTRIAN/CYCLE NETWORK

- Stage 2 Development Plan Boundary
- Footpath
- Dual Use Path
- Hike & Bike Trial (preliminary route subject to detailed design)

2.6 Development Control

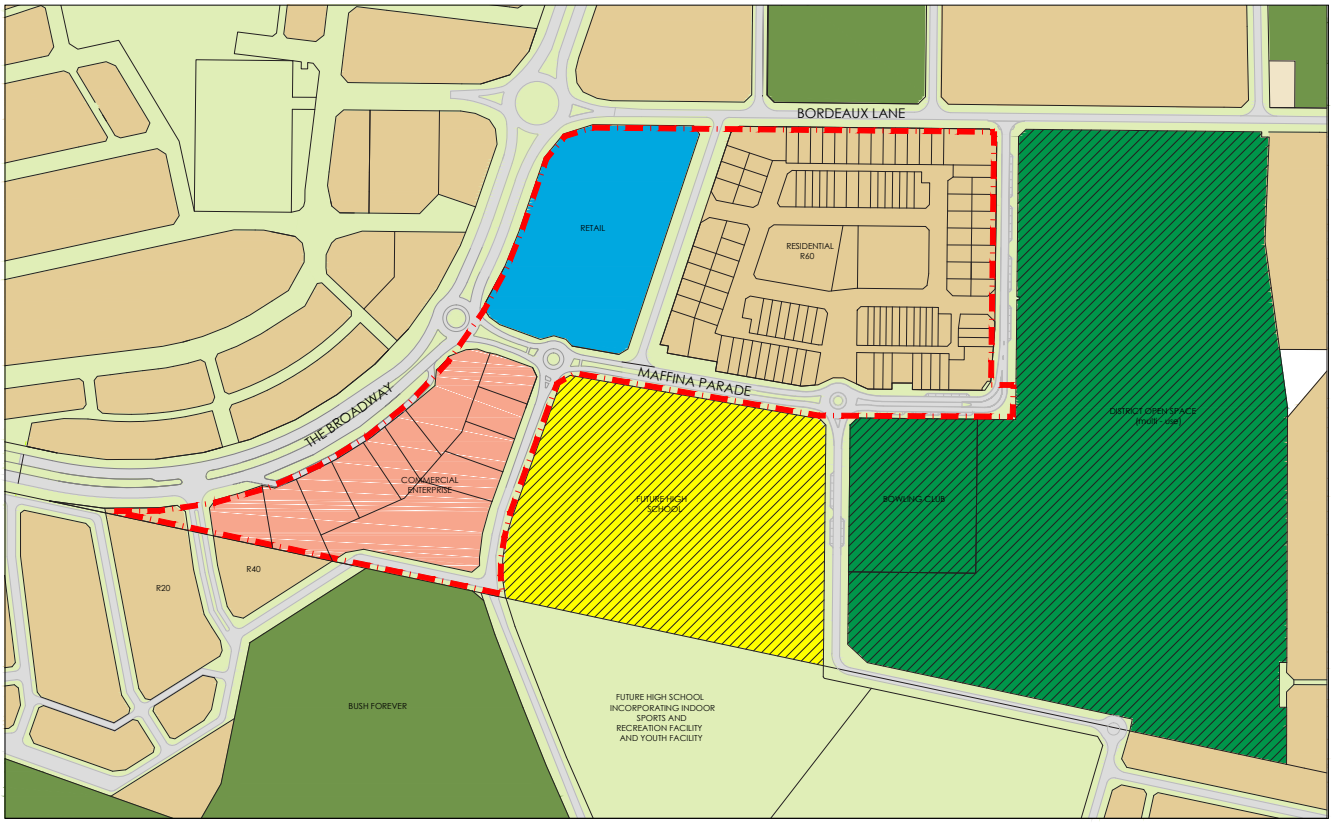
In accordance with clause 4 of the 'Special Use Zone – Ellenbrook' with the LPS No. 17, development control and land use permissibility for the District Centre will be based upon the Zoning Table of LPS No. 17 in conjunction with the Zoning Classification Plan as contained in this Development Plan. The Zoning Classification Plan depicts the location of the land use activities within the Stage 2 site of the District Centre, being:

- 'Residential' with a Residential Density Coding of 'R60';
- 'General Commercial'; and
- 'Commericial Enterprise'.

Within the zones designated above the use classes referred to in the Zoning Table of LPS17 shall have the same permissibility spread as set out in that table. The 'Commericial Enterprise' sites shall have the same permissibility as the 'Commericial Enterprise' zone within Schedule 4A (Ellenbrook Town Centre Zoning Table) of LPS17.

2.7 Development Standards

Development standards for permissible land use shall be in accordance with the relevant requirements as contained in LPS17, unless otherwise depicted on an endorsed Detailed Area Plan, prepared in accordance with 5A.1.15 of LPS17.



ZONING CLASSIFICATION PLAN

Commercial
Commercial Enterprise
Residential (R60)

** Permissibility of land uses within the 'Commericial Enterprise' zone are to be in accordance with the 'Commericial Enterprise' zone detailed in Schedule 4A (Ellenbrook Town Centre Zoning Table) of the City of Swan Local Planning Scheme No. 17.*

02 **Stage 2 Development**

2.8 Traffic

Each of the proposed sites will have direct frontage to at least two roads. The location and design of the access points into each of the respective sites will ensure that potential traffic conflict issues with adjacent sites are minimised.

Sinclair Knight Merz (SKM) now Jacobs has prepared a traffic report (refer Appendix B) which examines the following elements of the District Centre movement network:

- Road network and traffic volumes
- External intersections
- Internal intersections
- Pedestrians/cyclists

The traffic report confirms the proposed street network has capacity to accommodate the projected traffic volumes without comprising local amenity and community safety.

2.9 Access

There are multiple road access points provided into the District Centre. It is envisaged that the main access will be via an east-west road which intersects with The Broadway (Maffina Parade). This road will also function as a small 'Main Street' upon full development of the District Centre. This east-west road then provides a northern linkage to Bordeaux Lane and a southern linkage to Vale. Secondary road linkages are also proposed to The Broadway and Bordeaux Lane.

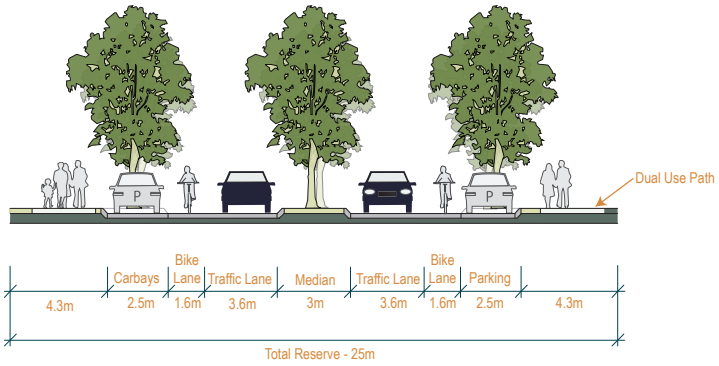
2.10 Road Profiles

For the Stage 2 development the following roads are proposed:

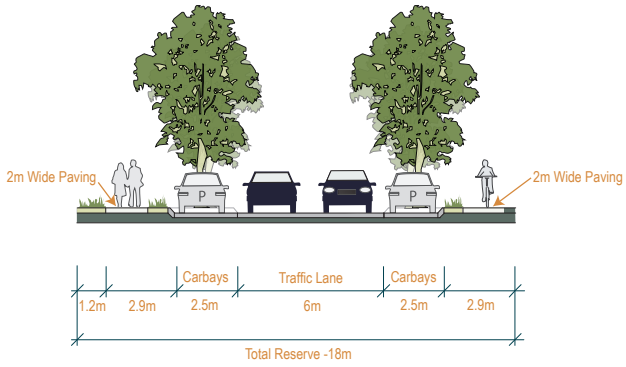
- An 18m wide northern link road from Bordeaux Lane between the subject site and the proposed retail site;
- A 25m wide portion of the main east-west access road (main street) from The Broadway (Maffina Parade);
- An 18m wide southern link road from the proposed main street through to The Vale; and
- A 15m wide road located on the southern boundary of the Development Plan area between the commericial enterprise and Bush Forever sites.

These roads will provide direct road frontage to all boundaries of the Stage 2 site. Please refer to the street profiles below detailing the four proposed roads:

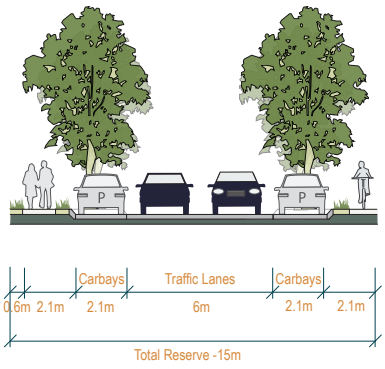
MAIN STREET PROFILE (AA)



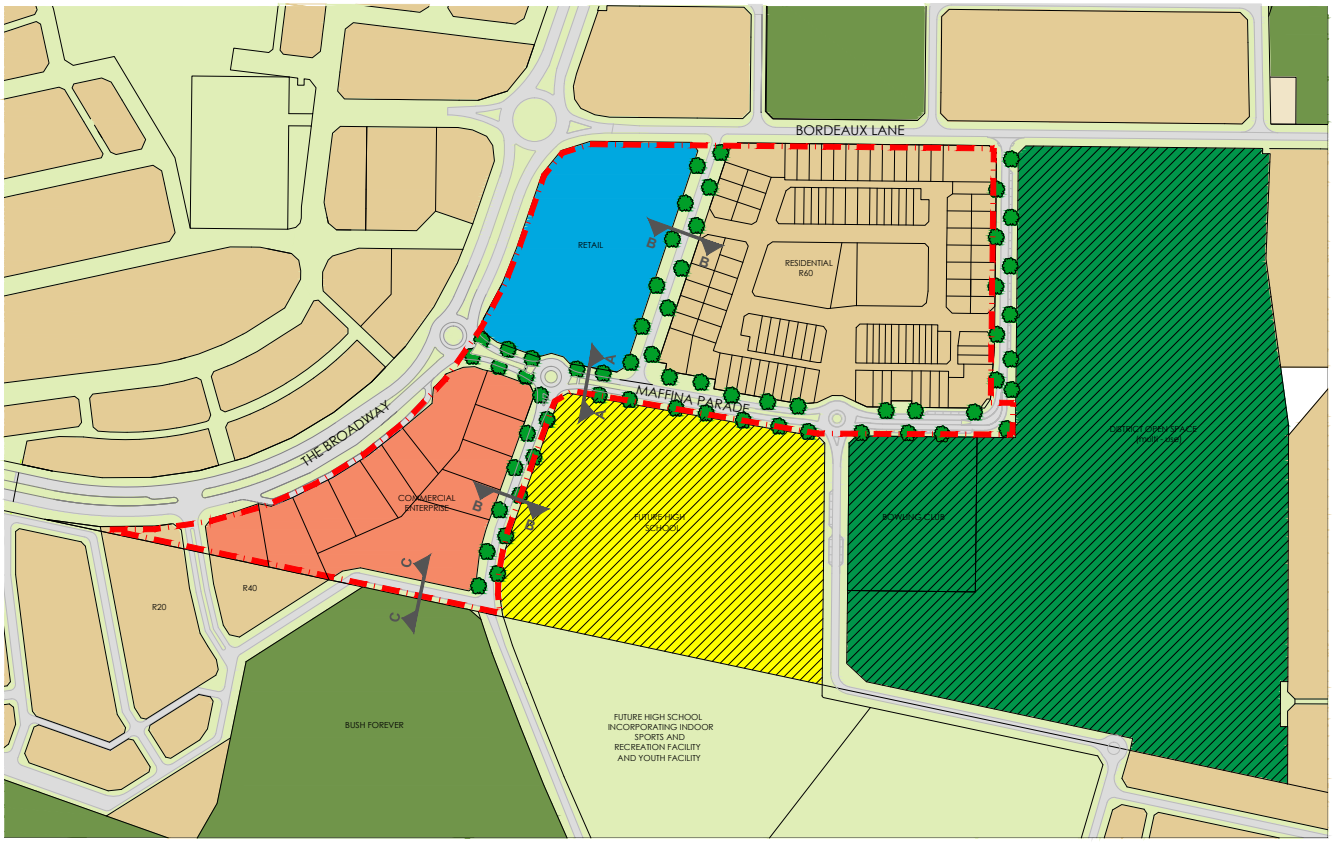
NORTH-SOUTH ROADS PROFILE (BB)



EAST-WEST ROADS PROFILE (CC)



02 **Stage 2 Development**



ROAD PROFILE SECTION PLAN

03 **Engineering Services And Infrastructure**

An Engineering Services report has been prepared by Cossill and Webley – Consulting engineers and appears at Appendix C. The report provides details on the following engineering issues relating to the Development Plan and provision of services:

- Access and Roads
- Drainage
- Sewerage
- Water Supply
- Site works

04 **Environment**

4.1 Environmental Management

In support of the Ellenbrook project, comprehensive environmental assessment studies have been undertaken by RPSBBG – Environmental Management Consultants. These studies are related to protection of the Lexia Wetlands and the associated conservation area.

The objective of the work is to ensure that the wetlands and vegetation are not adversely affected by groundwater fluctuation following urbanisation.

4.2 Environmental Studies

A number of detailed environmental studies have been conducted over the Ellenbrook project area including the Public Environmental Review (PER) assessed by the Environmental Protection Authority in 1992. On-going environmental studies include protection of the Lexia Wetlands and associated conservation areas, and involve:

- Routine monitoring of shallow groundwater levels in the vicinity of the wetlands, and water levels in the wetlands, predominately during the winter – spring period of groundwater recharge;
- Evaluation of the monitoring data, including comparative evaluation of data from nearby Water Corporation bores, in order to revise and update the interim water level criteria for the Lexia Wetlands (established as a condition of environmental approval for the Ellenbrook project).

4.3 Drainage & Nutrient Management Programme

Following approval of the PER, a number of conditions were set by the Environmental Protection Authority. One condition required more detailed drainage and nutrient management work to be undertaken. A 'Drainage and Nutrient Management Programme' was prepared for the northern catchment of Ellenbrook and is being implemented with the oversight of the Technical Review Committee. The northern catchment wholly contains the land comprising the District Centre.

4.4 Compliance With Existing Statutory Environmental Approvals

The development of the Ellenbrook District Centre in accordance with the Development Plan presented in this report is in accordance with what was assessed and approved by the Minister for the Environment as outlined in Statement 288 and 345 and the Minister's clearances of conditions of approval that have since been issued.

The Minister's approval of the Ellenbrook proposal, as described in the Ellenbrook Public Environmental Review and subsequently modified in accordance with the proponent's response to Condition 4.1 of Statement 288, created a major conservation area of approximately 600ha in the north of the project area.

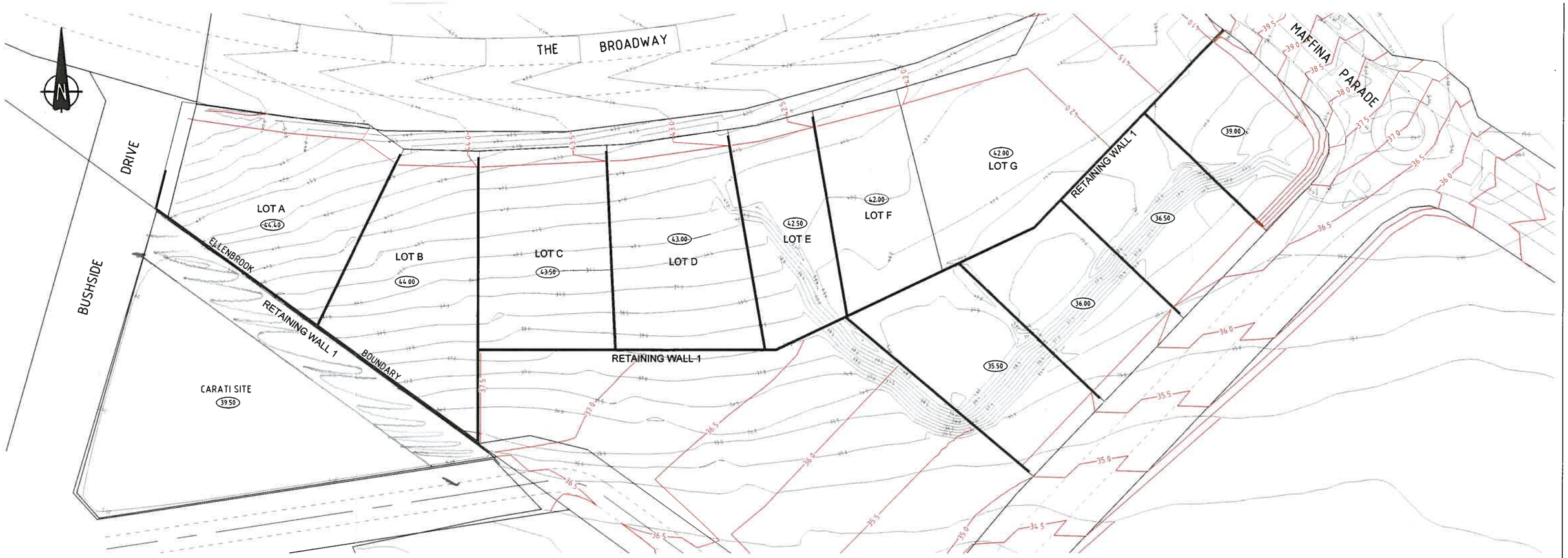
This area includes wetlands, vegetation, flora and fauna habitat focussed on the Lexia Wetlands and the Sawpit Conservation Area in the north of the original Ellenbrook project area. This area has now been reserved for Regional Open Space in the Metropolitan Region Scheme, as required by the Minister for Environment.

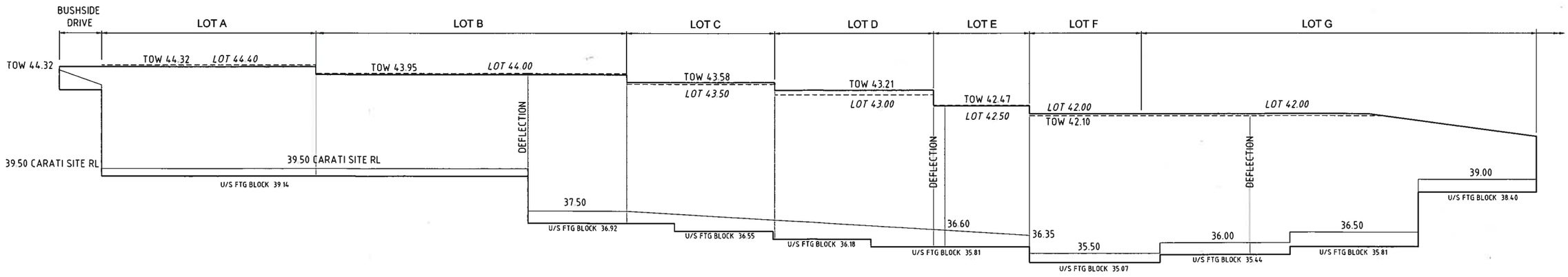
On the basis of the conservation outcomes achieved within this reserved area, the balance of the land within the project area has been approved for urban development subject to management of groundwater, drainage and nutrient export in accordance with conditions set in the Minister's Statement and management plans subsequently compiled by the proponent and cleared by the Minister for Environment.

The Minister's Statement reflected the balance of conservation and residential development objectives required by the State Government for the project area, recognising the need to facilitate the supply of affordable housing land by allowing for complete urban development of the southern portion of the original proposal area, and balancing the impacts of this development by the establishment of a large conservation area for wetlands, damplands, vegetation, flora and fauna in the north of the proposal area.

In the time since the Minister's Statements approving development of the Ellenbrook area, the State Government has published Bush Forever, the strategic plan for conservation of bushland on the Swan Coastal Plain portion of the Perth Metropolitan Region.

The Bush Forever document and accompanying maps ratify the Minister's Statements 288 and 345 by identifying for conservation only those parts in the north of the original Ellenbrook project that have been reserved for Parks and Recreation in the Metropolitan Region Scheme.





RETAINING WALL 1

1:500 0m 10.0 20.0 30.0m

1:100 0m 2.0 4.0 6.0m

REV	DATE	DRN	CKD	APP	AMENDMENT
A	20.10.14	BHJ	-	-	PRELIMINARY

Cossill & Webley CONSULTING ENGINEERS
Mailing Address PO Box 680 Subiaco WA 6904
Street Address B12 (Level 2) 431 Roberts Road Subiaco WA 6008
T (08) 9422 5800 F (08) 9422 5801 E admin@cosweb.com.au

CLIENT: ELLENBROOK MANAGEMENT PTY LTD

APPROVED

DESIGNED

SCALE: 1:500 & 1:100

PROJECT: ELLENBROOK DISTRICT CENTRE - INDUSTRIAL LOTS

TITLE: RETAINING WALL 1 PLAN AND LONGITUDINAL SECTION

WAPC No.: WAPC No.

DRAWING No.: 5935-IN-SK02

REVISION: A

ORIGINAL SIZE: A1

P:\5935 Ellenbrook District Centre\5935 Industrial\Cadwork\5935-IN-SK02.dwg, 20/10/2014 4:58:44 PM, Brianj, DWG To PDF.pc3, 1:1, - CW Reference

N

RETAIL

RESIDENTIAL
R60

THE BROADWAY

MAFFINA PARADE

COMMERCIAL ENTERPRISE

FUTURE HIGH
SCHOOL

DISTRICT OPEN SPACE
(multi - use)

BOWLING CLUB

R20

R40

BUSH FOREVER

FUTURE HIGH SCHOOL
INCORPORATING INDOOR
SPORTS AND
RECREATION FACILITY
AND YOUTH FACILITY

DISTRICT OPEN SPACE

DEPARTMENT OF PLANNING
8 JAN 2015
FILE 808/2/21/4 Pt 115 V

LEGEND

- Stage 2 Development Plan Boundary
- Retail
- Commercial Enterprise
- Residential (R60)

great places_

robertsday.com.au *planning·design·place*

SIZE A2

1:2500 0 metres 25 50 75 100 125

AERIAL PHOTOGRAPHY
SOURCE:
YYMMDD:

CADASTRAL INFORMATION
SOURCE:
YYMMDD:
DWG REF:
PROJECTION:

REV	DESCRIPTION	YYMMDD	DRAWN	APPR'D
C	UPDATED PLAN	141014	RF	AM
B	UPDATED ROAD	140818	RF	AM
A	BASE PLAN	140813	RF	AM

DEVELOPMENT PLAN STAGE 2
Ellenbrook District Centre
City of Swan

REF NO.	DRAW NO.	REV.
EJV DIS	**RD1 021**	**C**

A

title information_

163T

REGISTER NUMBER	
9282/DP402533	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
1	22/8/2014

WESTERN AUSTRALIA

RECORD OF CERTIFICATE OF TITLE

VOLUME 2848 FOLIO 477

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 9282 ON DEPOSITED PLAN 402533

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

85 SPRING STREET PROPERTIES PTY LTD OF LEVEL 2, 50 PITT STREET, SYDNEY, NEW SOUTH WALES
IN 3333/10000 SHARE
LANDROW PTY LTD OF LEVEL 3, 78 MILL POINT ROAD, SOUTH PERTH
IN 3333/10000 SHARE
DCA PROJECTS PTY LTD OF MEZZANINE LEVEL, BGC BUILDING, 28 THE ESPLANADE, PERTH
IN 1667/10000 SHARE
MARTINDALE PTY LTD OF LEVEL 3, RESERVE BANK BUILDING, 45 ST GEORGES TERRACE, PERTH
IN 1667/10000 SHARE
AS TENANTS IN COMMON

(AF M738581) REGISTERED 15 AUGUST 2014

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1.	I687188	RESTRICTIVE COVENANT BURDEN. REGISTERED 28.11.2003.
2.	*K467605	CAVEAT BY HOUSING AUTHORITY - AS TO THE PORTION FORMERLY COMPRISED IN VOL 2773 FOL 435 LODGED 8.1.2008.
3.	K572683	MORTGAGE TO BANK OF WESTERN AUSTRALIA LTD - AS TO THE PORTION FORMERLY COMPRISED IN VOLUME 2773 FOLIO 435 REGISTERED 21.4.2008.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: DP402533.
PREVIOUS TITLE: 2802-686.
PROPERTY STREET ADDRESS: NO STREET ADDRESS INFORMATION AVAILABLE.

END OF PAGE 1 - CONTINUED OVER

LOCAL GOVERNMENT AREA: CITY OF SWAN.

B

traffic report_

Technical Note

JACOBS

Date	08 September 2014
Project No	PB50714
Subject	**Ellenbrook District Centre - Traffic Assessment Update September2014**

1. Introduction

Jacobs was commissioned by Roberts Day to produce an updated traffic assessment for the Ellenbrook District Centre following changes to the proposed development yields and access arrangements. This technical note provides details of the yield and access changes, the traffic assessment methodology and the assessment outcomes and recommendations.

2. Proposed Development

The District Centre is located approximately 2km to the north-east of the Ellenbrook Town Centre and immediately to the south-west of Ellenbrook Village 6. The centre will be bound by The Broadway to the west and Bordeaux Lane to the north, with new road connections from the south providing links to The Vale. The location of the District Centre is shown in **Figure 2-1**.

The centre will provide a range of retail, commercial and residential uses. A new school will also be located directly to the south of the centre. A summary of the proposed development yields is provided in **Table 2-1**.

Table 2-1 – Proposed development yields

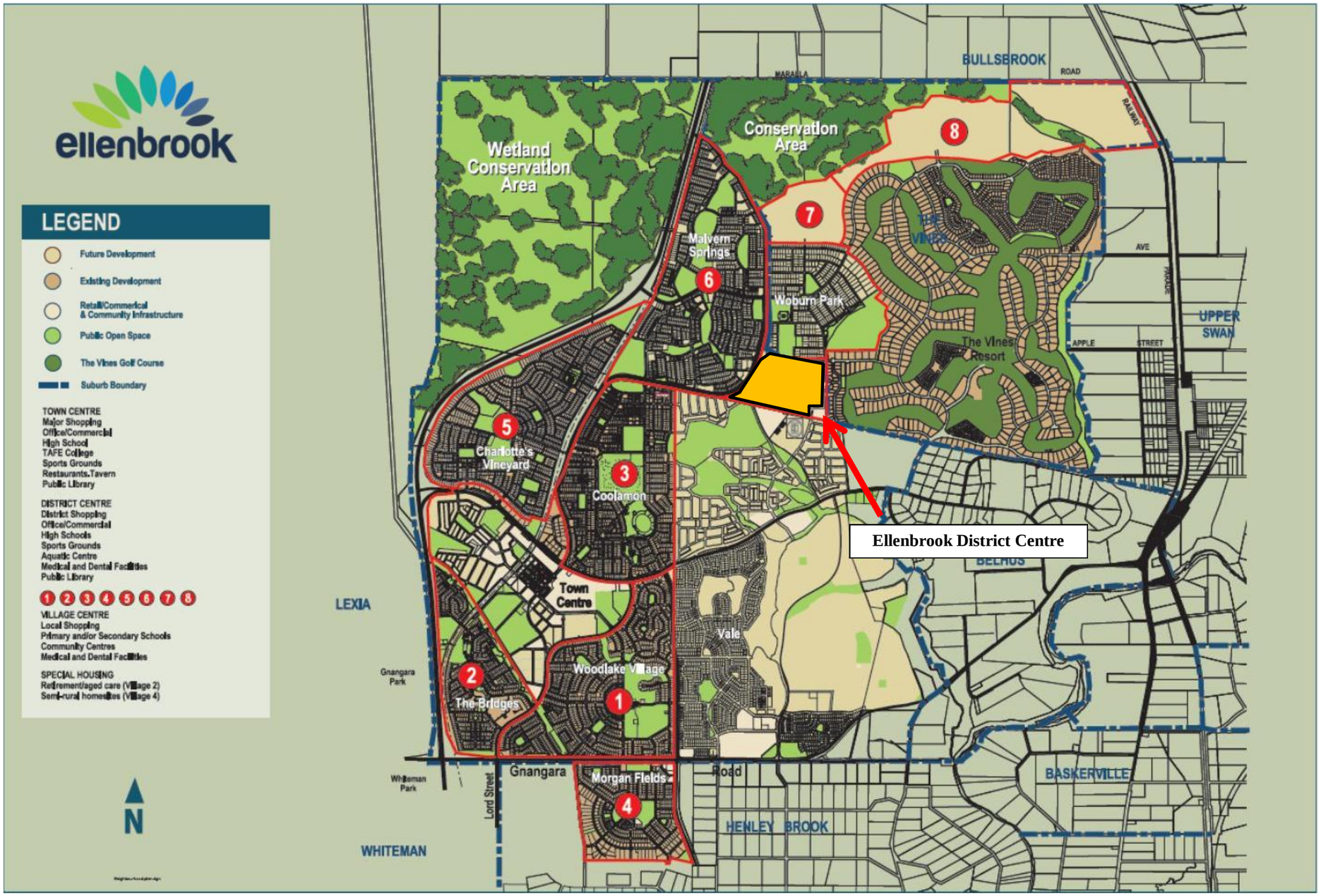
Land use	Yield
Residential	176 dwellings (including 70 grouped dwellings)
Retail	6,500m² GFA
Commercial	300m² GFA
Service commercial	11,800m² GFA

The centre's internal street network will consist of a main East-West Road that will run through the site between The Broadway and Bordeaux Lane. Two North-South roads will provide links to The Vale in the south. An access street will run between Bordeaux Lane and the East-West Road and will provide vehicular access to the retail uses. An indicative plan of the centre layout is shown in **Figure 2-2**.

Primary vehicular access to the school will be from the eastern North-South road. Access to the service commercial lots will be via a service road (accessed from The Broadway) and from the western North-South road. Further details of the service road are provided in **Section 4**.

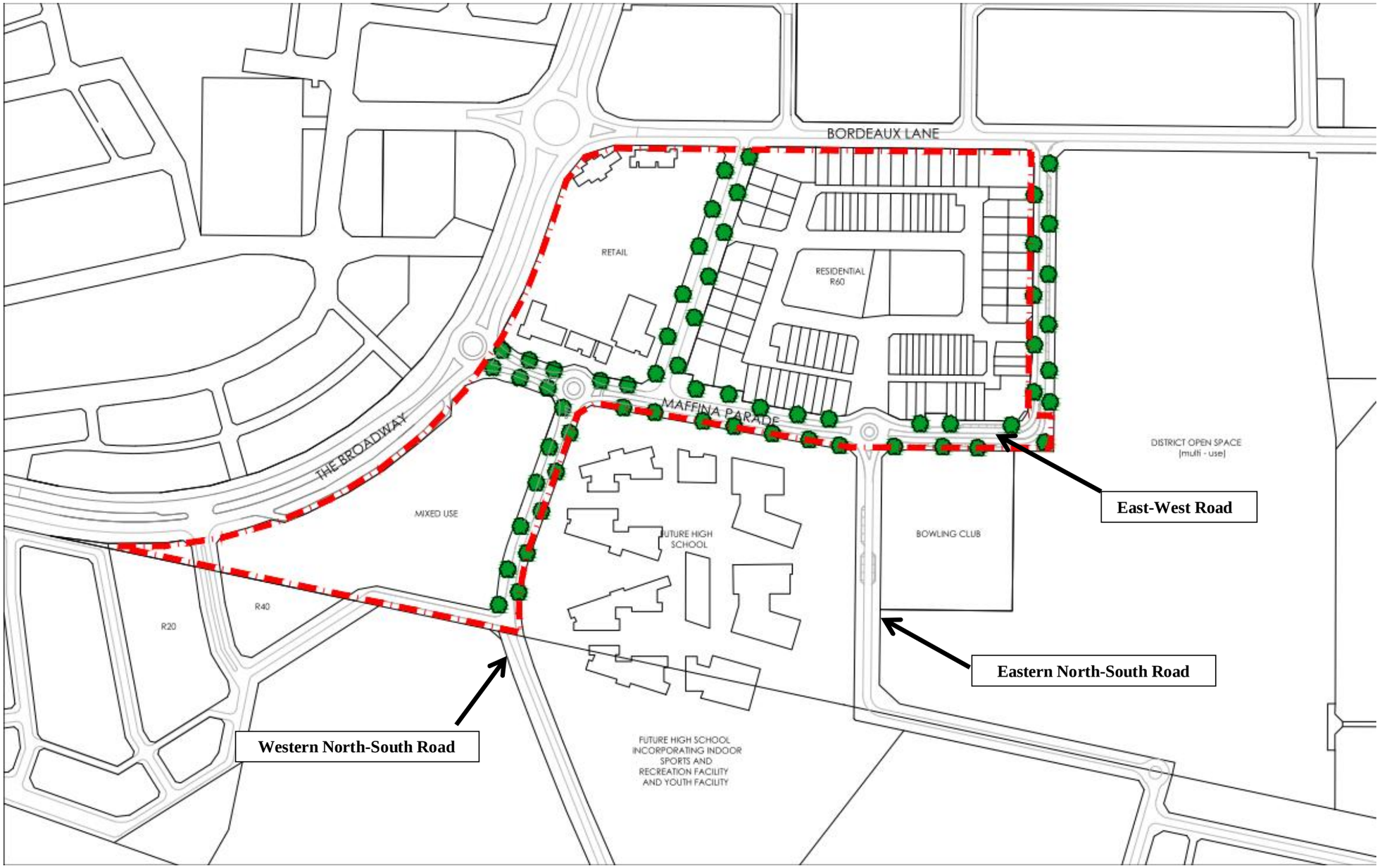
JACOBS

Figure 2-1 – District Centre location



JACOBS

Figure 2-2 – District Centre indicative layout



JACOBS

3. Traffic impact assessment

3.1 Trip generation

The number of vehicles trips forecast to be generated by the District Centre is detailed in the sections below.

3.1.1 Residential

The RTA NSW provides guidance on the number of trips generated by various land uses. A conservative estimate of two-way daily traffic generation associated with medium-high density aged persons dwellings is around two trips per dwelling. This would equate to 352 two-way vehicle trips per day for the residential uses.

3.1.2 Retail

The guidelines recommend that the retail component may generate up to 121 vehicle trips per day per 100m² GFA, based on assumptions for small stand-alone retail centres. Jacobs considers that this rate is likely to be too high for a retail centre located within the centre of Ellenbrook, in respect of the large residential catchment in the surrounding area. A trip rate of around 100 vehicle trips per day per 100m² is considered to be more appropriate. This would equate to 6,500 two-way vehicle trips per day.

3.1.3 Standard commercial

For standard commercial land uses the guidance recommends a daily trip rate of 10 vehicles per 100m² GFA. This equates to 30 vehicle trips per day.

3.1.4 Service commercial

Service commercial uses generate a lower level of vehicle trips than bulky goods retail uses. Based on the RTA guidance, and Jacobs experience of commercial land use trip generation, it was assumed that the service commercial lots will generate 30 two-way daily trips per 100m².

3.1.5 Summary

A summary of the daily and peak hour trip generation for the District Centre is provided in **Table 3-1**. It was assumed that 10% of the daily trips would occur during the peak hours.

Table 3-1 – Daily and peak hour vehicle trip generation

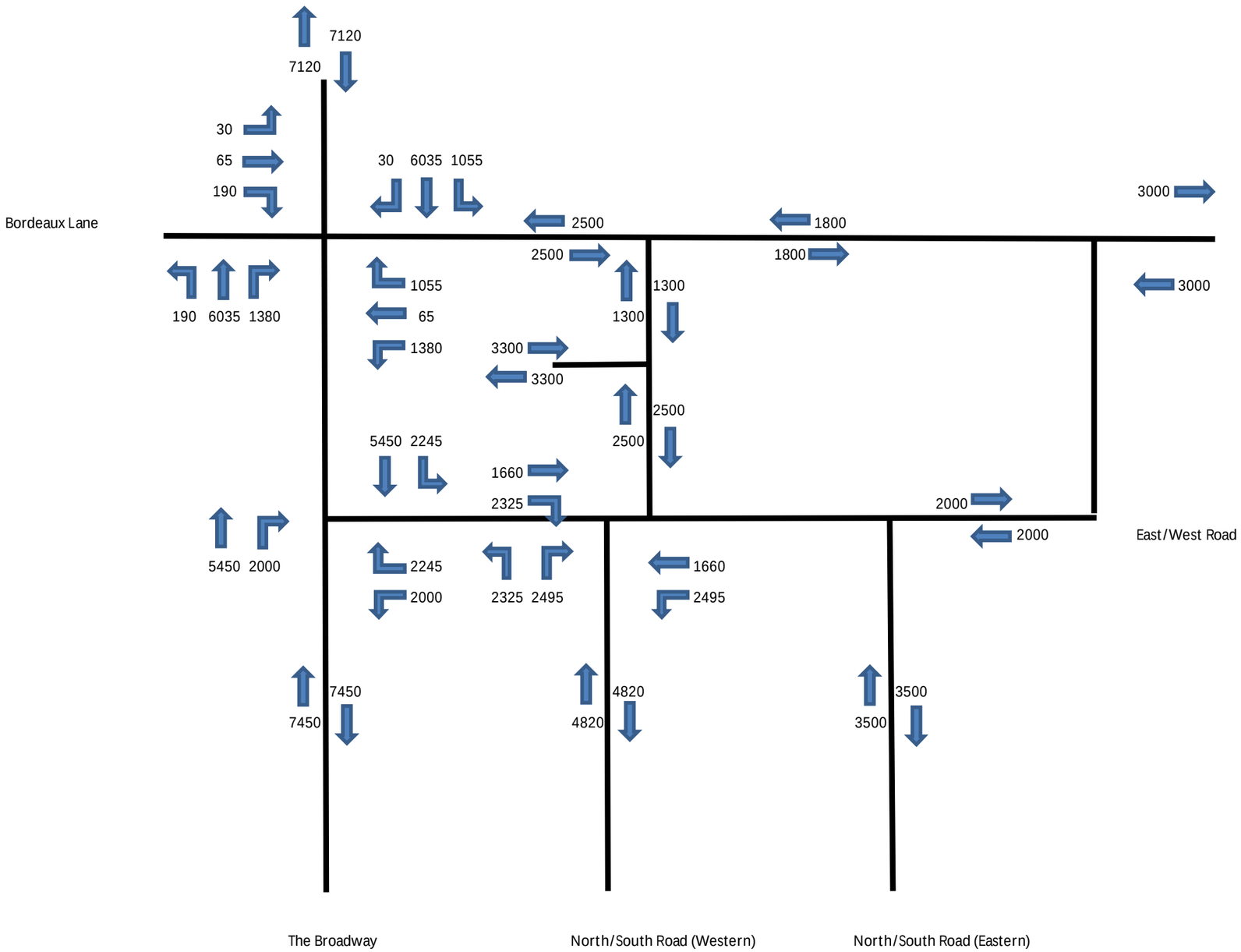
Land use	Two-way daily trips	Two-way peak hour trips
Residential	352	35
Retail	6,500	650
Standard commercial	30	3
Service commercial	3,540	354
Total	**10,422**	**1,042**

3.2 Trip distribution

To assess the distribution of the development trips on the local road network and internal streets, the proposed land uses were input into the latest version of the Ellenbrook Emme model. The model provided information on the distribution of trips from surrounding areas and volumes of through traffic expected along The Broadway, Bordeaux Lane and the centre's internal street network. The model also includes land use data for the proposed school, located directly south of the centre.

Due to the strategic nature of the model, it was necessary to make some manual adjustments to the estimated traffic distributions to take account of the precise locations and access arrangements of each of the land uses within the centre. The distribution of estimated daily trips on the road network within and surrounding the District Centre is shown in **Figure 3-1**.

Figure 3-1 – Forecast daily trip distribution



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3.3 Intersection modelling

To assess the performance of the road network, each of the key intersections within the District Centre were modelled in SIDRA using the estimated traffic volumes shown in **Figure 3-1**.

It was assumed that 10% of the daily traffic will occur in the peak hours, with a directional split of 70% of traffic heading southbound in the AM peak and 70% of traffic heading northbound in the PM peak. This reflects the likely travel patterns of people travelling to and from Ellenbrook Town Centre and Perth on a typical weekday.

Results of the SIDRA assessment have been reported for the following criteria to provide a comprehensive analysis of intersection operation:

Degree of saturation (DOS)

The degree of saturation is defined as the ratio of demand flow to capacity. The maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time under the prevailing roadway, traffic and control conditions. It should be noted that although theoretical capacity is reached when the degree of saturation is 1, a practical operational capacity occurs between 0.85 and 0.90.

Level of service (LOS)

The LOS is linked to DOS. There are six levels, designated A to F, with level of service A (*LOS A*) representing the best operating condition (at or close to free flow), and level of service F (*LOS* F) the worst (forced flow).

95% back of queue (metres)

Provides output on the 95 percentile queue length for a given intersection approach. The 95 percentile queue length is the value below which 95% of all queues lengths during the peak hour will fall or 5 % of all queue lengths exceed.

3.3.1 The Broadway/ East-West Road

The Broadway/ East-West Road intersection was initially assessed as a signalised configuration. Results of the SIDRA analysis for the intersection with traffic signals are summarised in **Table 3-2** and **Table 3-3**.

Table 3-2 – The Broadway/ Centre Access AM peak traffic signals SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: The Broadway South											
2	T	344	1.0	0.151	7.9	LOS A	3.0	21.2	0.48	0.40	47.4
3	R	126	1.0	0.463	24.0	LOS C	2.4	16.8	0.91	0.79	36.1
Approach		471	1.0	0.463	12.3	LOS B	3.0	21.2	0.59	0.50	43.8
East: Centre Access											
4	L	295	1.0	0.474	31.0	LOS C	9.2	64.8	0.84	0.82	32.4
6	R	142	1.0	0.480	40.2	LOS D	5.0	35.6	0.93	0.79	28.4
Approach		437	1.0	0.480	34.0	LOS C	9.2	64.8	0.87	0.81	31.0
North: The Broadway North											
7	L	331	1.0	0.731	32.5	LOS C	17.9	126.3	0.92	0.89	32.3
8	T	803	1.0	0.731	21.3	LOS C	20.3	143.0	0.90	0.80	35.5
Approach		1134	1.0	0.731	24.6	LOS C	20.3	143.0	0.90	0.83	34.5
All Vehicles		2041	1.0	0.731	23.7	LOS C	20.3	143.0	0.82	0.75	35.4

Table 3-3 – The Broadway/ Centre Access PM peak traffic signals SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: The Broadway South											
2	T	803	1.0	0.500	16.5	LOS B	10.2	72.2	0.79	0.68	39.2
3	R	295	1.0	0.842	32.8	LOS C	8.6	61.0	1.00	0.95	31.5
Approach		1098	1.0	0.842	20.9	LOS C	10.2	72.2	0.85	0.75	36.8
East: Centre Access											
4	L	126	1.0	0.126	16.6	LOS B	2.1	14.9	0.52	0.74	41.2
6	R	331	1.0	0.848	38.6	LOS D	11.6	81.6	0.87	0.95	29.0
Approach		457	1.0	0.848	32.5	LOS C	11.6	81.6	0.77	0.89	31.6
North: The Broadway North											
7	L	142	1.0	0.792	45.6	LOS D	6.8	47.8	1.00	0.94	26.9
8	T	344	1.0	0.792	33.7	LOS C	11.2	78.9	1.00	0.95	29.5
Approach		486	1.0	0.792	37.1	LOS D	11.2	78.9	1.00	0.95	28.7
All Vehicles		2041	1.0	0.848	27.3	LOS C	11.6	81.6	0.87	0.83	33.3

The results show that whilst the intersection operates within practical capacity, with a maximum DOS of 85%, queuing along the East-West Road is forecast to reach 65 metres in the AM peak and 82 metres in the PM peak. These queues would block back through the intersection with the western North-South Road and lead to congestion within the internal street network.

In light of these results the intersection was assessed as a roundabout configuration, with two lanes on all approaches. Results of the SIDRA analysis for the intersection as a roundabout configuration are summarised in **Table 3-4** and **Table 3-5**.

Table 3-4 – The Broadway/ Centre Access AM peak roundabout SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: The Broadway South											
2	T	344	1.0	0.177	4.8	LOS A	0.9	6.4	0.29	0.43	51.1
3	R	126	1.0	0.177	11.7	LOS B	0.9	6.3	0.30	0.73	46.1
Approach		471	1.0	0.177	6.7	LOS A	0.9	6.4	0.29	0.51	49.6
East: Centre Access											
4	L	295	1.0	0.286	7.8	LOS A	1.4	9.7	0.60	0.68	48.0
6	R	142	1.0	0.183	14.1	LOS B	0.8	5.5	0.59	0.85	44.2
Approach		437	1.0	0.286	9.8	LOS A	1.4	9.7	0.60	0.74	46.7
North: The Broadway North											
7	L	331	1.0	0.405	6.1	LOS A	2.4	17.2	0.31	0.52	50.1
8	T	803	1.0	0.405	4.9	LOS A	2.4	17.2	0.32	0.44	50.9
Approach		1134	1.0	0.405	5.3	LOS A	2.4	17.2	0.32	0.46	50.7
All Vehicles		2041	1.0	0.405	6.6	LOS A	2.4	17.2	0.37	0.53	49.5

Table 3-5 – The Broadway/ Centre Access PM peak roundabout SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: The Broadway South											
2	T	803	1.0	0.469	6.0	LOS A	3.1	22.1	0.56	0.54	48.9
3	R	295	1.0	0.469	13.0	LOS B	3.0	21.4	0.57	0.80	45.4
Approach		1098	1.0	0.469	7.9	LOS A	3.1	22.1	0.57	0.61	47.9
East: Centre Access											
4	L	126	1.0	0.139	7.1	LOS A	0.6	4.2	0.44	0.61	49.1
6	R	331	1.0	0.268	12.3	LOS B	1.3	9.3	0.44	0.72	44.8
Approach		457	1.0	0.268	10.8	LOS B	1.3	9.3	0.44	0.69	45.8
North: The Broadway North											
7	L	142	1.0	0.206	6.6	LOS A	1.1	7.8	0.44	0.58	49.3
8	T	344	1.0	0.206	5.5	LOS A	1.1	7.8	0.44	0.50	50.0
Approach		486	1.0	0.206	5.8	LOS A	1.1	7.8	0.44	0.52	49.8
All Vehicles		2041	1.0	0.469	8.1	LOS A	3.1	22.1	0.51	0.61	47.8

The results show that the intersection operates well within capacity during both peak hours, with minimal queue lengths forecast on all approaches. Importantly, the forecast queue along the East-West Road approach is not long enough to block back to intersection with the western North-South Road.

3.3.2 The Broadway/ Bordeaux Lane

The Broadway/ Bordeaux Lane intersection was assessed as a roundabout configuration. Results of the SIDRA analysis for the AM and PM peak hours are provided in **Table 3-6** and **Table 3-7**.

Table 3-6 – The Broadway/ Bordeaux Lane AM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: The Broadway South											
1	L	12	1.0	0.169	5.8	LOS A	0.9	6.3	0.21	0.52	50.8
2	T	381	1.0	0.169	4.6	LOS A	0.9	6.3	0.22	0.39	51.7
3	R	87	1.0	0.169	11.5	LOS B	0.9	6.2	0.22	0.77	46.4
Approach		480	1.0	0.169	5.9	LOS A	0.9	6.3	0.22	0.46	50.6
East: Bordeaux Lane East											
4	L	203	1.0	0.208	7.8	LOS A	0.9	6.5	0.58	0.68	48.2
5	T	7	1.0	0.208	6.5	LOS A	0.9	6.5	0.58	0.59	48.3
6	R	66	1.0	0.098	14.5	LOS B	0.4	2.6	0.58	0.84	43.9
Approach		277	1.0	0.208	9.3	LOS A	0.9	6.5	0.58	0.72	47.0
North: The Broadway North											
7	L	156	1.0	0.372	6.1	LOS A	2.1	14.5	0.28	0.53	50.4
8	T	889	1.0	0.372	4.9	LOS A	2.1	14.5	0.29	0.43	51.2
9	R	3	1.0	0.372	11.8	LOS B	2.0	14.4	0.30	0.87	46.8
Approach		1048	1.0	0.372	5.1	LOS A	2.1	14.5	0.29	0.45	51.1
West: Bordeaux Lane West											
10	L	3	1.0	0.012	7.5	LOS A	0.0	0.3	0.45	0.60	49.4
11	T	6	1.0	0.012	6.2	LOS A	0.0	0.3	0.45	0.52	49.8
12	R	28	1.0	0.024	12.4	LOS B	0.1	0.6	0.41	0.68	44.9
Approach		38	1.0	0.024	10.9	LOS B	0.1	0.6	0.42	0.65	46.0
All Vehicles		1843	1.0	0.372	6.0	LOS A	2.1	14.5	0.32	0.50	50.2

Table 3-7 – The Broadway/ Bordeaux Lane PM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: The Broadway South											
1	L	28	1.0	0.418	6.2	LOS A	2.6	18.6	0.38	0.56	49.9
2	T	889	1.0	0.418	5.1	LOS A	2.6	18.6	0.39	0.46	50.3
3	R	203	1.0	0.418	12.0	LOS B	2.6	18.2	0.39	0.77	46.2
Approach		1121	1.0	0.418	6.4	LOS A	2.6	18.6	0.39	0.52	49.5
East: Bordeaux Lane East											
4	L	87	1.0	0.093	6.9	LOS A	0.4	2.6	0.42	0.60	49.2
5	T	6	1.0	0.093	5.6	LOS A	0.4	2.6	0.42	0.50	49.7
6	R	156	1.0	0.128	12.2	LOS B	0.5	3.8	0.41	0.71	45.0
Approach		249	1.0	0.128	10.2	LOS B	0.5	3.8	0.41	0.66	46.4
North: The Broadway North											
7	L	66	1.0	0.179	6.3	LOS A	0.9	6.1	0.35	0.56	50.0
8	T	381	1.0	0.179	5.2	LOS A	0.9	6.1	0.35	0.47	50.7
9	R	3	1.0	0.179	12.0	LOS B	0.9	6.0	0.36	0.87	46.7
Approach		451	1.0	0.179	5.4	LOS A	0.9	6.1	0.35	0.48	50.6
West: Bordeaux Lane West											
10	L	3	1.0	0.016	8.9	LOS A	0.1	0.5	0.64	0.70	48.4
11	T	7	1.0	0.016	7.7	LOS A	0.1	0.5	0.64	0.65	48.4
12	R	12	1.0	0.013	13.8	LOS B	0.1	0.4	0.63	0.73	44.0
Approach		22	1.0	0.016	11.1	LOS B	0.1	0.5	0.64	0.70	45.9
All Vehicles		1843	1.0	0.418	6.7	LOS A	2.6	18.6	0.38	0.53	49.2

The results show that the intersection operates well within capacity during both peak hours, with minimal queuing on all approaches.

3.3.3 East-West Road/ Western North-South Road

The East-West Road/ Western North-South Road intersection was assessed as a roundabout intersection. The results of the SIDRA analysis for the AM and PM peak hour are provided in **Table 3-8** and **Table 3-9**.

Table 3-8 – East-West Connector/ Western North-South Road AM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North/South Road											
1	L	343	1.0	0.612	8.5	LOS A	5.4	38.0	0.66	0.66	46.8
3	R	368	1.0	0.612	13.2	LOS B	5.4	38.0	0.66	0.75	44.6
Approach		712	1.0	0.612	10.9	LOS B	5.4	38.0	0.66	0.71	45.6
East: East/West Road E											
4	L	158	1.0	0.321	7.3	LOS A	2.1	15.1	0.40	0.58	48.9
5	T	244	1.0	0.321	6.2	LOS A	2.1	15.1	0.40	0.51	49.3
Approach		402	1.0	0.321	6.7	LOS A	2.1	15.1	0.40	0.54	49.1
West: East/West Road W											
11	T	105	1.0	0.106	7.2	LOS A	0.6	4.3	0.54	0.59	48.6
12	R	147	1.0	0.124	12.5	LOS B	0.8	5.3	0.53	0.69	44.4
Approach		253	1.0	0.124	10.3	LOS B	0.8	5.3	0.53	0.65	46.0
All Vehicles		1366	1.0	0.612	9.6	LOS A	5.4	38.0	0.56	0.65	46.7

Table 3-9 – East-West Connector/ Western North-South Road PM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: North/South Road											
1	L	147	1.0	0.235	7.0	LOS A	1.5	10.5	0.32	0.52	48.9
3	R	158	1.0	0.235	11.6	LOS B	1.5	10.5	0.32	0.69	45.6
Approach		305	1.0	0.235	9.4	LOS A	1.5	10.5	0.32	0.61	47.1
East: East/West Road E											
4	L	368	1.0	0.459	8.9	LOS A	3.2	22.8	0.64	0.71	47.4
5	T	105	1.0	0.459	7.8	LOS A	3.2	22.8	0.64	0.67	47.4
Approach		474	1.0	0.459	8.6	LOS A	3.2	22.8	0.64	0.70	47.4
West: East/West Road W											
11	T	244	1.0	0.199	6.2	LOS A	1.1	7.9	0.36	0.51	49.8
12	R	343	1.0	0.237	11.7	LOS B	1.4	10.0	0.35	0.66	45.1
Approach		587	1.0	0.237	9.4	LOS A	1.4	10.0	0.35	0.60	46.9
All Vehicles		1366	1.0	0.459	9.2	LOS A	3.2	22.8	0.44	0.63	47.1

The results show that the intersection operates well within capacity during both peak hours, with minimal queuing on all approaches. Importantly, forecast queue lengths on the western approach of the East-West Road are not long enough to block back to The Broadway.

3.3.4 East-West Road/ Eastern North-South Road

The East-West Road/ Eastern North-South Road intersection was assessed as a roundabout intersection. The results of the SIDRA analysis for the AM and PM peak hour are provided in **Table 3-10** and **Table 3-11**.

Table 3-10 – East-West Connector/ Eastern North-South Road AM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Eastern Rd											
1	L	323	1.0	0.301	7.8	LOS A	1.9	13.5	0.38	0.58	48.3
3	R	40	1.0	0.301	11.8	LOS B	1.9	13.5	0.38	0.73	45.6
Approach		363	1.0	0.301	8.3	LOS A	1.9	13.5	0.38	0.60	48.0
East: East/West Rd E											
4	L	60	1.0	0.184	8.2	LOS A	1.0	6.9	0.41	0.63	48.4
5	T	139	1.0	0.184	7.3	LOS A	1.0	6.9	0.41	0.56	48.8
Approach		199	1.0	0.184	7.6	LOS A	1.0	6.9	0.41	0.58	48.7
West: East/West Rd W											
11	T	93	1.0	0.218	6.2	LOS A	1.3	9.2	0.17	0.45	50.1
12	R	216	1.0	0.218	11.2	LOS B	1.3	9.2	0.17	0.71	46.0
Approach		308	1.0	0.218	9.7	LOS A	1.3	9.2	0.17	0.63	47.1
All Vehicles		871	1.0	0.301	8.6	LOS A	1.9	13.5	0.31	0.61	47.8

Table 3-11 – East-West Connector/ Eastern North-South Road PM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Eastern Rd											
1	L	216	1.0	0.218	7.5	LOS A	1.3	9.2	0.29	0.55	48.7
3	R	60	1.0	0.218	11.5	LOS B	1.3	9.2	0.29	0.71	45.8
Approach		276	1.0	0.218	8.3	LOS A	1.3	9.2	0.29	0.59	48.0
East: East/West Rd E											
4	L	40	1.0	0.134	8.8	LOS A	0.7	5.0	0.48	0.66	48.1
5	T	93	1.0	0.134	7.8	LOS A	0.7	5.0	0.48	0.60	48.3
Approach		133	1.0	0.134	8.1	LOS A	0.7	5.0	0.48	0.62	48.2
West: East/West Rd W											
11	T	139	1.0	0.332	6.4	LOS A	2.2	15.4	0.24	0.46	49.6
12	R	323	1.0	0.332	11.3	LOS B	2.2	15.4	0.24	0.70	45.8
Approach		462	1.0	0.332	9.8	LOS A	2.2	15.4	0.24	0.63	46.9
All Vehicles		871	1.0	0.332	9.1	LOS A	2.2	15.4	0.29	0.61	47.4

The results show that the intersection operates well within capacity during both peak hours.

3.3.5 Bordeaux Lane/ Retail Access Road

The Bordeaux Lane/ Retail Access Road intersection was assessed as a priority T-intersection configuration with a single lane on all approaches. Results of the SIDRA analysis for the AM and PM peak hour are provided in **Table 3-12** and **Table 3-13**.

Table 3-12 – Bordeaux Lane/ Retail Access Road AM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: East-West Rd											
1	L	84	1.0	0.149	10.7	LOS B	0.6	4.0	0.42	0.68	46.3
3	R	25	1.0	0.149	11.0	LOS B	0.6	4.0	0.42	0.83	46.1
Approach		109	1.0	0.149	10.8	LOS B	0.6	4.0	0.42	0.72	46.3
East: Bordeaux Lane E											
4	L	38	1.0	0.135	8.2	LOS A	0.0	0.0	0.00	0.99	49.0
5	T	221	1.0	0.135	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		259	1.0	0.135	1.2	NA	0.0	0.0	0.00	0.15	58.1
West: Bordeaux Lane W											
11	T	95	1.0	0.163	1.3	LOS A	0.9	6.1	0.39	0.00	51.8
12	R	126	1.0	0.163	9.6	LOS A	0.9	6.1	0.39	0.77	48.0
Approach		221	1.0	0.163	6.0	NA	0.9	6.1	0.39	0.44	49.6
All Vehicles		589	1.0	0.163	4.8	NA	0.9	6.1	0.22	0.36	52.2

Table 3-13 – Bordeaux Lane/ Retail Access Road PM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: East-West Rd											
1	L	126	1.0	0.198	10.0	LOS B	0.8	5.6	0.27	0.63	47.0
3	R	38	1.0	0.198	10.3	LOS B	0.8	5.6	0.27	0.79	46.8
Approach		164	1.0	0.198	10.1	LOS B	0.8	5.6	0.27	0.66	47.0
East: Bordeaux Lane E											
4	L	25	1.0	0.063	8.2	LOS A	0.0	0.0	0.00	0.96	49.0
5	T	95	1.0	0.063	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		120	1.0	0.063	1.7	NA	0.0	0.0	0.00	0.20	57.3
West: Bordeaux Lane W											
11	T	221	1.0	0.180	0.6	LOS A	1.1	7.7	0.27	0.00	54.5
12	R	84	1.0	0.180	8.9	LOS A	1.1	7.7	0.27	0.83	48.7
Approach		305	1.0	0.180	2.8	NA	1.1	7.7	0.27	0.23	52.8
All Vehicles		589	1.0	0.198	4.6	NA	1.1	7.7	0.22	0.35	51.8

The results show that the intersection operates well within capacity during both peak hours.

3.3.6 East-West Road/ Retail Access Road

The East-West Road/ Retail Access Road intersection was assessed as a priority T-intersection configuration with a single lane on all approaches. Results of the SIDRA analysis for the AM and PM peak hour are provided in **Table 3-14** and **Table 3-15**.

Table 3-14 – East-West Connector/ Retail Access Road AM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: East/West Rd E											
5	T	336	1.0	0.347	4.1	LOS A	3.4	24.3	0.67	0.00	47.9
6	R	147	1.0	0.347	12.4	LOS B	3.4	24.3	0.67	1.00	46.7
Approach		483	1.0	0.347	6.6	NA	3.4	24.3	0.67	0.31	47.5
North: Retail Access Rd											
7	L	63	1.0	0.127	10.2	LOS B	0.3	2.0	0.42	0.71	46.8
9	R	63	1.0	0.310	28.7	LOS D	1.2	8.4	0.83	0.99	33.4
Approach		126	1.0	0.310	19.5	LOS C	1.2	8.4	0.63	0.85	39.0
West: East/West Rd W											
10	L	253	1.0	0.252	8.2	LOS A	0.0	0.0	0.00	0.81	49.0
11	T	223	1.0	0.252	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		476	1.0	0.252	4.4	NA	0.0	0.0	0.00	0.43	53.6
All Vehicles		1085	1.0	0.347	7.1	NA	3.4	24.3	0.37	0.42	48.7

Table 3-15 – East-West Connector/ Retail Access Road PM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: East/West Rd E											
5	T	223	1.0	0.182	2.3	LOS A	1.3	9.4	0.53	0.00	50.4
6	R	63	1.0	0.182	10.6	LOS B	1.3	9.4	0.53	0.91	48.3
Approach		286	1.0	0.182	4.1	NA	1.3	9.4	0.53	0.20	49.9
North: Retail Access Rd											
7	L	147	1.0	0.299	10.8	LOS B	0.7	5.3	0.47	0.77	46.3
9	R	253	1.0	0.846	42.4	LOS E	8.2	58.0	0.93	1.49	27.6
Approach		400	1.0	0.846	30.7	LOS D	8.2	58.0	0.76	1.23	32.4
West: East/West Rd W											
10	L	63	1.0	0.208	8.2	LOS A	0.0	0.0	0.00	0.99	49.0
11	T	336	1.0	0.208	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		399	1.0	0.208	1.3	NA	0.0	0.0	0.00	0.16	57.9
All Vehicles		1085	1.0	0.846	12.9	NA	8.2	58.0	0.42	0.56	43.5

The results show that the intersection operates well within capacity in the AM peak hour. In the PM peak hour, the Retail Access Road is close to practical capacity with a DOS of 85% with a queue of 58 metres. If this approach does become congested, in reality vehicles are likely to re-route north along the Retail Access Road and along Bordeaux Lane, which are forecast to be un-

congested during the PM peak. For this reason it is recommended that a priority T-intersection is a suitable configuration, however a 10-15 metre left turn pocket should be provided along the Retail Access Road approach to mitigate any potential build ups of delay.

3.3.7 East-West Road/ Bordeaux Lane

The East-West Road/ Bordeaux Lane intersection was assessed as a priority T-intersection configuration with a single lane on all approaches. Results of the SIDRA analysis for the AM and PM peak hour are provided in **Table 3-16** and **Table 3-17**.

Table 3-16 – Bordeaux Lane/ East-West Connector AM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: East-West Rd											
1	L	31	1.0	0.351	15.3	LOS C	1.7	12.3	0.62	0.84	42.1
3	R	138	1.0	0.351	15.5	LOS C	1.7	12.3	0.62	0.94	42.0
Approach		168	1.0	0.351	15.5	LOS C	1.7	12.3	0.62	0.92	42.0
East: Bordeaux Lane E											
4	L	208	1.0	0.223	8.2	LOS A	0.0	0.0	0.00	0.82	49.0
5	T	213	1.0	0.223	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		421	1.0	0.223	4.1	NA	0.0	0.0	0.00	0.41	54.0
West: Bordeaux Lane W											
11	T	91	1.0	0.096	2.2	LOS A	0.6	4.2	0.48	0.00	50.7
12	R	45	1.0	0.096	10.5	LOS B	0.6	4.2	0.48	0.87	48.0
Approach		136	1.0	0.096	5.0	NA	0.6	4.2	0.48	0.29	49.8
All Vehicles		725	1.0	0.351	6.9	NA	1.7	12.3	0.23	0.50	49.9

Table 3-17 – Bordeaux Lane/ East-West Connector PM peak hour SIDRA results

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: East-West Rd											
1	L	45	1.0	0.480	15.8	LOS C	3.1	22.1	0.60	0.77	41.6
3	R	208	1.0	0.480	16.1	LOS C	3.1	22.1	0.60	0.98	41.6
Approach		254	1.0	0.480	16.0	LOS C	3.1	22.1	0.60	0.94	41.6
East: Bordeaux Lane E											
4	L	138	1.0	0.122	8.2	LOS A	0.0	0.0	0.00	0.78	49.0
5	T	91	1.0	0.122	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
Approach		228	1.0	0.122	5.0	NA	0.0	0.0	0.00	0.47	52.8
West: Bordeaux Lane W											
11	T	213	1.0	0.136	1.1	LOS A	0.9	6.4	0.38	0.00	52.9
12	R	31	1.0	0.136	9.4	LOS A	0.9	6.4	0.38	0.89	48.9
Approach		243	1.0	0.136	2.1	NA	0.9	6.4	0.38	0.11	52.3
All Vehicles		725	1.0	0.480	7.9	NA	3.1	22.1	0.34	0.51	48.1

The results show that the intersection operates well within capacity during both peak hours.

3.4 Summary and recommendations

The analysis presented in this section has assessed the operation of the key intersections within the District Centre using forecast traffic volumes for ultimate build-out and SIDRA modelling. The key findings of the analysis and recommendations are as follows:

- The Broadway/ Centre Access Road intersection should be configured as a roundabout. Traffic signals at this intersection may lead to excessive queuing and delay within the District Centre and may lead to vehicles blocking back through adjacent intersections.
- The intersections of the North-South road and the East-West Road should operate effectively as roundabouts.
- The Bordeaux Lane/ The Broadway intersection should operate effectively as a roundabout.
- The two intersections with the Retail Access Road should operate effectively with priority T-intersection configurations. A 10-15 metre left turn pocket should be provided along the Retail Access Road at the southern intersection to mitigate potential congestion in the PM peak hour.
- The intersection of Bordeaux Lane and the East-West Road should operate effectively as a priority T-intersection.

4. Service commercial access

The service commercial lots will be located in the south-west corner of the District Centre. It is proposed that the lots fronting The Broadway will be accessed via a one-way access road that will provide access for service vehicles and other users of the site.

The benefits of providing the access road are that it would provide safe one-way movement through the site and reduce the potential for vehicle conflicts along The Broadway that would be associated with individual access points for each of the lots. Segregation would also be provided between the service vehicles and pedestrians travelling along The Broadway.

In the short term The Broadway will operate with a single lane in each direction, but will widen to two lanes in each direction in the longer term. Concept plans of the short and long-term access arrangements are shown in **Figure 4-1** and **Figure 4-2**.

The service road entrance would permit left-in only movements with no break in the median along The Broadway. This will help to minimise vehicle conflicts and maintain traffic flow along The Broadway. The service road exit will permit left out and right out movements. These movements will apply in the short term and long term scenarios.

In terms of traffic access to the service road, vehicles travelling to the site from the south would need to perform a U-turn movement at The Broadway/ East-West Road roundabout. This movement would be preferable to allowing right turn movements into the service road. Vehicles travelling north from the service road could perform a right turn out onto The Broadway. In the long term a gap would be provided within the median on The Broadway to facilitate staged movement for the right turn.

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Figure 4-1 – Service commercial lots short-term access arrangements

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Figure 4-2 – Service commercial lots long-term access arrangements

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CONSULTING ENGINEERS

ELLENBROOK MANAGEMENT PTY LTD

ELLENBROOK DEVELOPMENT
DISTRICT CENTRE DEVELOPMENT

REPORT ON ENGINEERING ASPECTS

REPORT NO. 5935-S3

JULY 2014

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1. INTRODUCTION

This report has been prepared by Cossill and Webley Pty Ltd, Consulting Engineers. It summarises the assessment undertaken by the firm, to date, on the engineering aspects of the proposed District Centre within Ellenbrook. The District Centre is located within the Ellenbrook landholding south of Bordeaux Lane abutting The Broadway to the west and existing residential development at The Vines to the east. The District Centre facilities extend southward into The Vale landholding and the southern boundary also abuts proposed residential development and a portion of Bush Forever land.

The report has been prepared for Ellenbrook Management Pty Ltd as supporting documentation for the Development Plan prepared by Roberts Day.

Requirements covering siteworks, roads, drainage, sewerage, water supply and public utility services have been assessed as they relate to the Development Plan proposal.

The engineering assessment has been based on the Development Plan dated June 2014 (ref EJV DIS RD1 007), which yields some 10 hectares in total. Components of the District Centre as shown on the above Development Plan include a proposed high school, mixed use site and retail development.

2. SITE DESCRIPTION

The site of the proposed District Centre Village generally lies on gently sloping land falling from west to east. The south western corner abutting The Broadway has a maximum elevation of approximately RL 42 metres and falls steeply to about RL 35.0 over about 100 metres. East of the RL 35.0 contour the land grades gently to about RL 31.0m along the eastern boundary with The Vines.

The majority of the site has previously been cleared with some natural vegetation remaining along the eastern boundary. There are localised stockpiles of topsoil and associated materials that have been placed on the site resulting from adjoining land development activities and these will be removed prior to development. Approximately 15 metres of the Water Corporation's DN450 collector sewer has been constructed in the north-east corner of the site.

The preliminary inspection of available geological and topographical data indicates that the ground conditions within the District Centre most likely comprise Bassendean Dune Sand overlying Guildford Formation. This is consistent with the conditions experienced to date within the site and for works completed within the adjoining Villages. A geotechnical investigation has been undertaken by Coffey Geoscience (GEOTHERD08050AE-AA). The sands which make up the majority of the area are free draining and suitable for urban development of the nature proposed in the Development Plan.

Post development average annual maximum ground water levels, as predicted by Jim Davies and Associates as part of the Drainage Management Programme for the Ellenbrook Development Northern Catchment, are below the existing ground surface of the District Centre. The ground water levels will be used to determine finished surface levels and for sizing drainage facilities.

3. SITEWORKS

Siteworks comprising bulk earthworks for the proposed District Centre development will include the general re-contouring of the site to meet desirable maximum grades applicable to each land use and to match existing adjacent road verge levels. Bulk earthworks will also be used to ensure adequate grades for drainage and sewerage and to provide acceptable slopes for building in accordance with marketing and maximum allowable engineering grades.

In general it is expected that the District Centre bulk earthworks will be designed to result in a balanced cut to fill from within the total Ellenbrook land holding.

4. ACCESS AND ROADS

Existing road access to this precinct of the Ellenbrook landholding, and the north-east corridor area, generally, is via Gnangara Road which is linked to the Perth and Midland central areas and other metropolitan areas by Lord Street, Reid Highway, Alexander Drive, Tonkin Highway, Beechboro Road and West Swan Road.

Expansions of the regional road network completed with financial assistance from Ellenbrook Management include the extension of Reid Highway between Tonkin Highway and Midland, the construction of Lord Street between Reid Highway and Gnangara Road. These links now form an important network for all residents and road users in the Perth north east corridor. Ellenbrook also contributed, along with the State Government and the City of Swan, to the construction of an access road within the Perth Darwin Highway reserve. This access road runs from Gnangara Road to the extension of The Promenade and will provide a direct and alternative route (to Pinaster Parade) in and out of Ellenbrook for the District Centre.

Access to the site is via The Broadway and Bordeaux Lane which border the western and northern boundaries respectively. These roads were completed in December 2005 and enable access between The Vines and Ellenbrook and provide efficient access to the Ellenbrook Town Centre and to Gnangara Road. In the longer term the District Centre will be connected to the south through The Vale with connections off Millhouse Road to the east (West Swan Road) and to the west by connection to The Promenade. Together these roads will provide a high level of road access for the area to and from the above regional road network.

Internally the District Centre development would be serviced by a system of local distributor roads and local access roads the traffic planning of which has been separately assessed and documented by Sinclair Knight Merz.

The roads have and will be designed in line with current Department of Planning and Infrastructure (DPI) policies for more innovative and varied approaches to commercial and residential street development. This may include the incorporation of traffic calming measures, to reduce vehicle speeds, road pavement and landscaping treatments aimed at creating a higher quality commercial and residential environment and improved traffic safety, as well as a high standard of access and permeability.

The road reserve and pavement widths will be varied to suit land use and local activities within the District Centre. Road narrowing and reduced building set backs have and will be used selectively to highlight areas of increased activity and speed control.

4. ACCESS AND ROADS - continued

The detailed design of roads in the District Centre will be carried out in close consultation with the City of Swan and DPI with initial proposals for reserve and carriageway widths as follows:

Road Classification	Width (Metres)	
	Road Reserve	Carriageway
i) Integrator Roads		
. Boulevard	*22 – 30*	*2 x 4.2 + parking*
. Other	*18 - 22*	*6 - 7.4*
ii) Neighbourhood Connector (up to 7000 vehicles per day)	18 – 22	7.0 – 7.4
iii) Access streets (up to 3000 vehicles per day)	14 – 16.5	5.5 – 6
iv) Rear Lanes (Access to lots)	6	6

Road reserves widths will be locally reduced adjacent to public open space and where access streets are adjacent to district distributor or arterial roads.

On street parking embayments will be used where land uses and planning determine street access is required. Parking and access from localised off street bulk parking areas have also been identified.

5. DRAINAGE

Drainage within the District Centre development will be designed in accordance with the approved strategy detailed within the UWMP prepared for the project by RPS, Cossill and Webley and Jim Davies and Associates.

In general the drainage strategy comprises retention on site with the incorporation of a retention basin. The retention basin will be designed as a landscaped depression within the existing low lying area at the south west corner of the District Centre Development Plan. It is proposed that rainfall from storms with a frequency of 1 in 100 year will be contained within the dedicated basin. The detail of this system will be finalised with the City of Swan at the detailed design phase.

Surface drainage within the subdivision areas would be via a conventional system of road gullies and underground pipes draining to the retention / infiltration basins where recharge into the ground water will be possible. At source infiltration will also be achieved by adopting 'open based pits' subject to prevailing groundwater conditions and incorporation of road drainage swales (verge or central median) where conditions are favourable (eg road grade, extent of frontage, lot size, etc).

The pipe system would be designed to cater for run-off from storms with a frequency of up to 1 in 5 years in local streets and 1 in 10 years for district roads with flows from less frequent events, up to 1 in 100 years, provided for in overland floodways comprising road reserves, drainage channels and swales, linear open space, etc. Where possible and with the support of the City of Swan, drainage facilities will be designed to incorporate best management practices and water sensitive design principles.

In areas of high post-development groundwater, sub-soil drainage and earthworks filling would be carried out to provide adequate clearance between the groundwater and building levels. Sub-soil drains would be constructed at or above the pre-development average annual maximum groundwater levels, in line with the environmental criteria for the project.

6. SEWERAGE

The Water Corporation has made provision for the sewerage of the Ellenbrook development in its planning for servicing the overall north-east corridor.

The sewerage strategy for the District Centre is divided into two main catchments. The northern catchment (adjacent Bordeaux Lane) will flow into an existing interim Sewer Pump Station located near the corner of Bordeaux Lane and Taittinger Grove. The southern half of the site (extent to be confirmed depending on timing of development) flows to the south via a gravity sewer reticulation into The Vale gravity sewer network. Ultimately the Bordeaux Lane Pump Station will be graded out and a DN450 Collector Sewer will be constructed along the eastern edge of the District Open Space and through The Vale to the proposed Ellenbrook Pump Station "E".

The DN450 Collector Sewer within the District Centre is currently being constructed by the Water Corporation through a developer constructed works agreement between Stockland and the Water Corporation.

7. WATER SUPPLY

As with sewerage, the Water Corporation has made provision for water supply to the Ellenbrook development in its planning for servicing the overall north-east corridor.

To date the planning has based on a local supply, from the Gnangara groundwater mound beneath the State Forest, west of Ellenbrook, supplemented by connection to the metropolitan system within the north-east and north-west corridors.

The Water Corporation completed a trunk water main link from the Wanneroo system in January 1999. This main operates as a transfer main in both directions from the Wanneroo and Lexia systems depending on ground water production and local demand at any point in time. The first stage of the Lexia ground water treatment plant has recently been completed.

Special water headwork's have been agreed with the Water Corporation for the Ellenbrook project. The Water Corporation has agreed to provide the necessary trunk infrastructure to service the development based on an agreed rate and orderly pattern of development.

The planning for the water supply to the northern areas of Ellenbrook, including the District Centre, has recently been reviewed by the Water Corporation following concerns with ground water levels in the Lexia groundwater storage. The Water Corporation have extended their large diameter distribution mains from The Promenade north along The Broadway beyond the southern entry to Malvern Springs. Ultimately these large diameter distribution mains will be extended north along The Broadway beyond Bordeaux Lane. The initial water service for the District Centre will be via existing services in Bordeaux Lane.

8. OTHER PUBLIC UTILITY SERVICES

Underground reticulated electricity supply for the District Centre will be sourced from the existing high voltage feeds along Bordeaux Lane. Sites for switching and transformer padmounts will be defined during the subdivisional planning phase.

Telephone supply can be provided by the extension of the reticulation system from Woodlake Village and from the new facilities being brought into Malvern Springs and Woburn Park to service the Ellenbrook Development in this northern area.

Reticulated Natural gas has been supplied to the Ellenbrook development via a connection to the existing Dampier-Bunbury pipeline at a "gate station" which is located within the old state forest 65 section of Ellenbrook. This supply was installed for the initial stages of Woodlake Village and has been extended to serve Coolamon and Charlotte's Vineyard and now connects through to The Vines with services to Malvern Springs and Woburn Park.

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