Lendlease Communities (Ellenbrook)

North Ellenbrook (East) DSP

Traffic Impact Assessment

July 2022

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Background

Lendlease Communities (Ellenbrook) is undertaking the preparation and lodgement of the North Ellenbrook (East) District Structure Plan (DSP) and rezoning process. As part of this process, GHD has been engaged to provide:

- Traffic and transport engineering services in support of the preparation, lodgement, and approval of the North Ellenbrook East DSP and rezoning process; and
- Related assessment and advice regarding the location/s of a potential new interchange on Perth Darwin National Highway (PDNH) between Warbrook and Maralla Roads.

1.2 Scope and limitations

This report has been prepared by GHD for Lendlease and may only be used and relied on by Lendlease for the purpose agreed between GHD and Lendlease as set out in section 1 of this report.

GHD otherwise disclaims responsibility to any person other than Lendlease arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Lendlease and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. District Structure Plan Proposal

2.1 Proposed Structure Plan

The proposed North Ellenbrook East DSP is shown in Figure 1.

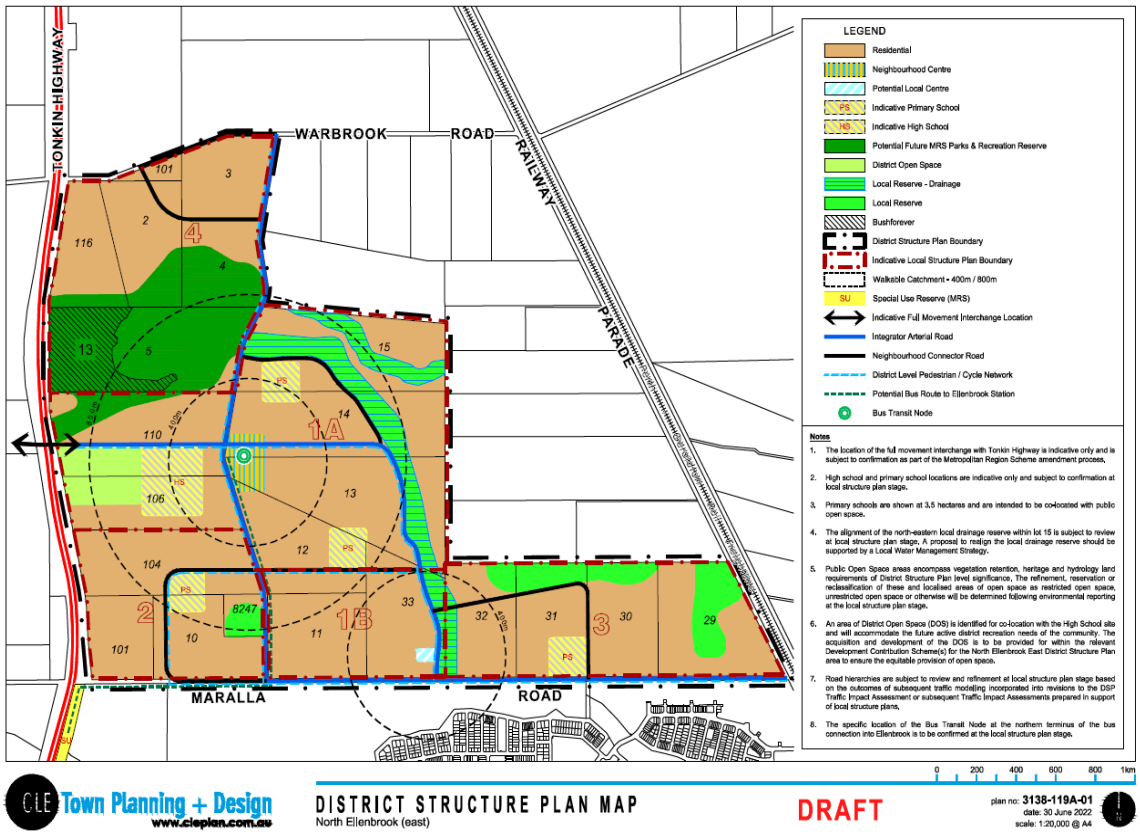


Figure 1 Proposed North Ellenbrook East DSP

2.2 Existing situation

2.2.1 Road hierarchy

The existing road hierarchy surrounding the DSP area is shown in Figure 2. The indicative location of a proposed interchange with PDNH is indicated by a blue arrow.

Features of the road network are as follows:

- Maralla Road, Sawpit Road, Railway Parade and Ellenbrook Road are access roads.
- Warbrook Road east of Railway Parade is a local distributor approximately seven metres wide. West of Railway Parade, Warbrook Road is an access road approximately six metres wide.
- Maralla Road adjacent to the DSP area is approximately four metres wide. Sawpit Road is approximately six metres wide. Railway Parade north and south of Maralla Road is approximately six metres wide. Railway Parade north of Warbrook Road is approximately seven metres wide.
- Great Northern Highway (GNH) is a primary distributor road under the control of Main Roads WA and is approximately 10.7 metres wide with two lanes northbound and one lane southbound.

- PDNH is a primary distributor road under the control of Main Roads WA. The southern section (to The Promenade in Ellenbrook) was opened in 2019 and the northern section (to Muchea) was opened in April 2020. It consists of a dual carriageway between Maralla Road and Muchea with interchanges at Stock Road, Neaves Road and Brand Highway, flyovers at Muchea South Road, the railway line and the Ellen Brook, and a deviation at Brand Highway.

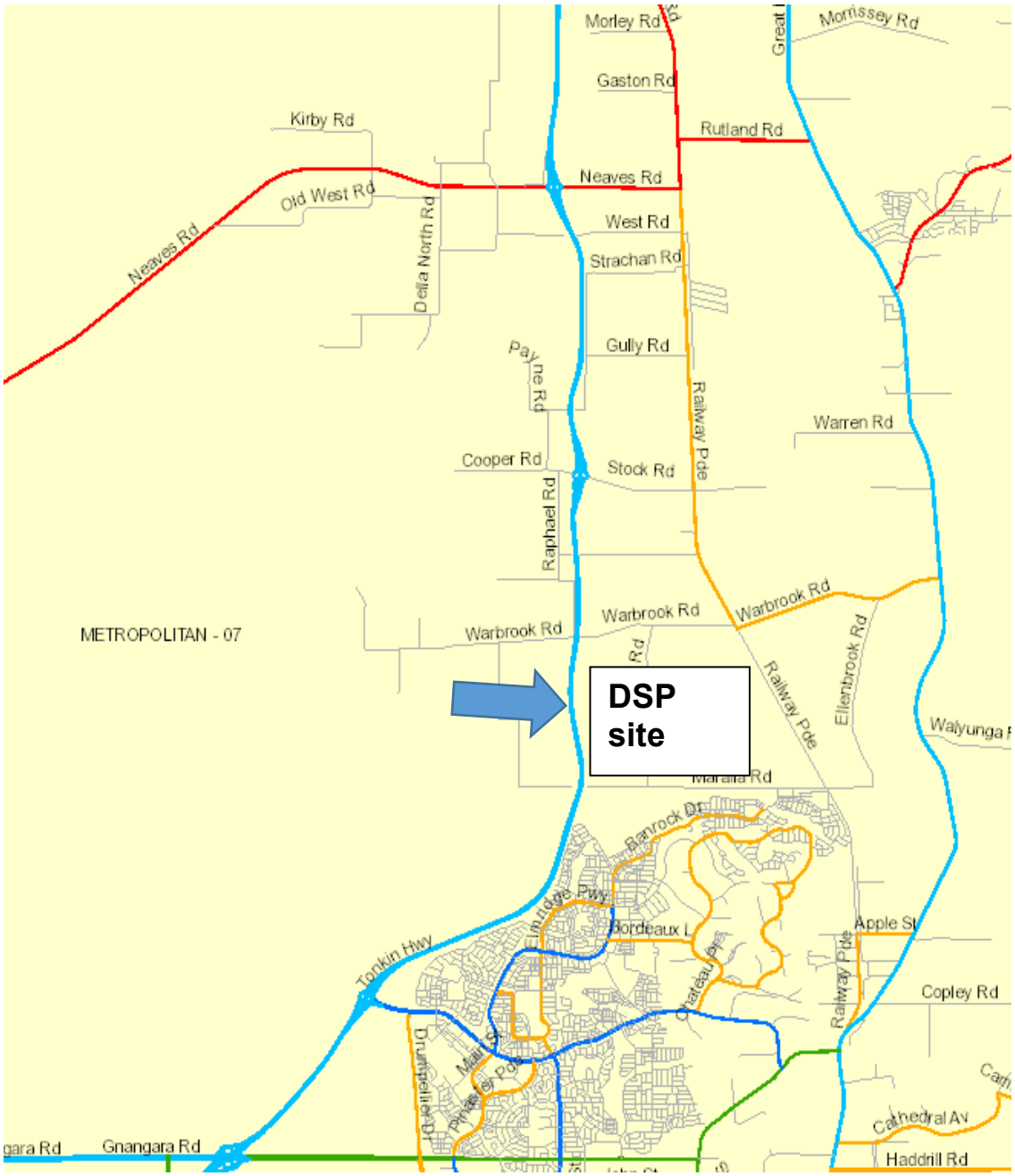


Figure 2 Existing road hierarchy (MRWA)

2.2.2 Speed data

All local roads within and surrounding the project area have a speed limit 110 km/h, except for Warbrook Road east of Railway Parade, which has a speed limit of 90 km/h. GNH has a speed limit of 100 km/h.

2.2.3 Restricted Access Vehicle (RAV) routes

A short section of Warbrook Road just west of GNH provides access to Network 2 vehicles i.e., trucks up to 27.5 metres long.

2.2.4 Traffic data

GHD has undertaken several traffic surveys in the area as follows:

- 12-hour video survey, weekday 6:00 am – 6:00 pm at the following locations:
    - Warbrook Road/Great Northern Highway intersection
    - Warbrook Road/Railway Parade intersection (as four-way)
    - Warbrook Road/Sawpit Road intersection
    - Maralla Road/Railway Parade intersection
    - Maralla Road/Sawpit Road intersection
    - The Promenade/The Broadway intersection
- One-week automatic counts at the following locations:
    - Maralla Road east of Railway Parade
    - Warbrook Road east of Ellenbrook Road
    - Dunnet Drive (south of Maralla Road)
    - The Broadway north of The Promenade

Existing traffic data is summarised in Appendix C.

2.2.5 Crash data

A crash assessment of key roads and intersections within and surrounding the DSP area has been undertaken using the Main Roads WA Crash Analysis Reporting System (CARS). The assessment covers the five-year period between 2017 and 2021.

2.2.5.1 Warbrook Road/Great Northern Highway intersection

There have been 7 reported crashes at this location (shown in Figure 3) within the review period: one medical and six property damage only (PDO) major. The crash patterns indicate a predominant right-angle collision issue, and these are overrepresented compared with the network average. Collisions occurring during wet conditions are also overrepresented. These crash patterns indicate that an upgrade of the intersection is required.

The collision diagram is shown in Figure 4.

Figure 3 Warbrook Road/Great Northern Highway intersection (Source: Google Earth Pro)

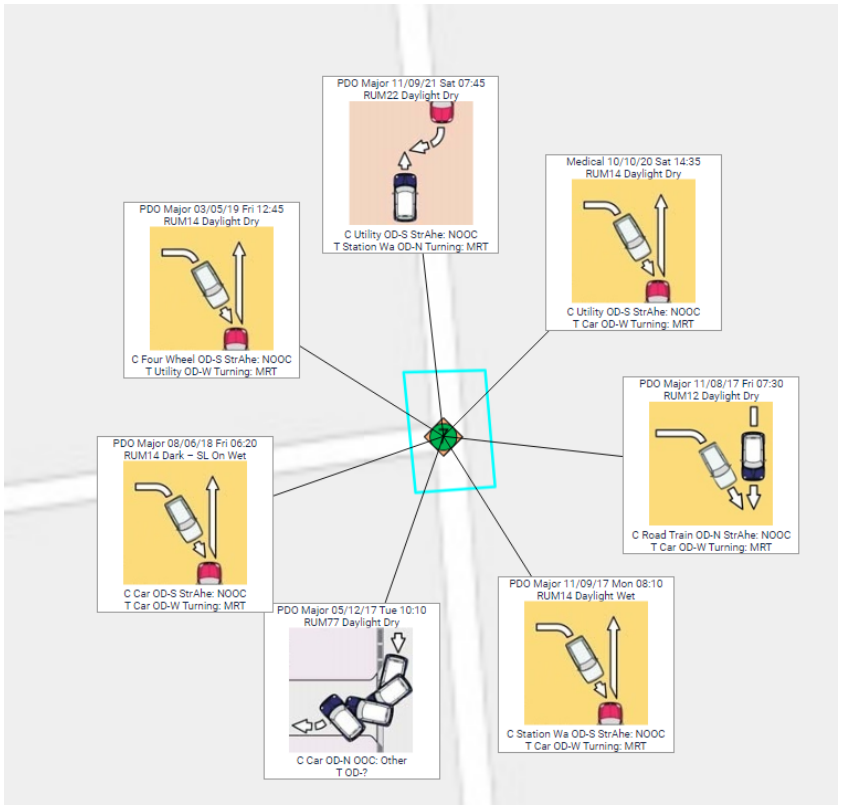


Figure 4 Collision Diagram Warbrook Road/Great Northern Highway

2.2.5.2 Warbrook Road/Ellenbrook Road intersection

There have only been three reported crashes at this intersection (shown in Figure 5) within the study period. All of them were PDO major. Two were right angle collisions and one hit object. Accordingly, no significant safety issue is identified at this intersection.

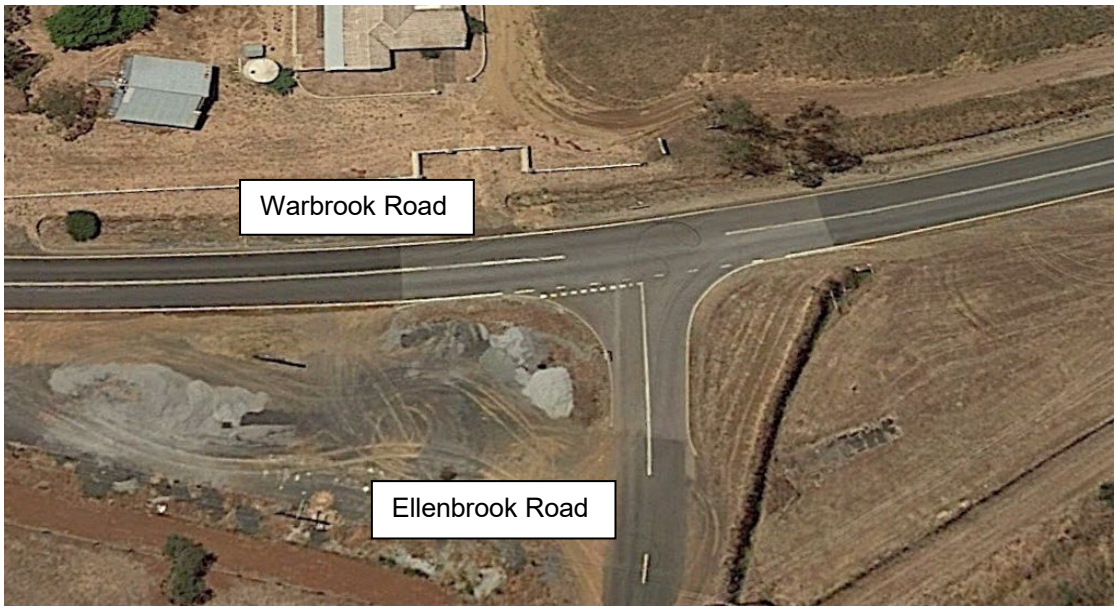


Figure 5 Warbrook Road/Ellenbrook Road intersection (Source: Google Earth Pro)

2.2.5.3 Warbrook Road/Railway Parade intersection (as four-way)

The Warbrook Road East/Railway Parade intersection (shown in Figure 6) has had one reported crash within the study period - PDO major. It was a right-angle collision.

Warbrook Road West/Railway Parade intersection has had no reported crashes.

Accordingly, no significant safety issue is identified at either of these intersections.

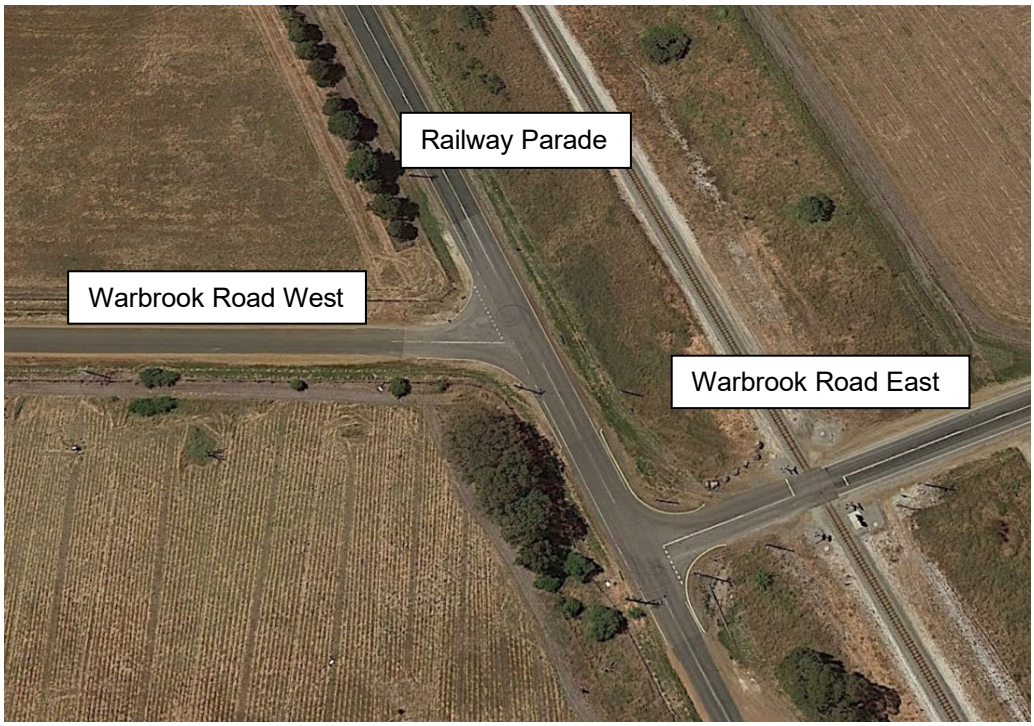


Figure 6 Warbrook Road/Railway Parade intersection (Source: Google Earth Pro)

2.2.5.4 Maralla Road/Railway Parade intersection

There have only been two reported crashes at this intersection (shown in Figure 7) within the review period – two medical. One was a right angle collision and one right turn through. Accordingly, no significant safety issue is identified at this intersection.

Figure 7 Maralla Road/Railway Parade intersection (Source: Google Earth Pro)

2.2.5.5 Maralla Road/Sawpit Road intersection

There have been no reported crashes at this location (shown in Figure 8) within the review period. Accordingly, no significant safety issue is identified at this intersection.

Figure 8 Maralla Road/Sawpit Road intersection (Source: Google Earth Pro)

2.2.5.6 Dunnett Drive/Maralla Road intersection

No crash data is available for this intersection (shown in Figure 9).

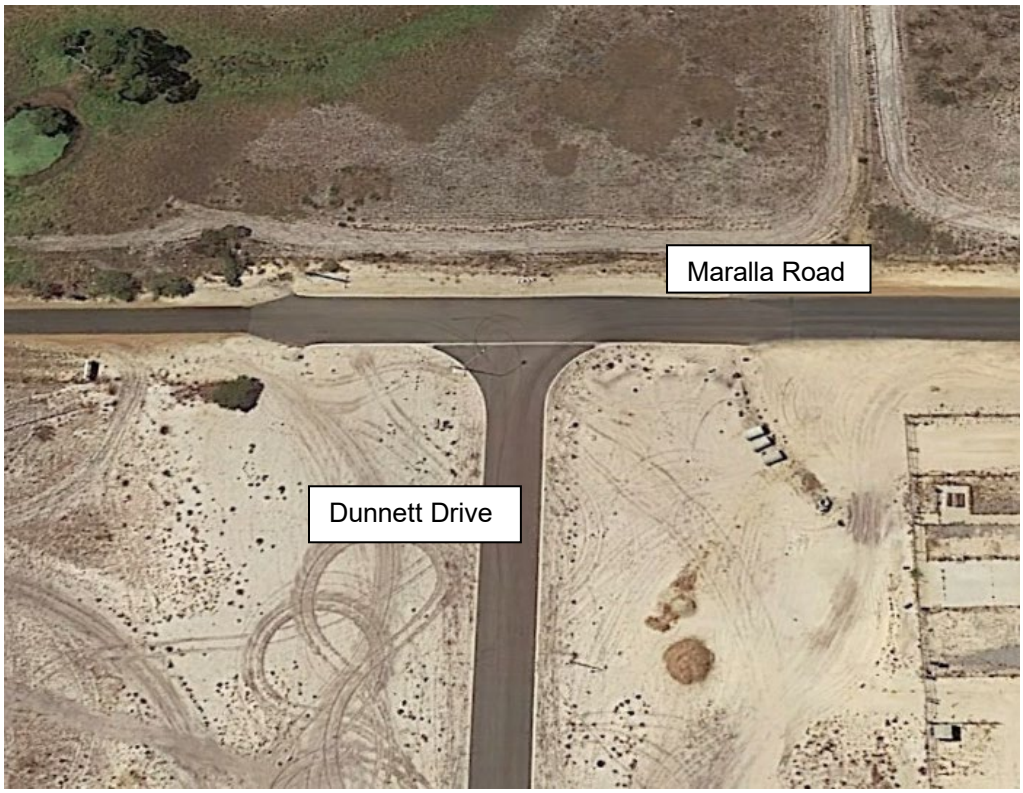


Figure 9 Dunnett Drive/Maralla Road intersection (Source: Google Earth Pro)

2.2.5.7 Warbrook Road/Sawpit Road intersection

There have been no reported crashes at this location (shown in Figure 10) within the review period. Accordingly, no significant safety issue is identified at this intersection.

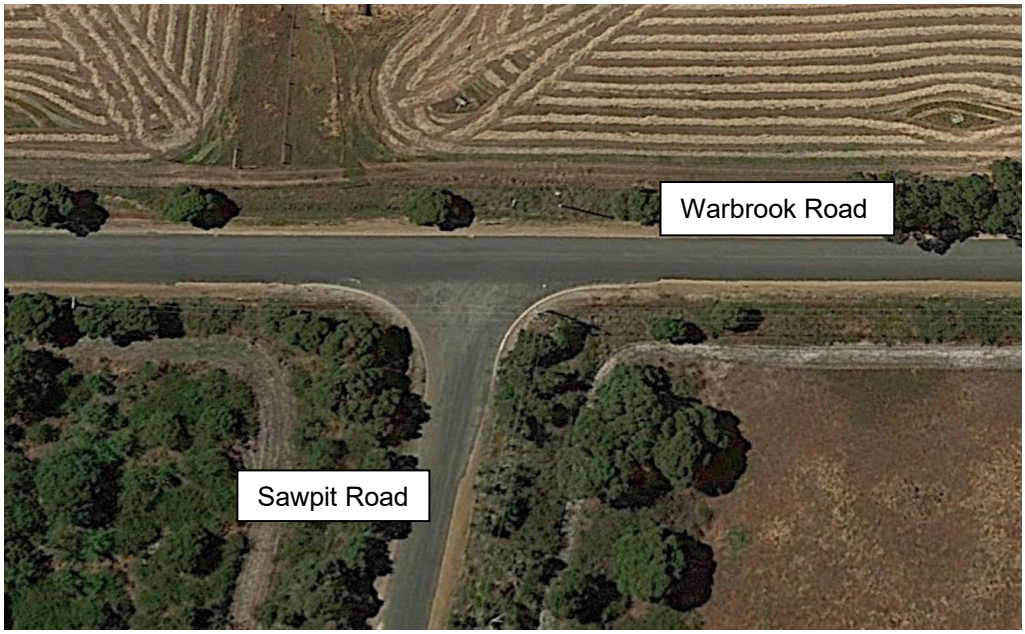


Figure 10 Warbrook Road//Sawpit Road intersection (Source: Google Earth Pro)

2.3 Proposed internal transport networks

Analysis has been undertaken to establish the requirements with an additional interchange with PDNH. It assumes an interchange with PDNH between Maralla Road and Warbrook Road (indicatively shown in Figure 11). Refer to Appendix A for further information.

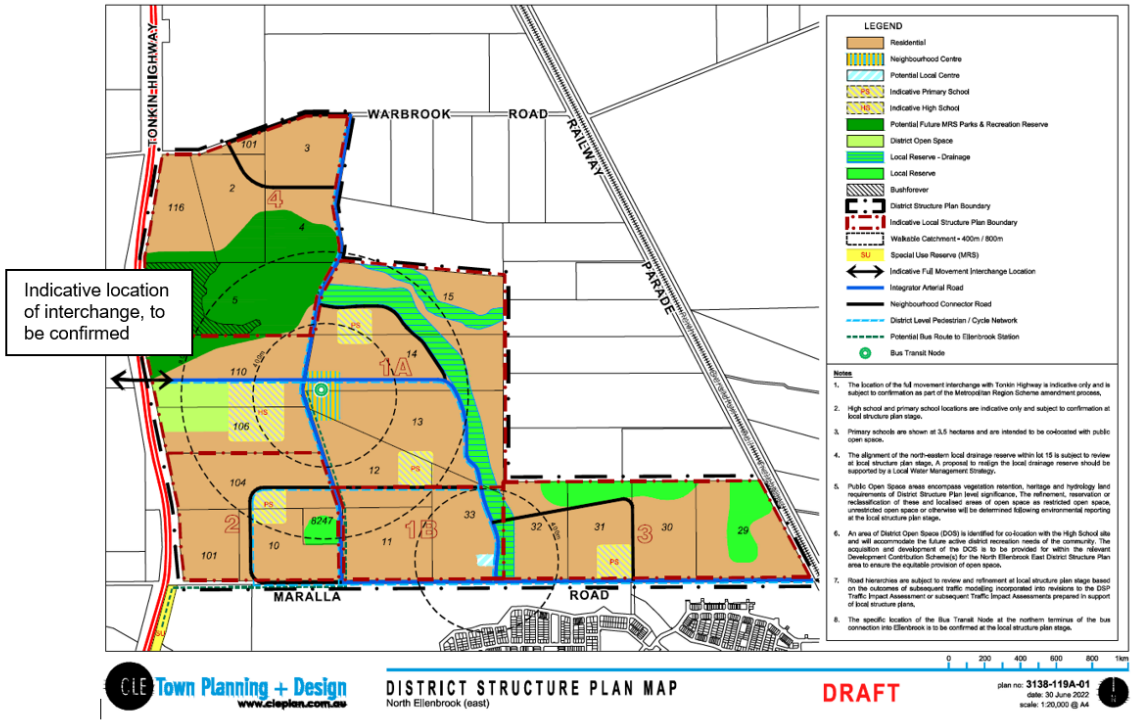


Figure 11 Internal transport network including interchange with PDNH

2.4 Changes to external transport networks

An extension of Tonkin Highway (PDNH) to Muchea was completed by Main Roads WA in 2020 (Figure 12).

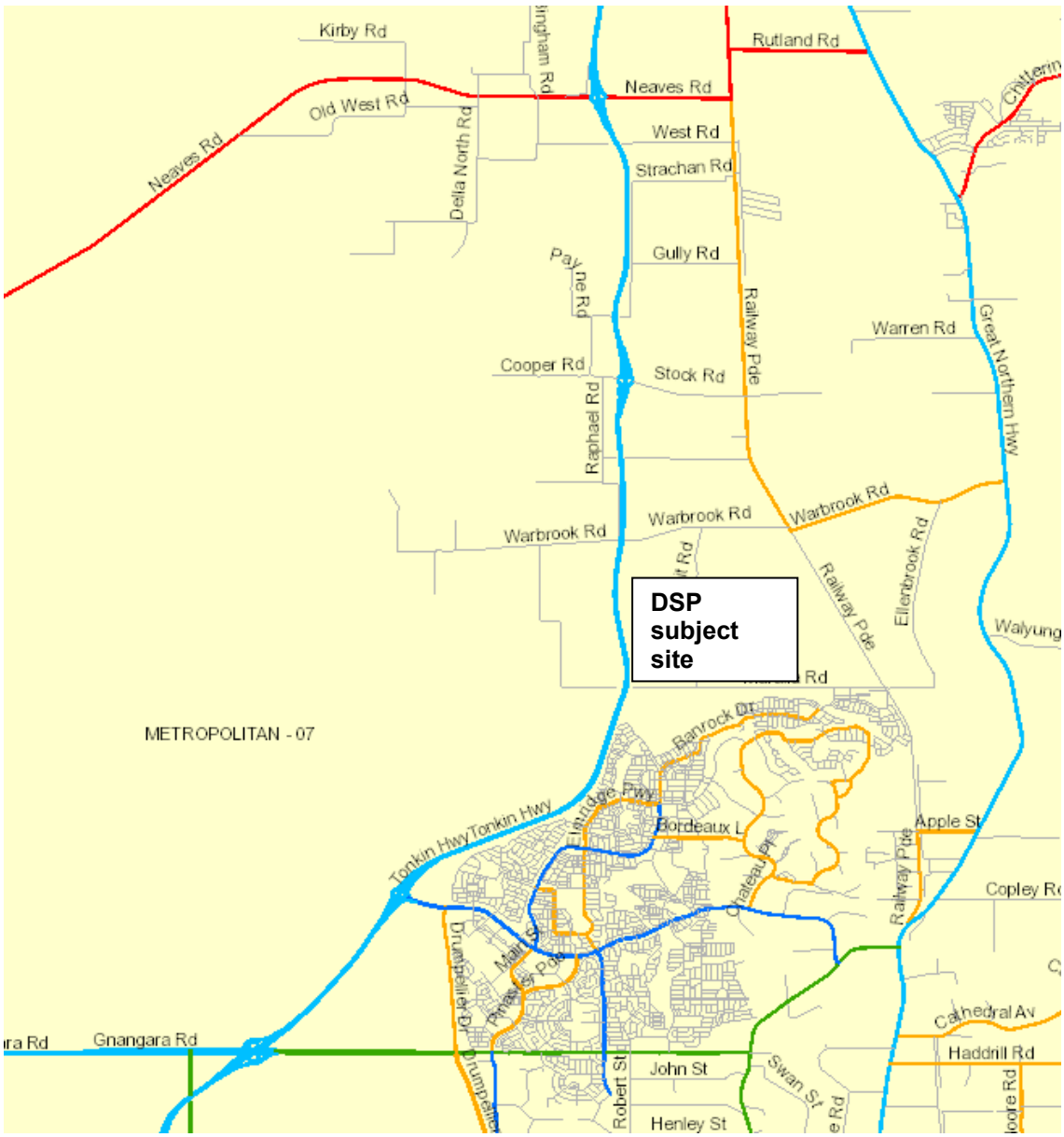


Figure 12 Tonkin Highway (PDNH) extension (MRWA)

2.5 Integration with surrounding area

A masterplan study for the proposed Bullsbrook industrial area, including an associated transport plan, was recently completed/finalised on behalf of the Department of Planning, Lands and Heritage (DPLH).

2.6 Analysis of transport networks – general advice

2.6.1 Assessment years

The following design years have been analysed:

- 2051 full development

2.6.2 Daily versus peak hour traffic

A review of recent traffic survey data undertaken in nearby Ellenbrook at The Broadway north of The Promenade indicates that the AM peak hour represents 8.1% of daily traffic flow and the PM peak hour represents 9.4% of daily traffic flow. Therefore, for analysis purposes, it is

assumed that the peak hour will provide 9% of the daily traffic volumes within the North Ellenbrook (east) DSP area.

2.7 Analysis of internal transport networks

2.7.1 Introduction

Analysis has been undertaken of the internal transport network with reference to the WAPC's *Transport Impact Assessment Guidelines (Vol 2)* and the *NSW Roads and Traffic Authority (RTA) Guide to Traffic Generating Developments*. Based on discussions with the DPLH, a rate of nine (9) trips/dwelling/day has been used for standard dwellings and 6.5 for group housing dwellings. This rate aligns with the rate that was adopted for the North Ellenbrook (west) DSP.

Table 1 includes assessment parameters and forecast North Ellenbrook (east) DSP generated traffic.

Table 1 North Ellenbrook (east) DSP traffic generation (lots under contract)

DSP Zone	Land use/Lot Yield	Daily Trip Rate	Daily vehicle traffic volume
110	469 15	9 per dwelling 6.5 per group housing dwelling	4,221 98
15	485 15	9 per dwelling 6.5 per group housing dwelling	4,365 98
14	394 12	9 per dwelling 6.5 per group housing dwelling	3,546 78
13	466 15	9 per dwelling 6.5 per group housing dwelling	4,194 98
12	342 11	9 per dwelling 6.5 per group housing dwelling	3,078 72
11	375 12	9 per dwelling 6.5 per group housing dwelling	3,375 78
33	331 10	9 per dwelling 6.5 per group housing dwelling	2,979 65
32	212 7	9 per dwelling 6.5 per group housing dwelling	1,908 46
10	284 8	9 per dwelling 6.5 per group housing dwelling	2,556 52
Total	**3,463**		**30,907**

According to the DPLH, the total North Ellenbrook DSP area is planned to accommodate 5,500 dwellings, i.e., an additional 2,037 dwellings on lots not under contract, i.e., outside of the Lendlease area, which equates to approximately 18,333 vehicles per day (vpd).

A total of 10,000 m^2 of retail floor area is proposed within the North Ellenbrook (east) DSP area. Based on *RTA Guide to Traffic Generating Development*, this represents 121 trips/100 m^2 of gross lettable floor area (GLFA) and 12,100 vpd.

For traffic generation associated with schools, reference is made to the *Western Australian Planning Commission (WAPC) Traffic Impact Assessment Guidelines*[1], which indicates one trip per pupil in the AM peak period and one trip per pupil in the PM peak period. Accordingly, two trips per day per pupil has been adopted.

- A primary school of 540 pupils represents 1,080 daily trips (two way).
- A high school of 1,400 pupils represents 2,800 daily trips (two way).

It is noted there may be industry in the north west corner of the DSP (Lots 2, 101 and 116) with up to 79 employees by 2041.

Total volumes generated by the residential dwellings within the DSP is 49,240 vehicles per day (vpd), which compares favourably with the Main Roads WA Regional Operations Model (ROM) 24 forecast of 50,000 vpd.

2.7.2 Non structure plan traffic

It is understood that development is proposed on the western side of PDNH. Recent ROM24 output from Main Roads WA indicates this area will generate 77,900 vpd on ultimate development[2]. This area is subject to a separate assessment for submission to DPLH.

The *Bullsbrook Industrial Area Masterplan* is currently being prepared and land use has been updated for use in the Main Roads WA ROM24, however the land use is project specific and will extend several years beyond 2051.

2.7.3 Liveable Neighbourhoods

Liveable Neighbourhoods provides guidance on road types and anticipated traffic volumes on arterials (Table 2) and local streets (Table 3). Reference is made to this document when considering the proposed road hierarchy and forecast traffic volumes.

[1] https://www.dplh.wa.gov.au/policy-and-legislation/state-planning-framework/fact-sheets,-manuals-and-guidelines/transport-impact-assessment-guidelines

[2] It is noted that 11,300 vpd are forecast to access the DSP (east) area from the DSP area west of PDNH should an interchange be constructed.

Table 2 Function and characteristics of arterials – Liveable Neighbourhoods 2009

Route type and function	Route characteristics	Route name	Max speed limit (km/hr)	Indicative volume range* (vehicles per day)	Indicative street reserve width (metres)**	Indicative road pavement width (metres)
Primary distributors Form the regional grid of MRWA traffic routes, including highways, and catering for inter- and intra-regional traffic. Major truck routes.	Should be designed to be fronted by development and connected with service roads wherever possible. Usually median divided.	Six lane **Primary distributor**	80	50 000	Determined by Main Roads WA	
	Intersections limited and often signal-controlled.	Four lane **Primary distributor**	80	35 000		
Integrator arterials Form a finer grain of routes than the primary distributors, with frequent connections to local streets. Low percentage of trucks. Usually bus routes. On-street bike lanes and separate dual-use paths are usually required.	Four lane and two lane arterial road types. Integrators outside centres typically have service roads and development frontage to support a mix of uses.	**Integrator A** (Four lanes, outside centres)	70 or 60	15 000-35 000	50.6 - 52.6	2 x 8.2 including bike lane and 2 x 5.5 service roads with parking.
	Direct vehicle access from adjoining property should be limited where no service roads are provided. On-street parking desirable.	**Integrator A - centres** (Four lanes, in centres)	60	<25 000	35.6	2 x 10.7 in centres including combined on-street parking and bike lane.
	Integrators through centres typically will have at least one clear travel lane in each direction, and a parking and/or manoeuvring lane. Volumes above 15 000 vehicles per day need detailed design to manage traffic at intersections, facilitate bus movement and deal with parking and access.	**Integrator B** (Two lanes, outside centres)	60	7000-15 000 15 000-20 000	29.2	2 x 7.5 including on-street parking and bike lane. 2 x 7.5 including bike lane. Parking requires special consideration, or service roads may be needed.
		Integrator B - centres (Two lanes)	40-50	15 000	25.2	2 x 7.5 including on-street parking.

Table 3 Function and characteristics of local streets – Liveable Neighbourhoods 2009

Street type and function	Street characteristics	Street name	Max design speed/ target operating speed (km/hr)	Indicative volume range* (vehicles per day)	Indicative street reserve width (metres)+	Indicative road pavement width (metres)
Neighbourhood connectors Streets with mostly residential frontage that typically provide the lower order sub-arterial network. These streets service and link neighbourhoods and towns.	A two-lane divided street used for higher neighbourhood connector volumes, or for character, stormwater infiltration swales or safety. These are often special streets and their design needs to have particular regard to context, function and adjacent land uses.	**Neighbourhood connector A** (Median)	50/50	7000	24.4 **	2 x 7.1 including parking, on-street bike lane, median plus shared path on one verge.
	A two-lane undivided street for lower volume neighbourhood connectors. Typically can accommodate buses, will have at least one shared path and above 3000 vehicles per day separate on-street bike lane.	**Neighbourhood connector B** (Minor)	50/50	3000	19.4	11.2 including parking, plus shared path on one verge.
Access streets Access streets are to accommodate shared pedestrian, bike and vehicular movements. The requirements of adjacent land uses should be supported through street design.	Varied formats to suit a range of typical conditions in predominantly residential areas at different densities, and with different traffic volumes. An avenue access street (Access street A) with median is particularly suited to incorporation of a drainage swale. Access street B is a wider undivided street for situations with increased parking and/or traffic demand. The most typical and most common residential street will be Access street C – Yield street. Access street D is for short, low volume and low parking demand streets. In addition, a comprehensively designed variant with 3.5 m travel lane with indented parking, is also specified for very low volume short streets.	**Access street A** – avenue	50/40	3000	20-24	2 x 3.5 (or 2 x 3.6 under some conditions) plus indented parking.
		Access street B – wider street	50/40	3000	16.5-18	9.7
		Access street C – yield or give way street	50/40	3000	15.4-16	7.2 (7-7.5)
		Access street D – narrow yield or give way street	50/30	1000	14.2	5.5-6
			50/20	150	14.2	3.5 (plus parking indents)
Laneways Provide access to the side or rear of lots principally for access to garages.	Laneways may incorporate some services and can provide rubbish collection access. Laneways usually contain some studio units over garages for surveillance. Lane may be widened in parts to create mews courts.	**Laneway/rear lane**	15	300	6** - 6.4	6** typical 3-6.4 (range)

2.7.4 Pedestrian/cycle networks

The Integrator Arterials and Neighbourhood Connectors will include provision for appropriate cycling lanes and/or shared path infrastructure. Access roads will have pedestrian paths on each side of the road.

A cycle/shared path network is to be developed at LSP stage in conjunction with the Department of Transport and City of Swan. The proposed network should identify connectivity

with the wider/external cycling network, including the PSP along the eastern side of PDNH. Figure 1 includes an indicative district level pedestrian/cycle network which shows a potential connection with the PDNH PSP would be at the location of the proposed interchange. Detail regarding the nature of the connection between the two paths will be subject to development of a concept design.

2.7.5 Safe walk/cycle to school assessment

A path network will be developed throughout the precinct to facilitate good access to schools and will include shared paths and crossing facilities.

2.7.6 Pedestrian permeability and efficiency

An efficient and permeable pedestrian network that includes refuge islands, pram ramps and tactile pavers will be developed at LSP stage.

2.7.7 Access to public transport

Bus services currently serve the Ellenbrook area (south of Maralla Road). A terminus exists in Banrock Drive (near Dunnett Drive) for Route 955 which travels between Bassendean Station/ Morley Bus Station and Ellenbrook at approximately 30-minute intervals. The northern extent of Route 955 is shown in Figure 13.

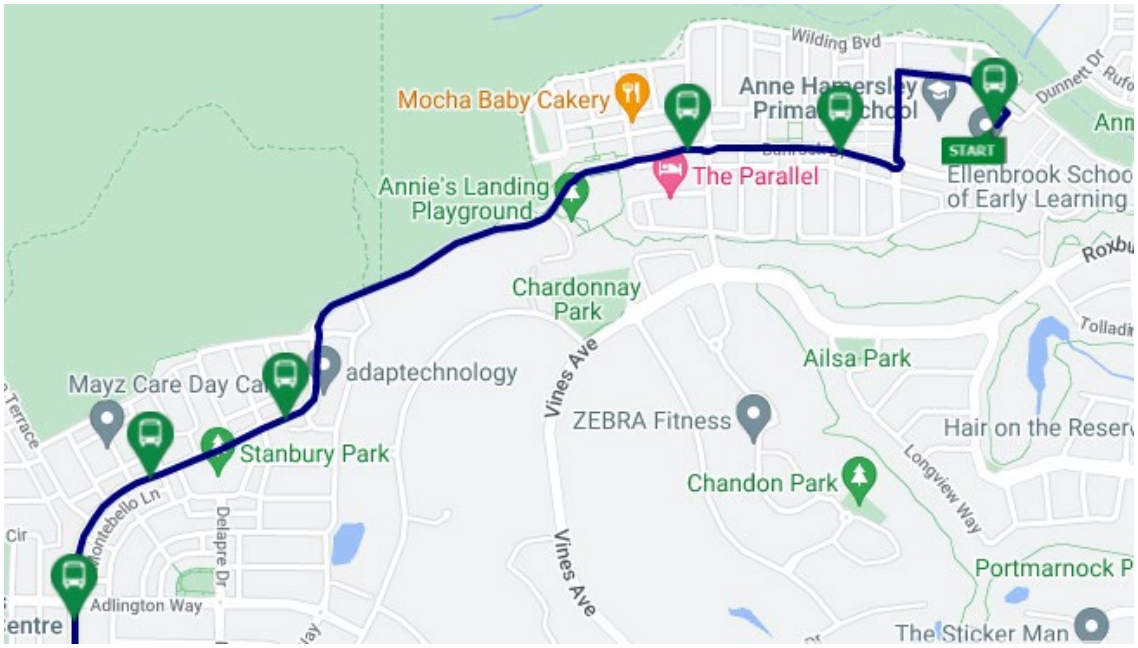


Figure 13 Northern extent of Route 955 (source: Transperth)

2.7.8 Speed limits

The speed limit on Warbrook (Sawpit Road to Railway Parade), Sawpit and Maralla Roads is 110 km/h. This limit is recommended to be reduced to 70 km/h on each of these roads to facilitate the proposed DSP development.

2.7.9 Meeting with Main Roads WA

A meeting with Main Roads WA to discuss the future interchange with PDNH was held on 19 November 2019. The minutes of the meeting are shown in Appendix B, with key points identified as follows:

- MRWA emphasised the need to address the relationship and connectivity with the proposed industrial precinct to the north. This was likely to be more prevalent on the west

side of PDNH but will still need to be considered and addressed by any Transport Impact Assessment (TIA) conducted as part of a DSP submission.

- MRWA enquired about the connectivity of the eastern DSP area with the north – Lendlease advised that connectivity is constrained due to environmentally sensitive land use (i.e., Western Swamp Tortoise habitat). This will be identified within the TIA and is unlikely to be an issue.
- MRWA advised that the dog bone configuration for the interchange shown in the draft plan would be suitable if most traffic was to be light vehicles. However, should a reasonable proportion of heavy vehicles utilise the interchange (i.e., traffic associated with the industrial area to the north), a more appropriate design that better accommodates larger vehicles will be required. This should be acknowledged in the DSP TIA, but determination of interchange form can be made in conjunction with MRWA's design team at concept design stage.

2.7.10 Surrounding network base flows

GHD undertook traffic surveys of the existing road network in August 2019 as indicated in Section 2.2.4. Figure 14 indicates available traffic data (H = heavy vehicles).

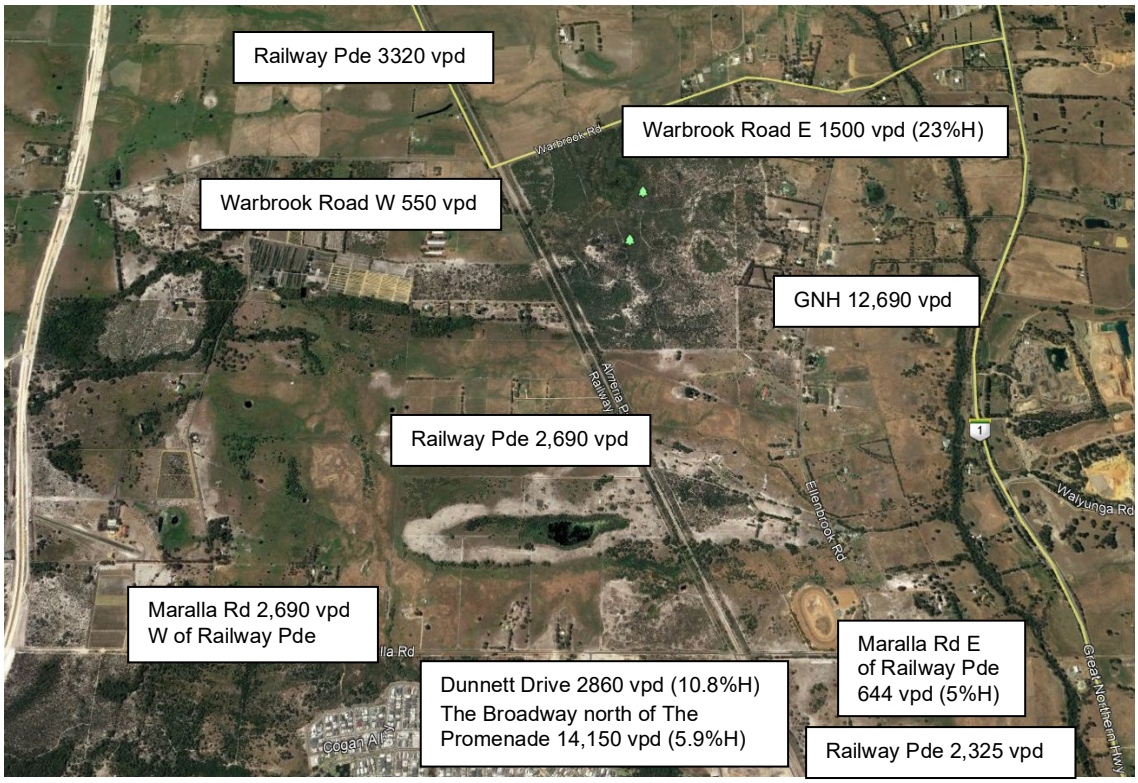


Figure 14 Base traffic flows on external road network (vpd) 2019 (Source: Google Earth Pro)

12-hour video surveys in the area indicate these represent 81-88% of average daily traffic. A value of 85% has been adopted for analysis purposes.

2.7.11 Railway Parade/Maralla Road

The City of Swan (the City) has prepared a concept of a modified intersection which realigns the two staggered Maralla Road and Railway Parade intersections and increases the intersection spacing. The City is currently arranging minor reconfiguration of the intersection until the longer-term solution is required.

A report to Council dated 11 December 2019 recommends:

In summary, traffic modelling indicates that the following recommendation is the optimum option for the City:

- Implementing interim upgrades at the intersection to address safety concerns in the 2019/20 financial year.
- Acquire land as soon as possible for a dual lane roundabout whilst the area is undeveloped to ensure it is appropriately reserved.
- Continue to monitor the ongoing safety and capacity to determine when intervention is required with the ultimate option.

Figure 15 shows the City's interim plan submitted to the Council meeting on 11 December 2019.

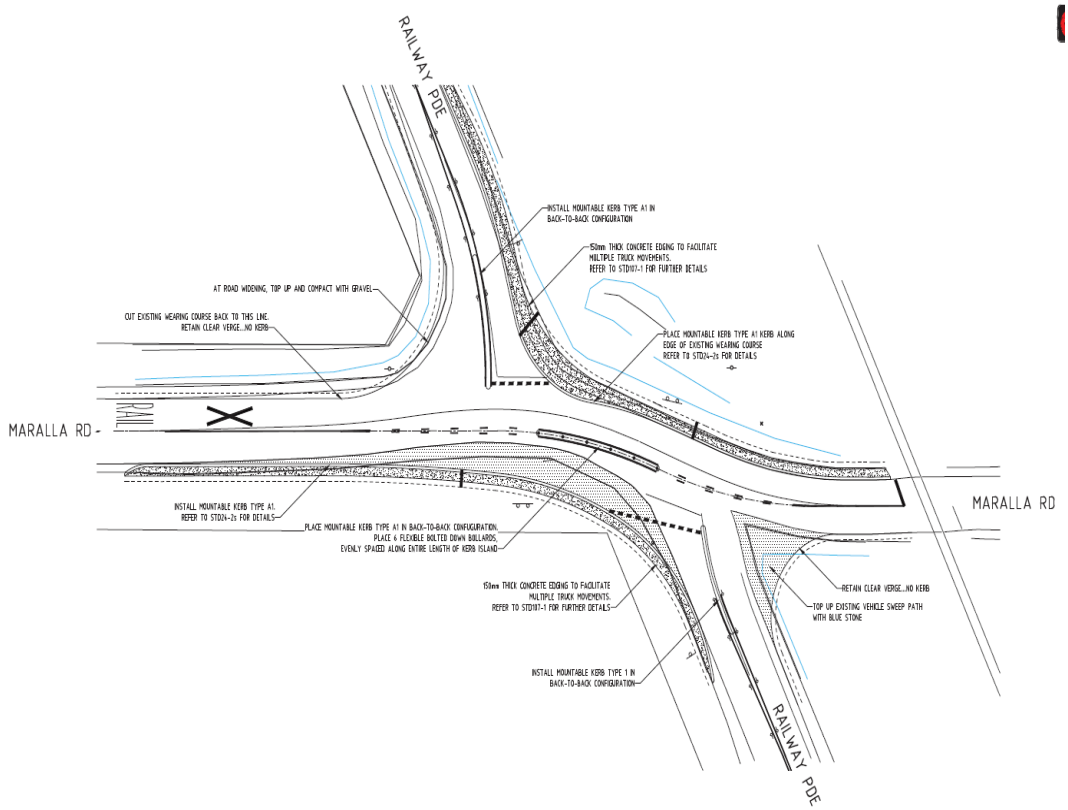


Figure 15 Maralla Road/Railway Parade intersection (City of Swan)

2.8 Proposed interchange with PDNH

GHD's Roads, Structural, Geotechnical and Hydrology teams have undertaken a desktop assessment of a proposed interchange with PDNH between Maralla and Warbrook Roads. An indicative sketch of a possible location has been developed and is shown in Appendix A.

As of May 2022, the interchange has received a total of $100 million in funding. This consists of $50 million in Federal funding and a further $25 million as part of the 2022-23 WA State Budget. An additional $25 million is to be contributed through private investment.

With funding allocated, Main Roads WA will soon commence planning work for the interchange with works anticipated to begin in 2024-25. The location and form of interchange are still to be determined, including whether it will have bus facilities or whether these will be located elsewhere. The final location and form of the new interchange will be resolved through the Main Roads planning process.

Main Roads WA has advised that the first intersection with the east west road that connects to the interchange should be no closer than 300 m from the interchange, however this is to be confirmed by Main Roads WA subject to modelling results/guidance that will be undertaken and included in future planning for the interchange.

2.9 Traffic assessment - additional interchange with PDNH

The following section discusses the analysis of the road network assuming an additional interchange with PDNH is constructed between Maralla and Warbrook Roads and based on the revised road network shown in Figure 16 (noting that the precise interchange location and configuration is still to be confirmed).

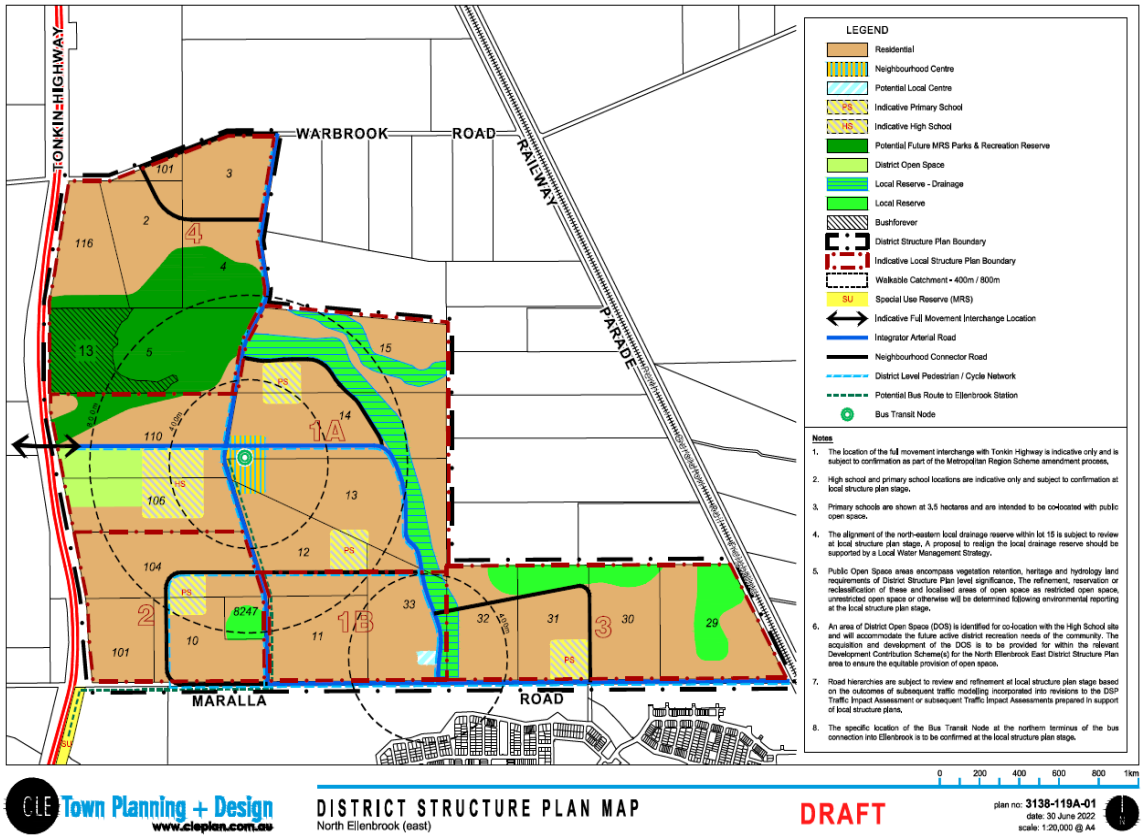


Figure 16 Revised concept with access to PDNH 2051

2.9.1 Design traffic flows – additional interchange with PDNH

Main Roads WA has provided ROM24 output, including link volumes from Bullsbrook ROM Iteration #6 for the Bullsbrook study. This model run replicates the road network and land uses proposed in the North Ellenbrook (east) and North Ellenbrook (west) DSPs. It assumes:

- Full buildout of the Bullsbrook Industrial area as identified in the Perth@3.5M Frameworks
- Full buildout of the Bullsbrook town centre expansion
- The background traffic is per Main Roads ROM24 model for horizon year 2041
- An interchange with PDNH within the two North Ellenbrook District Structure Plan areas.

ROM24 forecast two-way daily traffic volumes on the road network generated by the DSP and surrounding development with an additional interchange with PDNH are shown in Appendix C.

2.9.2 Road hierarchy

Following discussion with DPLH, a proposed road hierarchy and forecast traffic volumes have been developed. Forecast traffic volumes to 2051 based on the ROM24 outputs are shown in Table 4 and the proposed road hierarchy is shown in Figure 17.

Future modelling to be undertaken (by MRWA/DPLH/City of Swan) will provide guidance on the locations and proximity of new intersections. The road hierarchy may also be reviewed based on the outcomes of further modelling and can be refined at LSP stage.

Table 4 Forecast traffic volumes and road hierarchy to 2051

Road	Proposed hierarchy	Indicative daily traffic volume	Heavy Vehicle Percentage	Assumed 20% background traffic growth to 2051	Forecast volume in PCU including HVs (1HV=2PCU)	Comments
Sawpit Road north of interchange connection	Integrator A (52.6 m)	31,000	14.5%	NA	35,495	Outside Town Centre
Sawpit Road south of interchange connection	Integrator A (50.6 m)	19,479	5.5%	20%	24,446	Outside Town Centre
Warbrook Road (Sawpit Rd to Railway Pde)	Integrator B (29.2 m)	Outside DSP, to be assessed at next stage.	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside Town Centre, cycle lanes, etc.
Warbrook Road (Railway Pde to GNH)	Integrator B (29.2 m)	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside Town Centre, cycle lanes, etc.
Railway Parade (Warbrook Rd to Maralla Rd)	Integrator B (29.2 m)	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	4 lanes with no parking. Off road bicycle lanes or PSP
Railway Parade (Maralla Rd to GNH)	Integrator B (27 m to 29.2 m)	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	Outside DSP, to be assessed at next stage	4 lanes with no parking. Off road bicycle lanes or PSP
Maralla Road (Sawpit Rd to Railway Pde)	Integrator A (35.6 m)	21,110	6.5%	20%	26,704	Primary School and provides east-west access, cycle lanes required, turn lanes required at Dunnett Dr given high

Road	Proposed hierarchy	Indicative daily traffic volume	Heavy Vehicle Percentage	Assumed 20% background traffic growth to 2051	Forecast volume in PCU including HVs (1HV=2PCU)	Comments
						turning volumes (all approaches)
Link to PDNH (Northlink to Commercial Dev)	Integrator A (50.6 m to 52.6 m)	39,000	16.5%	20%	53,235	Outside Town Centre, connecting an interchange
Link to PDNH (east of Commercial Dev) - Road G	Integrator B (29.2 m)	13,460	21.5%	NA	16,354	NA
Dunnett Drive	To be determined by future modelling	NA	NA	NA	NA	No of lanes and intersection configuration subject to further modelling and consideration by City of Swan
Road A (east-west)	Integrator B (29.2 m)	8,100	NA	NA	NA	NA
Road A (north-south)	Integrator B (29.2 m)	15,900	NA	NA	NA	NA
Road E	Neighbourhood Connector (24.4 m)	Subject to future detailed modelling	NA	NA	NA	NA
Road F	Neighbourhood Connector (24.4 m)	Subject to future detailed modelling	NA	NA	NA	NA

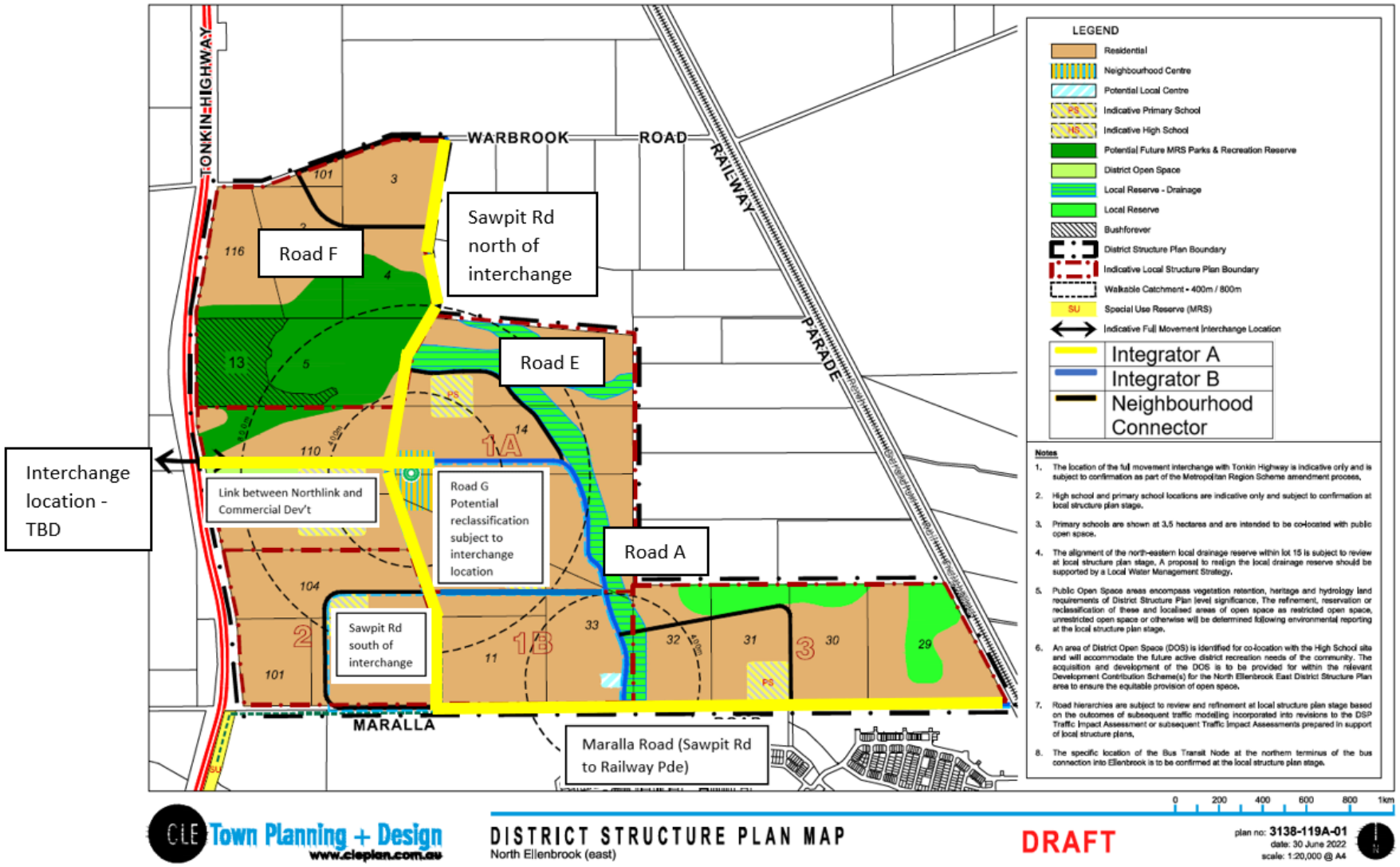


Figure 17 Proposed road hierarchy

In discussion with stakeholders, it is apparent the road hierarchy needs to provide some flexibility for potential future public transport requirements and revised forecast traffic volumes. The nature and requirements for public transport provision are still to be determined, however there will be a requirement to provide connections to the north (Bullsbrook) and to the south (Ellenbrook). Services to the south would most likely be in the form of a high frequency bus service to/from the Ellenbrook town centre. The provision of bus lanes and/or bus prioritisation at intersections is to be determined at LSP stage.

There is potential to use the Special Use Reserve (SUR), shown in yellow in Figure 18, to provide dedicated bus connectivity with Ellenbrook. Use of the SUR by buses would require further investigation by the relevant stakeholders, along with a determination of onward connectivity requirements (north of Maralla Road) at LSP stage.

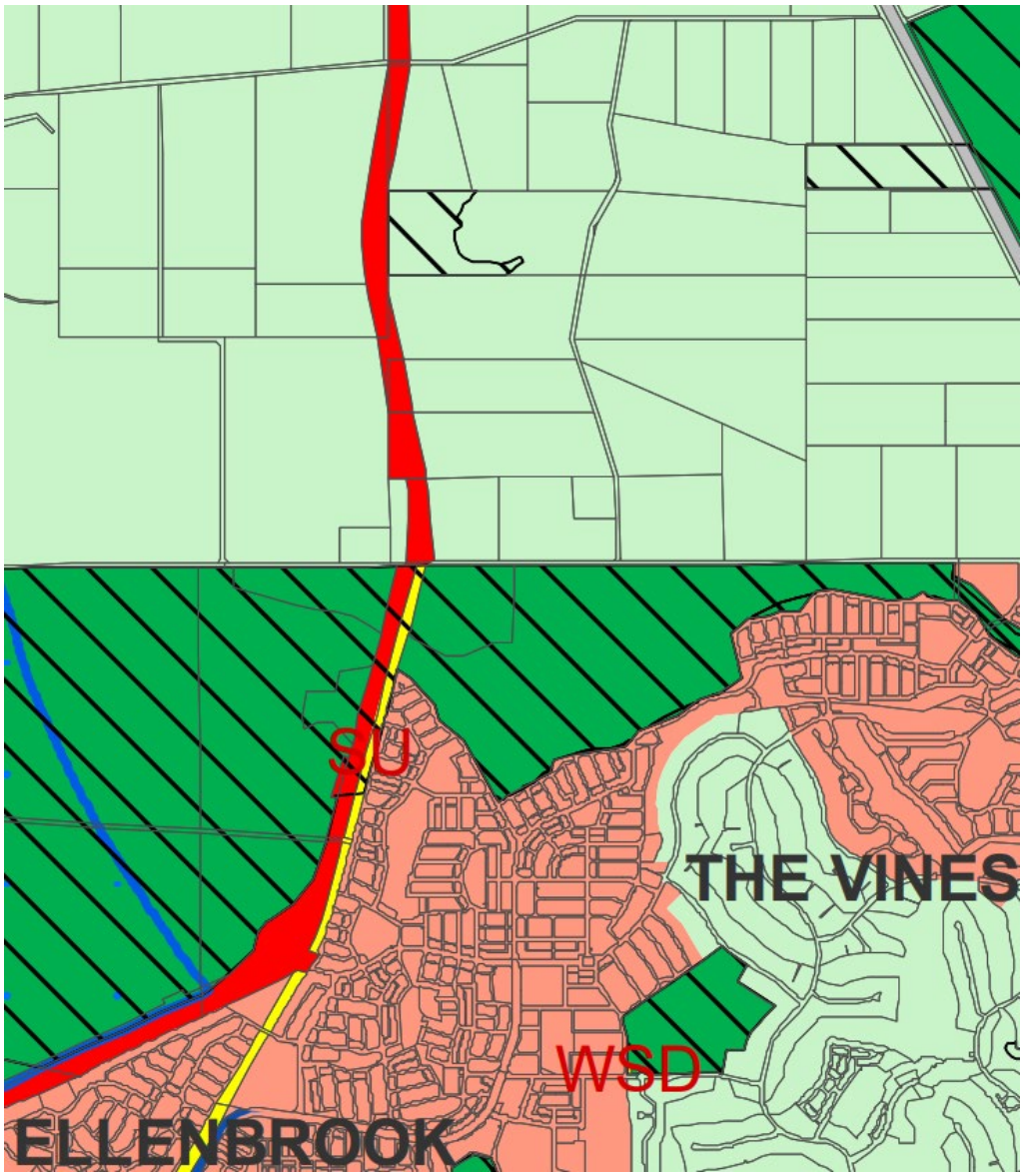
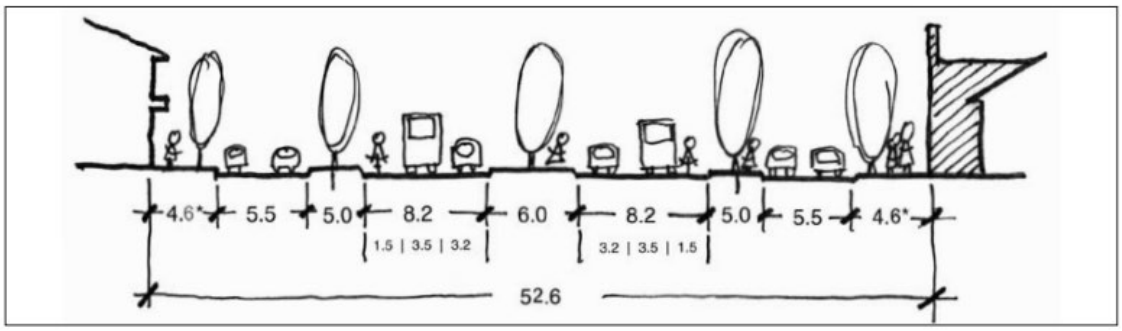


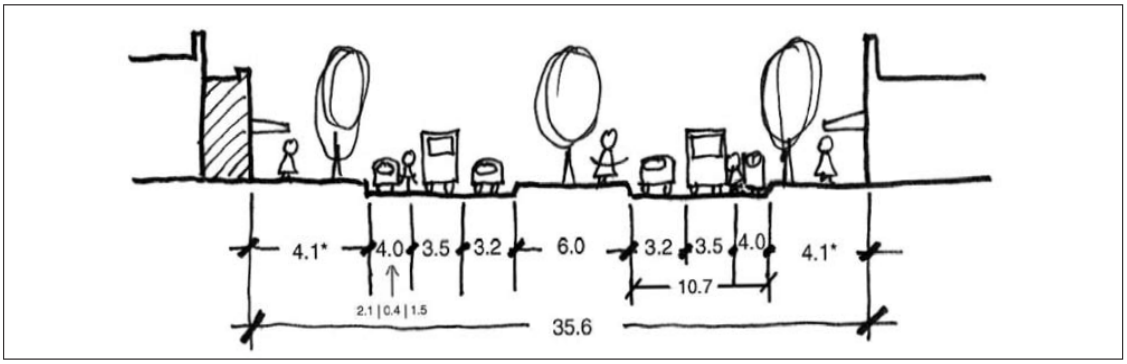
Figure 18 Special Use Reserve (shown in yellow)

2.9.3 Typical road cross sections - Liveable Neighbourhoods (2009)

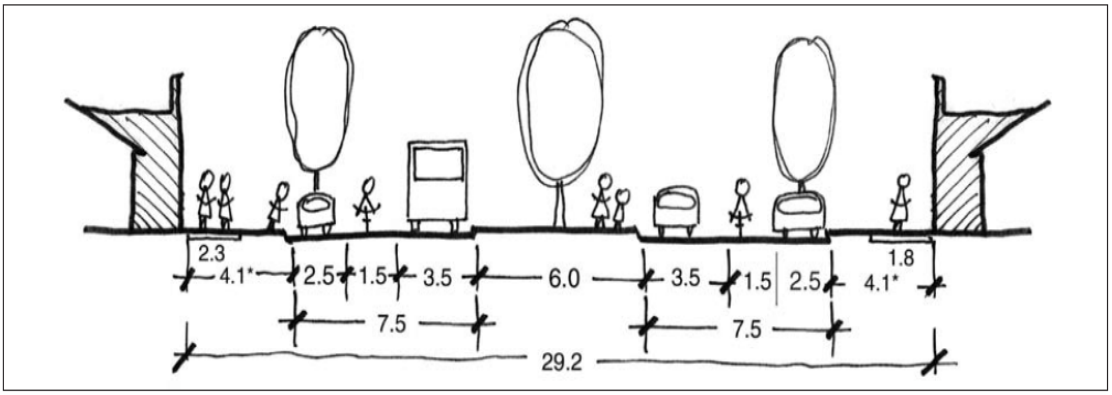
Typical road cross sections for the various street types are shown as follows:

Integrator A – arterial streets

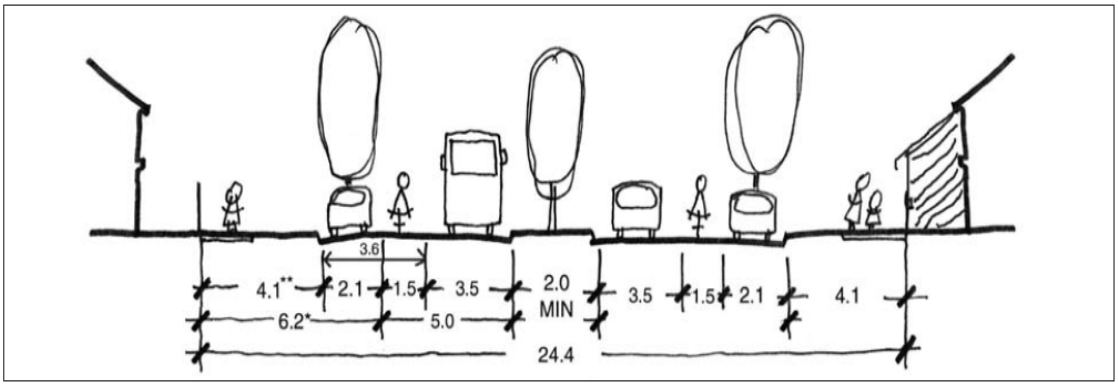




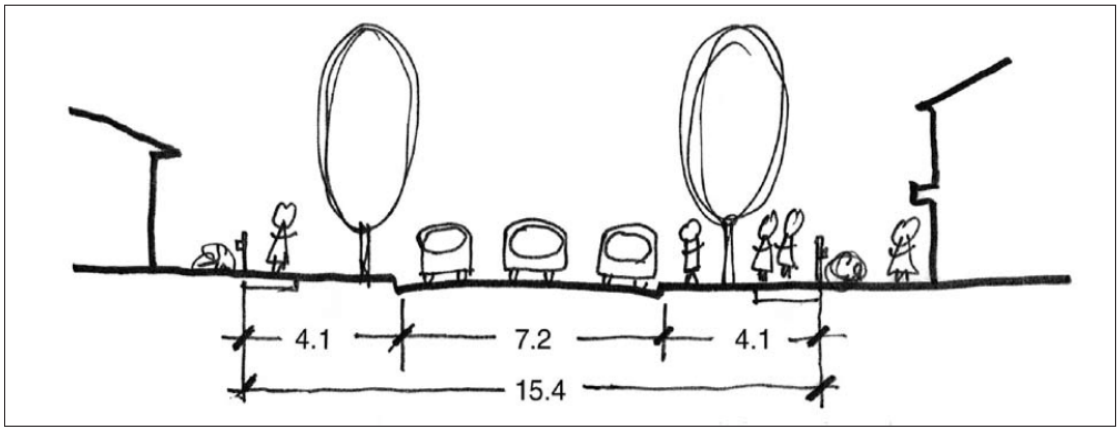
Integrator B - arterial streets



Neighbourhood connector streets



Access Street C



2.9.4 Roads and intersections – additional interchange with PDNH

The type and location of intersection required within the DSP will be the subject of subsequent modelling and is not addressed at this stage. The modelling results shall be added/used to update the TIA prior to the changing of zoning to urban. This will include modelling of the intersections using derived peak hour volumes from the broader modelling.

2.9.5 Forecast traffic volumes on road network external to the DSP area

As discussed with stakeholders, further modelling will be undertaken to confirm forecast traffic volumes, intersection requirements and road hierarchy requirements external to the DSP area as part of subsequent planning stages. It is acknowledged that Main Roads WA/DPLH/City of Swan are planning additional broader modelling to consider the broader road network outside of the DSP area.

This broader modelling will consider wider constraints on the network, such as the reassignment of traffic from Dunnett Drive to other routes; and the possible road link (i.e., the SUR) to/from the south adjacent to PDNH/Tonkin Highway to support bus services. The modelling assessment that will be undertaken by the State and Local Governments will consider the external road network. The modelling results shall be added/used to update the TIA prior to a change to urban zoning.

2.9.6 Connection to new interchange

The proposed new connection to PDNH on the western boundary of the North Ellenbrook (east) DSP area is proposed as an Integrator Arterial (note that there is no consideration to this link potentially connecting with GNH in the future). This road will be control of access and the

number of intersections will be spaced out to promote safe and efficient regional movements to/ from PDNH. The location of commercial crossovers will not be within any intersection area of influence and due consideration will be given to manoeuvring and queuing when positioning these crossovers. Intersection treatments will consider Main Roads WA driveways policies and guidelines (if and where applicable) and abutting noise sensitive land uses will be subject to State Planning Policy (SPP) 5.4.

2.9.7 Access to frontage properties

Access from a frontage street will generally be gained via Access Streets. Residential frontage access is not proposed via higher order roads including Neighbourhood Connectors. Commercial access will be derived to achieve maximum set back from key intersections.

Liveable Neighbourhoods recommends that on streets with vehicle volumes greater than 5,000 vpd, lot layout must ensure that vehicle egress will not involve reversing into the street. Appropriate egress may be achieved by a variety of lot layout solutions that still maintain frontage, including:

- using service roads to busier arterial routes
- using battle-axe lots to provide vehicle access from side or rear streets
- arranging lots to side onto busier streets, with vehicle access from a side street
- providing for frontwards exit layouts for garages and driveways for some larger lots fronting neighbourhood connectors using detailed area plans
- providing shared driveways to garages at rear, arranged to require frontwards exit using detailed area plans.

2.9.8 Pedestrian/cycle networks

The Neighbourhood Connectors will include on-road cycle lanes and pedestrian paths. Access roads will have pedestrian paths on each side of the road.

2.9.9 Safe walk/cycle to school assessment

A path network throughout the precinct will be developed at LSP stage to facilitate good access to schools and other key trip attractors and will include shared paths and crossing facilities.

2.9.10 Pedestrian permeability and efficiency

An efficient and permeable pedestrian network that includes refuge islands, pram ramps and tactile pavers will be developed at LSP stage.

2.9.11 Access to public transport

Future planning for public transport is subject to further stakeholder investigation. At this stage, flexibility remains within the DSP and road hierarchy to accommodate this.

As outlined in section 2.7.7, there are bus services currently serving the Ellenbrook area (south of Maralla Road). A terminus exists in Dunnett Drive for Route 955 which travels between Bassendean Station/Morley Bus Station and Ellenbrook at approximately 30-minute intervals. The alignment of Route 955 will be amended at the commencement of the Ellenbrook Line (currently forecast for late 2022). A minor extension of this bus service into the DSP area may be considered but is not preferred by the PTA.

The PTA advised that the two North Ellenbrook DSPs (east and west) would likely require servicing by one or two bus routes in the future. The primary alignment of the route to/from the south (Ellenbrook) would likely see it access the DSP (east) area either via Sawpit Road or

Road A and connect to a local bus terminal either at the Neighbourhood Centre or at a terminal on or near the proposed PDNH interchange.

Services to/from the north (Bullsbrook) will also be required, however these services are likely to be less frequent than services to/from the south. A potential route alignment would be via Sawpit Road and east along Warbrook Road to GNH. Alternatively, a route may travel through the proposed industrial precinct north of Warbrook Road to Stock Road, and east to GNH.

2.10 Neighbourhood centre

The proposed neighbourhood centre (retail/commercial) is located along two Integrator Arterials (integrator running north-south and integrator running east-west to PDNH).

The ultimate traffic volumes will restrict direct access and in addition, the type of intersection control in the vicinity of the centre will impose further restrictions. The following will apply:

1. The east-west integrator road will be control of access. The number of intersections will be spaced out to promote safe and efficient regional movements to/from PDNH.
2. Abutting noise sensitive land uses will be subject to SPP5.4.
3. The location of commercial crossovers shall not be within any intersection area of influence. Due consideration shall be given to manoeuvring and queuing when positioning these crossovers.
4. Intersection treatments shall consider Main Roads WA driveways policies and guidelines (if and where applicable).

2.11 Connectivity with industrial precinct to the north

The Stock Road interchange with PDNH to the north of the DSP area is the most suitably located to serve the proposed Bullsbrook industrial area and as such, is likely to be used by most of the heavy vehicle traffic seeking to access the industrial precinct. However, planning for the implementation of a new interchange with PDNH within the DSP area should be cognisant of the potential use of the interchange by trucks accessing the nearby industrial area.

As outlined in section 2.8, planning and project development of the new interchange, including its design, will be undertaken by Main Roads WA. The new interchange is to cater for all vehicles that will service the surrounding land uses, which may include commercial and industrial uses. Whilst planning should consider the potential use of the DSP interchange and road network by trucks and commercial vehicles, it should not be encouraged. For example, should the new interchange design be in the form of a “dog bone” layout, it would be less attractive to heavy vehicles compared with a roundabout interchange (which is the form of interchange at Stock Road).

2.12 Grade separation of rail crossings

Grade separation using a bridge or an underpass offers the safest but most expensive treatment at a rail crossing. However, justification of the high expenditure involved with grade separation is required before replacing an existing level crossing or constructing a new grade separated crossing. Section 10 of Main Roads WA’s *Railway Crossing Control in Western Australia Policy and Guidelines*[3] (April 2017) outlines the warrants and scenarios whereby grade separation may be pursued.

[3] https://www.mainroads.wa.gov.au/globalassets/technical-commercial/technical-library/road-and-traffic-engineering/traffic-management/railway-crossing-control-in-western-australia-policy-and-guidelines-2017.pdf (accessed 04/0/2022)

The proposed IMT within the Bullsbrook Industrial Area (north of Stock Road) is currently planned to cater for up to 250,000 twenty-foot equivalent units (TEUs) per year which equates to approximately seven train movements (14 two-way) per day, which is less than one movement per hour. ROM indicates 5,300 vpd and 700 vpd would traverse the Warbrook Road and Maralla Road crossings, respectively from the DSP area. Given the forecast number of train and vehicle movements, the conflict between traffic generated by the DSP area and freight train movement at the crossings will be very low. Based on the warrants included in the guidelines, additional DSP-generated traffic is not likely to trigger the need for grade separation over the railway line.

The Department of Planning, Lands and Heritage's *Bullsbrook Freight and Industrial Land Use Strategy's Transport Strategy* recommends that once proposed development in the area that will generate additional freight train movements and/or traffic volumes is known, an Australian Level Crossing Assessment Model (ALCAM) assessment should be undertaken to aid in the determination of whether there is a need for grade separation over the railway. This should occur prior to the establishment of the IMT.

2.13 Conclusions - additional interchange with PDNH

- The forecast traffic volumes on the internal road network, including a proposed additional interchange to PDNH, indicates the DSP road network generally complies with anticipated traffic volumes in *Liveable Neighbourhoods.*
- Adjacent to the commercial centre, the four-way intersection Sawpit Road/Road G will require detailed modelling to determine an appropriate intersection treatment. Further detailed modelling at this intersection and other intersections within the DSP will be undertaken at LSP stage.
- There are currently interchanges with PDNH located at Stock Road, approximately 3.8 km to the north, and The Promenade, approximately 5.7 km to the south. Their location does not facilitate good access to the proposed North Ellenbrook DSP area, hence why an additional interchange in the proposed location is the preferred scenario.
- Forecast traffic volumes on the connection to PDNH will need to be confirmed as part of subsequent modelling. It is acknowledged that Main Roads WA/DPLH/CoS are planning additional broader modelling to consider the broader road network outside the DSP area.
- Maralla Road is currently a narrow, single lane road and will require upgrade to Integrator A status. Intersections along Maralla Road will be subject to further modelling at a later stage.
- The current crash patterns at the intersection of GNH/Warbrook Road indicates upgrade is required by Main Roads WA. The type of upgrade has not been agreed with Main Roads at this stage to address crash patterns or future traffic volumes.
- The intersection of Maralla Road/Railway Parade North and Railway Parade South are only 15 m apart. It is understood the City of Swan is planning a minor reconfiguration of the intersections in the short term, and possibly a two-lane roundabout in the long term. However, any recommended upgrade will be subject to further modelling and agreement with the City of Swan.
- It is understood from DPLH that the longer-term planning for the area includes the possibility of Maralla Road being grade separated over the railway line and Railway Parade. Any upgrades/removal/improvements to this and any other existing level crossings should be undertaken by a collaborative approach between the developers in

the vicinity, the City of Swan and the State Government. It is considered that DSP traffic alone will not trigger the need for grade separation over the railway line.

- The intersection of Warbrook Road/Railway Parade will be subject to subsequent modelling.
- The upgrade of the railway crossings to a more active level of control, i.e., boom gates, should be considered as part of subsequent modelling in conjunction with the PTA, City of Swan, and Main Roads WA, as well as via an ALCAM assessment.
- The treatment of Maralla Road/Dunnett Drive intersection will be subject to subsequent modelling and agreement with the City of Swan.
- The treatment of Dunnett Drive will be subject to subsequent modelling and agreement with the City of Swan.

2.14 Preliminary development with no interchange with PDNH

No ROM modelling has been undertaken assuming a scenario with no interchange with the PDNH. At this stage, construction of the interchange is anticipated to commence at some point in the financial year of 2024-25. This will likely pre-date any development within the DSP area. However, should construction of the interchange be delayed, the recent GHD surveys and available data indicate that there is some capacity within the existing road network to accommodate additional traffic.

Figure 14 indicates current traffic volumes up to 3,320 vpd on Railway Parade north of Warbrook Road and less on other roads within the external local road network. Given the low levels of traffic volumes in the area, it appears that there is potential for some small pockets of initial development to occur within the DSP area prior to the interchange being constructed. However, this would be subject to further modelling and analysis of forecast traffic volumes and agreement with stakeholders.

3. Recommendations

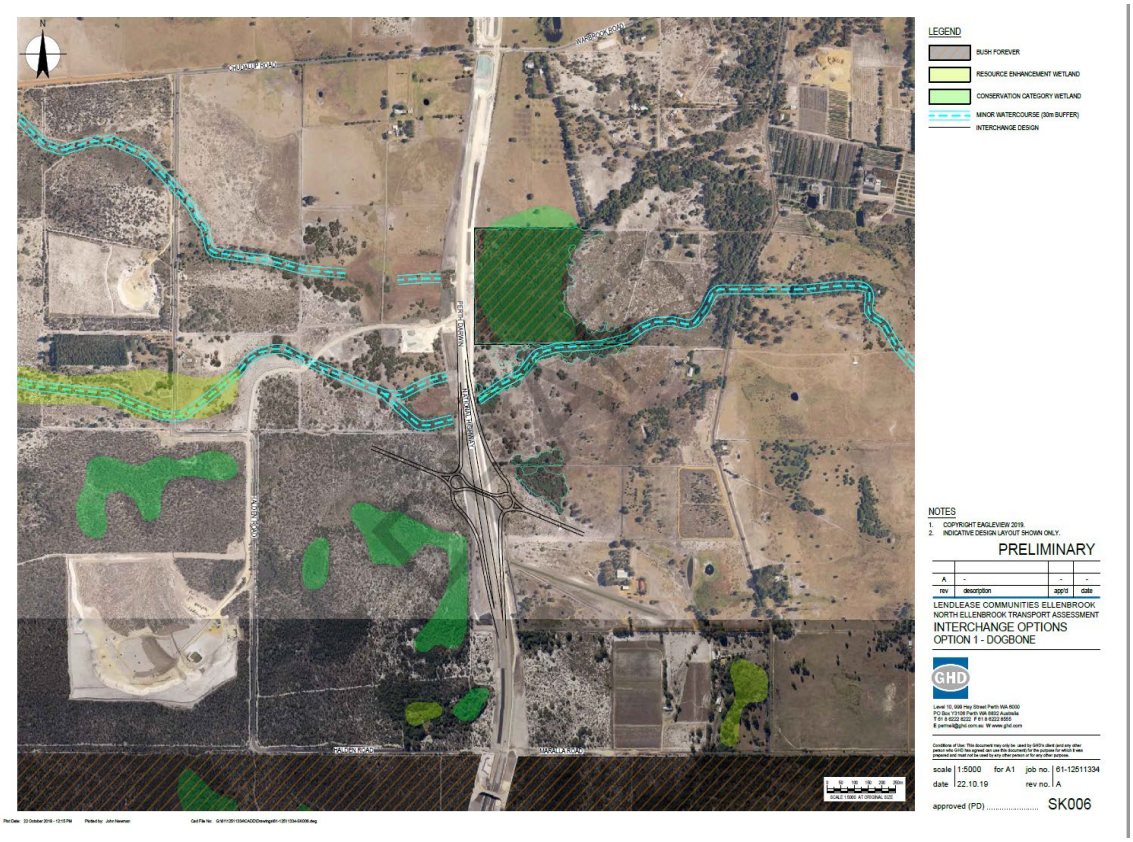
The following recommendations are made regarding the transport network for the North Ellenbrook (east) DSP area:

- The proposed road hierarchy for the DSP area is adopted for the ultimate development and will include section of Integrator Arterial A/B adjacent to the commercial centre and access to the PDNH.
- Maralla Road is upgraded to Integrator A status.
- Footpaths are constructed on at least one side of each street as development occurs.
- An additional interchange with PDNH between Maralla and Warbrook Roads is progressed to facilitate good access to and from the DSP area.
- Further modelling is undertaken by Main Roads WA/DPLH/City of Swan to inform the intersection requirements and locations within the DSP area.
- Further modelling is undertaken by Main Roads WA/DPLH/City of Swan to confirm the external road requirements, including cross section and intersection requirements at GNH, Railway Parade, Dunnett Drive and Maralla Road. This should include a future connection to the south adjacent to PDNH/Tonkin Highway to support bus services to access Ellenbrook north (e.g., via the SUR). Any intersection with the east-west road connecting the interchange should be at least 300-400 m from the interchange.
- A collaborative approach is undertaken including DPLH, Main Roads WA, City of Swan, PTA and DoT to develop the road network and planning for public transport.
- Stakeholders to further consider the nature of any bus services to serve the DSP area.
- Main Roads WA to consider the intersection of Warbrook Road and GNH to address existing crash patterns.
- Further consideration be given to measures to discourage heavy vehicles from travelling through the North Ellenbrook (east) DSP area, particularly from using the proposed interchange with PDNH. This is to be in conjunction with Main Roads WA and City of Swan.
- Consideration is given by Main Roads WA to reducing the current 110 km/h speed limit on Warbrook (Sawpit Road to Railway Parade), Sawpit and Maralla Roads within the DSP area to facilitate the proposed DSP development.

Appendices

Appendix A - (Technical assessment of additional interchange with PDNH)

Indicative interchange location



Memorandum

26 August 2019

To	The Trustee for Lendlease Communities (Ellenbrook) Trust (Lendlease Communities (Ellenbrook) Pty Ltd)		
Copy to	Jim McNeill; Steve McDermott; Steve Barlow		
From	John Newman	Tel	+61 8 6222 8692
Subject	Task 2 – Interchange Options Assessment	Job no.	12511334

1 Introduction

GHD has been engaged by Lendlease to provide traffic and transport engineering services in support of the preparation, lodgement and approval of the North Ellenbrook District Structure Plan (DSP) and rezoning process. Part of these works involves an assessment of a potential location(s) for a new interchange with Perth Darwin National Highway (PDNH) in the vicinity of Maralla Road.

The scope of works proposed as part of the interchange option assessment include:

- Undertake an analysis of the most appropriate interchange location on PDNH in the vicinity of Maralla Road that will enable the most efficient access to the North Ellenbrook proposed DSP area.
- Examination of “back-up” access options to directly service Lendlease’s DSP area.
- Liaise with Main Roads WA and attempt to gain support for the identified location and seek to have them account for it in their future planning.
- Provide high-level advice as to the possible interchange cost (based on previous similar examples that GHD has been involved with) for the purposes of Developer Contribution Plan costing and other funding models.

2 Background

An additional interchange option is being considered along PDNH between Maralla Road and Warbrook Road to provide access to the adjacent proposed developments. Concerns on east-west access have been raised due to the spacing of almost ten kilometres (km) between the existing interchanges being constructed as part of Northlink Stage 3. An existing interchange is located approximately 4.5 km south of Maralla Road at The Promenade and approximately 5 km north of Maralla Road at Stock Road. To facilitate development of the residential subdivision to the east and industrial area to the west, the additional interchange has been proposed to provide this east-west access.

The preferred interchange option will form part of the North Ellenbrook DSP submitted by Lendlease for the proposed mixed-use subdivision to the east. To finalise the subdivision layout, the interchange location and approximate form is required.

At present, works are being undertaken on PDNH as part of NorthLink Stage 3. The design and alignment of the new road has been considered during the assessment of the interchange options.

3 Project Constraints

Several existing constraints have been considered during the options assessment. These are shown in the sketches provided in Appendix A (ref. 61-12511334-SK001 to 61-1251134-SK003) and summarised below:

- Minor water courses bisect the PDNH alignment. A 30-metre buffer zone has been provided around water courses as shown on the attached sketches.
- Bush forever sites located south of Maralla Road and to the east of the proposed PDNH alignment.
- The PDNH alignment is bound by Conservation Category Wetlands and Resource Enhancement Wetlands.
- The Stock Road interchange is located approximately 2.65 km north of Warbrook Road. The proximity of the proposed interchange to the Stock Road interchange has been considered. Earlier discussions with Main Roads WA indicate that it was not preferred to have the interchange between the eastern bush forever site and Warbrook Road.
- Design constraints associated with NorthLink Stage 3 include the vertical alignment (interface with grade separation), the vehicle inspection bay / turn around and drainage basin locations.
  - The vertical alignment cuts through the southern ridges with approximately six metres to ten metres vertical separation.
  - Vehicle inspection bay / turn around is located north of Warbrook Road.
  - A large drainage basin is located adjacent to the eastern bush forever site.
- The topography of the site is characterised by low-lying gently sloping land in the northern half of the study area with elevations ranging from reduced level (RL) 42 metres Australian Height Datum (AHD) to RL 44 metres AHD. Elevations rise steeply in the southern portion to a maximum level of approximately RL 55 metres AHD at Maralla Road. A natural ridge runs across the PDNH alignment in a northwest-southeast direction.
- Perth Groundwater Atlas (2004) indicates that shallow groundwater, at approximately one metre to two metres below existing ground levels, is present in the northern portion of the site.
- Most of the area is underlain by thin Bassendean Sands over clayey soils of the Guildford Formation which are not likely to present significant geotechnical risks to the proposed interchange development. Wetland areas and watercourses are shown to comprise peaty clays that may present a geotechnical risk due to compressibility.

4 Interchange Options Assessment

4.1 Interchange location

Several options were considered for the proposed interchange location taking into consideration the constraints mentioned above. The northern option near Warbrook Road was not progressed due to proximity to the Stock Road interchange. The southern option (at Maralla Road) was not progressed due to spatial constraints imposed by wetland and bush forever locations. The location immediately southwest of the bush forever site (located centrally between Maralla and Warbrook Roads) was not progressed due to minor impacts on surrounding environmental constraints.

In relation to the existing PDNH interchanges, the preferred option location is 4 km south of the Stock Road interchange and 4.5 km north of The Promenade interchange. Within the DSP area, the preferred location is 1.5 km south of Warbrook Road and 0.9 km north of Maralla Road.

The location of the preferred interchange option was selected based on considerations made to minimise environmental impact, project costs and the interchange's integration with PDNH design and site topography. The preferred location aligns with the southern ridge and is topographically advantageous for a grade separation with PDNH. The options considered for the interchange at this location are summarised in Section 4.2 below.

It is noted that PDNH must be designed for High Wide Loads (HWL) 10 metres x 10 metres. As such, allowance has been made for these vehicles to travel up and over the entry / exit ramps. Alternatively, additional earthworks could be considered to raise the existing ridge to provide the required clearance.

4.2 Interchange form

Options considered are summarised below with indicative design layouts shown in the sketches provided in Appendix A (ref. 61-12511334-SK001 to 61-1251134-SK003).

- Option 1 – Grade separated dog bone roundabout
- Option 2 – Grade separated roundabout
- Option 3 – Parclo B4
- Option 4 – Diamond (not progressed due to insufficient area)

A preliminary assessment of the positives and negatives of each option are summarised in Table 1.

Table 1 Summary of options considered

Interchange Option	Positives	Negatives
Option 1	• Reduced impact area, narrow entry / exit ramps (limited earthworks) • Roundabouts with minor road provide safe systems solution (lower impact speed) • Ease of access for HWLs over ramps, flush roundabout kerb • Limited environmental impact	• Roundabout impedes free flow of minor road traffic • Interchange not consistent with other PDNH interchanges
Option 2	• Roundabout with minor road provides safe systems solution (lower impact speed) • Limited environmental impact • Interchange consistent with other PDNH interchanges	• Two bridges required - more expensive • Roundabout impedes free flow of minor road traffic
Option 3	• Maintains free flow of minor road traffic • Limited environmental impact • Interchange consistent with other PDNH interchanges	• Additional earthworks associated with loop ramps and crossings • Potential for high-speed right-angle collisions • May require HWL clearance, loop ramps may not facilitate HWL flyover

5 Cost Estimates

A preliminary cost rating respective to the other options is listed below. An approximate high-level estimate will be completed after feedback on options. A more accurate estimate by a Quantity Surveyor of one or more options can be arranged upon request.

1. Option 1 – Grade separated dog bone roundabout (lowest cost)
2. Option 2 – Grade separated roundabout
3. Option 3 – Parclo B4 (most expensive)

Regards

John Newman
Civil Engineer

Attachment – Interchange Options Sketches

Appendix B MRWA Meeting Minutes

28 November 2019

Project	North Ellenbrook District Structure Plan	From	Steve Barlow
Subject	PDNH interchange	Tel	+61 8 6222 8340
Venue/Date/Time	DAC / Tuesday 19 November 2:30pm	Job No	12511334
Copies to	Attendees, Steve McDermott (GHD)		
Attendees	Lindsay Broadhurst (MRWA) Ian Thompson (MRWA) Anika Bezaud (MRWA) Scott Vanson (Lendlease) Jeremy Cordina (Parcel Property) Fenualla O'Brien (Parcel Property) Steve Barlow (GHD) Jim McNeill (GHD) John Newman (GHD)	Apologies	N/A

Summary Minutes

- GHD provided a background on the options analysis undertaken for the potential locations of a new interchange with Perth Darwin National Highway.
- The interchange has been prompted by the planned residential developments on either side of the highway in the north Ellenbrook area – Parcel Property on the west and Lendlease on the east.
- MRWA provided in principle support for an interchange within the approximate 400 metre area between Warbrook and Maralla Roads proposed (see attached draft plan) on the basis urban land use approvals proceed.
- MRWA was comfortable with any proposed District Structure Plans (DSP) providing a general indication of an interchange location at this stage – subject to further refinement at the appropriate stage of the project.
- GHD advised that both Parcel and Lendlease were collaborating and had achieved a consensus on a general location (i.e. the 400 metre area).
- It was agreed by all that environmental considerations will be key as this impacted the NorthLink alignment – MRWA suggested the proponents speak with MRWA's environmental team members who worked on NorthLink. → **Lendlease to follow up**
- MRWA mentioned the constraint of a high water table throughout the area and that this may have a bearing on the final location of an interchange.

- MRWA emphasised the need to address the relationship and connectivity with the proposed industrial precinct to the north. This was likely to be more prevalent on the west side of PDNH but will still need to be considered and addressed by any Transport Impact Assessment (TIA) conducted as part of a DSP submission.
- MRWA enquired about the connectivity of the eastern DSP area with the north – Lendlease advised that connectivity is constrained due to environmentally sensitive land use (i.e. Western Swamp Tortoise habitat). This will be identified within the TIA and is unlikely to be an issue.
- MRWA advised that the dog bone configuration for the interchange shown in the draft plan would be suitable if the majority of traffic was to be light vehicles. However, should a reasonable proportion of heavy vehicles utilise the interchange (i.e. traffic associated with the industrial area to the north), a more appropriate design that better accommodates larger vehicles will be required. This should be acknowledged in the DSP TIA but determination of interchange form can be made in conjunction with MRWA's design team at concept design stage.
- MRWA advised that the cost of an interchange would likely be circa $40m-$50m.
- MRWA advised that funding would need to be via developer contributions. State Government support may be possible, but more likely in the case where there was benefit for the industrial area development to the north but this is not a preferred outcome for the proponents. Political lobbying is another potential avenue for funding support.

Appendix C Traffic survey data/ROM24 data

STREET NAME :	Banrock Dr extension	LOCATION:	South of Maralla Rd
SUBURB:	Ellenbrook	START DATE :	Friday 02 Aug 2019
FILE NAME :	Banrock-01NS0Individual84.txt	FINISH DATE :	Thursday 08 Aug 2019
SITE ID NUMBER :	Banrock-01	SPEED ZONE :	0
PREPARED BY :	Austraffic	ROAD CLASSIFICATION:	Local

		DIRECTION OF TRAVEL		
		TWO-WAY	Northbound	Southbound
TRAFFIC VOLUME:	Week Days Only Average	2,860	1,462	1,397
[VEH/DAY]	Total Survey Average	2,727	1,387	1,340
WEEK DAY PEAK AM	7:00	236	158	85
HOUR VOLUME: PM	15:00	269	125	170
PEAK DAY		Fri 02 Aug 2019	Fri 02 Aug 2019	Thu 08 Aug 2019
PEAK DAY VOLUME		3002	1567	1493
WEEKDAY PACE	15Kph Pace Starts	35	36	34
	% Pace Volume	84%	83%	85%
TOTAL SPEEDS:	85th Percentile	49	50	46
Km/Hr	Average	42.7	43.8	41.5
95th Percentile	Friday 02/08/19	52.4	53.4	50.3
	Saturday 03/08/19	51.6	52.4	49.5
	Sunday 04/08/19	51.3	52.1	50.4
	Monday 05/08/19	51.5	52.3	49.0
	Tuesday 06/08/19	52.8	53.8	49.2
	Wednesday 07/08/19	51.3	52.1	49.2
	Thursday 08/08/19	51.0	52.0	49.0
CLASSIFICATION % *:	Week Days CLASS 1 %	87.3%	84.1%	90.7%
	Week Days Commercial	10.8%	14.2%	7.3%

NOTES : (OBSERVATIONS)

* CLASS 1 - Short Vehicles up to 5.5m
Commercial - Classes 3 to 12 inclusive

STREET NAME :	Maralla Rd	LOCATION:	East of Railway Pde
SUBURB:	Ellenbrook	START DATE :	Friday 02 Aug 2019
FILE NAME :	Maralla-01EW0Individual84.txt	FINISH DATE :	Thursday 08 Aug 2019
SITE ID NUMBER :	Maralla-01	SPEED ZONE :	50
PREPARED BY :	Austraffic	ROAD CLASSIFICATION:	Local

		DIRECTION OF TRAVEL		
		TWO-WAY	Eastbound	Westbound
TRAFFIC VOLUME:	Week Days Only Average	644	331	313
[VEH/DAY]	Total Survey Average	674	347	327
WEEK DAY PEAK AM	7:00	54	33	27
HOUR VOLUME: PM	15:00	65	35	35
PEAK DAY		Sun 04 Aug 2019	Sun 04 Aug 2019	Sun 04 Aug 2019
PEAK DAY VOLUME		918	470	448
WEEKDAY PACE	15Kph Pace Starts	48	48	50
	% Pace Volume	68%	69%	70%
TOTAL SPEEDS:	85th Percentile	65	63	64
Km/Hr	Average	55.7	55.4	56.2
95th Percentile	Friday 02/08/19	72.8	72.9	70.9
	Saturday 03/08/19	71.7	71.5	70.5
	Sunday 04/08/19	69.2	71.4	66.6
	Monday 05/08/19	68.7	70.3	68.5
	Tuesday 06/08/19	69.5	71.7	68.6
	Wednesday 07/08/19	69.2	69.5	69.6
	Thursday 08/08/19	70.8	69.3	70.6
CLASSIFICATION % *:	Week Days CLASS 1 %	93.1%	93.2%	93.1%
	Week Days Commercial	5.0%	5.1%	4.9%

NOTES : (OBSERVATIONS)

STREET NAME :	Warbrook Rd	LOCATION:	East of Ellenbrook Rd
SUBURB:	Ellenbrook	START DATE :	Friday 02 Aug 2019
FILE NAME :	Warbrook-01EW0Individual84.txt	FINISH DATE :	Thursday 08 Aug 2019
SITE ID NUMBER :	Warbrook-01	SPEED ZONE :	90
PREPARED BY :	Austraffic	ROAD CLASSIFICATION:	Local

		DIRECTION OF TRAVEL		
		TWO-WAY	Eastbound	Westbound
TRAFFIC VOLUME: [VEH/DAY]	Week Days Only Average	1,501	748	754
	Total Survey Average	1,444	722	723
WEEK DAY PEAK HOUR VOLUME: AM	7:00	120	69	67
PM	15:00	146	73	73
PEAK DAY		Fri 02 Aug 2019	Fri 02 Aug 2019	Fri 02 Aug 2019
PEAK DAY VOLUME		1689	836	853
WEEKDAY PACE	15Kph Pace Starts	74	72	74
	% Pace Volume	58%	55%	62%
TOTAL SPEEDS: Km/Hr	85th Percentile	92	90	91
	Average	81.1	79.8	82.3
95th Percentile	Friday 02/08/19	98.6	97.4	98.1
	Saturday 03/08/19	97.7	97.1	96.3
	Sunday 04/08/19	95.3	95.7	95.1
	Monday 05/08/19	95.1	95.9	96.7
	Tuesday 06/08/19	99.7	97.1	99.4
	Wednesday 07/08/19	98.9	97.6	98.6
	Thursday 08/08/19	96.2	96.1	96.3
CLASSIFICATION % *:	Week Days CLASS 1 %	74.0%	73.2%	74.8%
	Week Days Commercial	23.1%	24.0%	22.2%
NOTES : (OBSERVATIONS)				

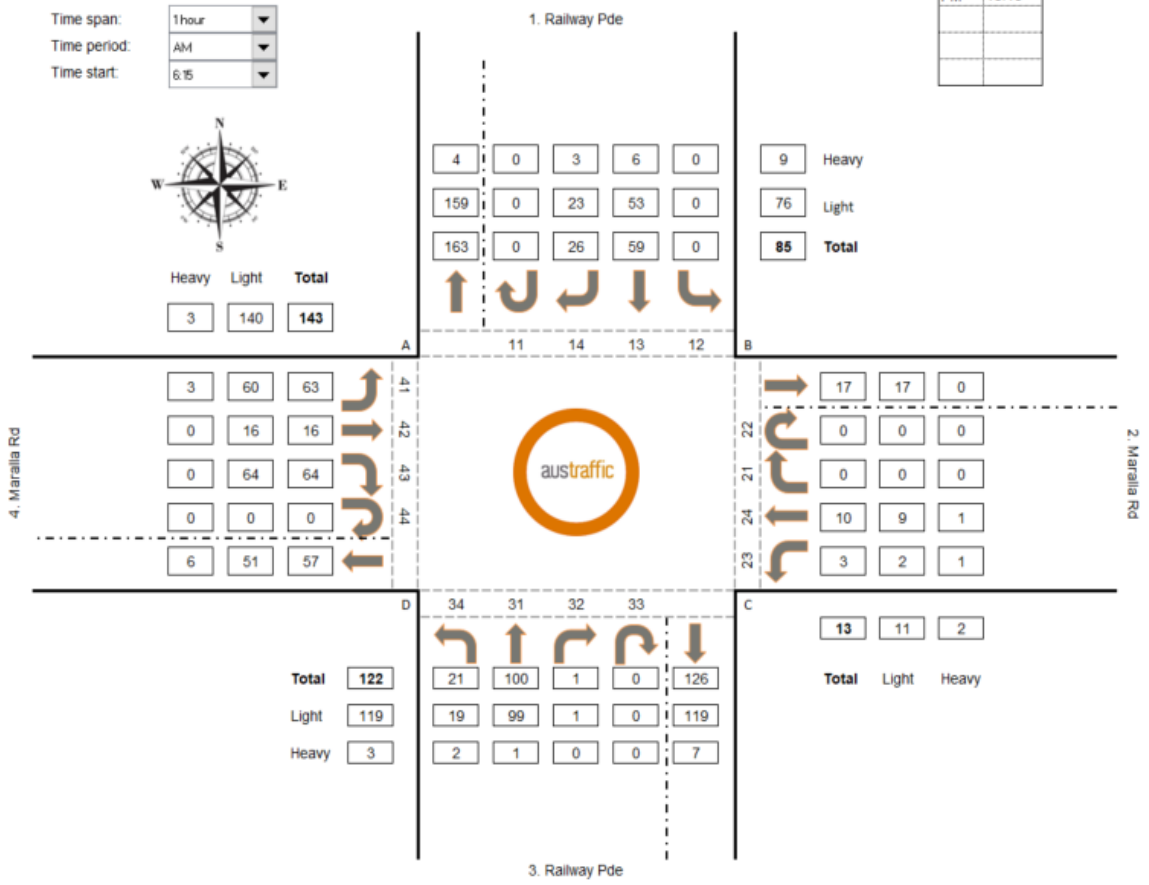
austraffic

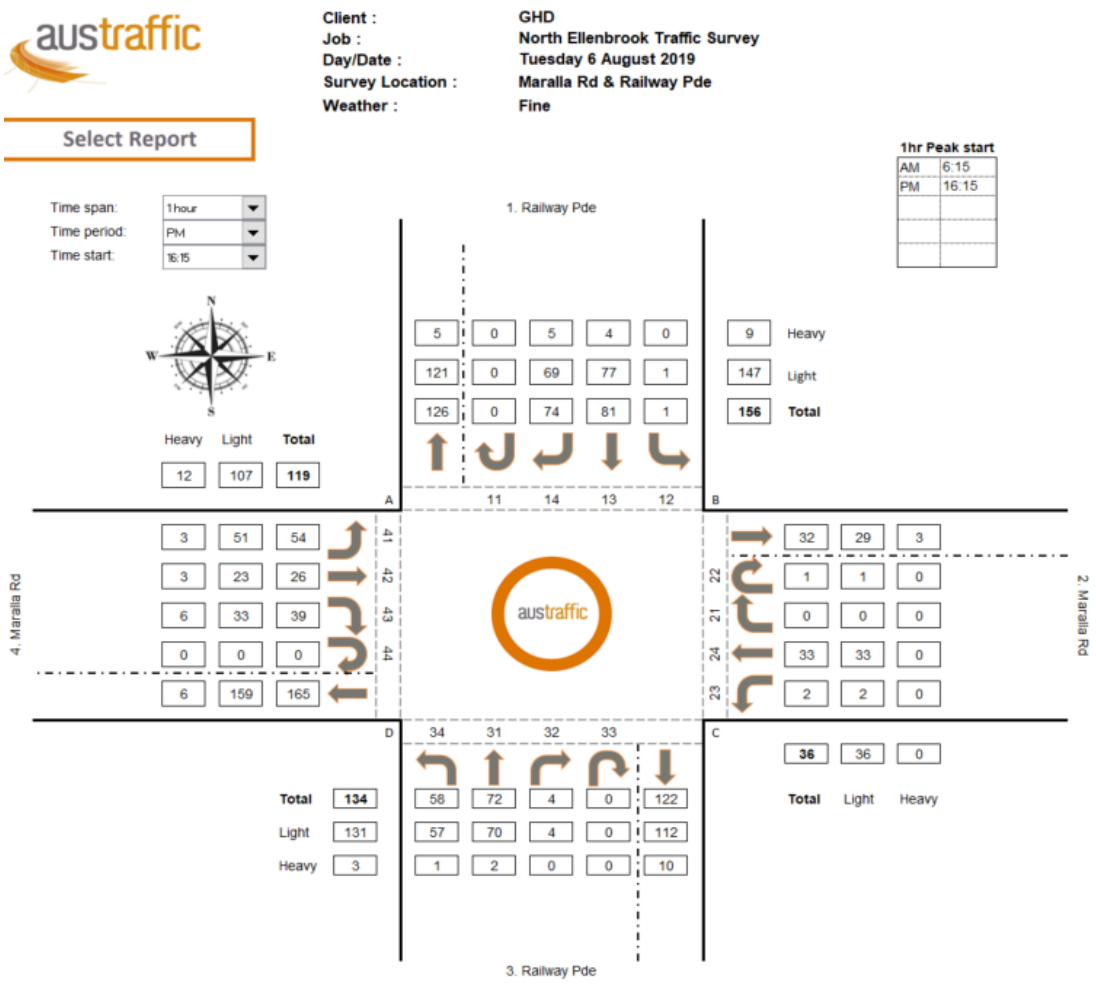
Client : GHD
Job : North Ellenbrook Traffic Survey
Day/Date : Tuesday 6 August 2019
Survey Location : Maralla Rd & Railway Pde
Weather : Fine

Select Report

Time span: 1hour
Time period: AM
Time start: 6:15

1hr Peak start	
AM	6:15
PM	16:15




austraffic
Client : GHD
Job : North Ellenbrook Traffic Survey
Day/Date : Tuesday 6 August 2019
Survey Location : Maralla Rd & Railway Pde
Weather : Fine
Select Report
1hr Peak start
AM 6:15
PM 16:15
Time span: 1hour
Time period: PM
Time start: 16:15
1. Railway Pde
2. Maralla Rd
3. Railway Pde
4. Maralla Rd
Heavy Light Total
12 107 119
5 0 5 4 0 9 Heavy
121 0 69 77 1 147 Light
126 0 74 81 1 156 Total
11 14 13 12
3 51 54
3 23 26
6 33 39
0 0 0
6 159 165
41 42 43 44
32 29 3
1 1 0
0 0 0
33 33 0
2 2 0
22 21 24 23
34 31 32 33
58 72 4 0 122
57 70 4 0 112
1 2 0 0 10
Total 134
Light 131
Heavy 3
36 36 0
Total Light Heavy
A
B
C
D
austraffic

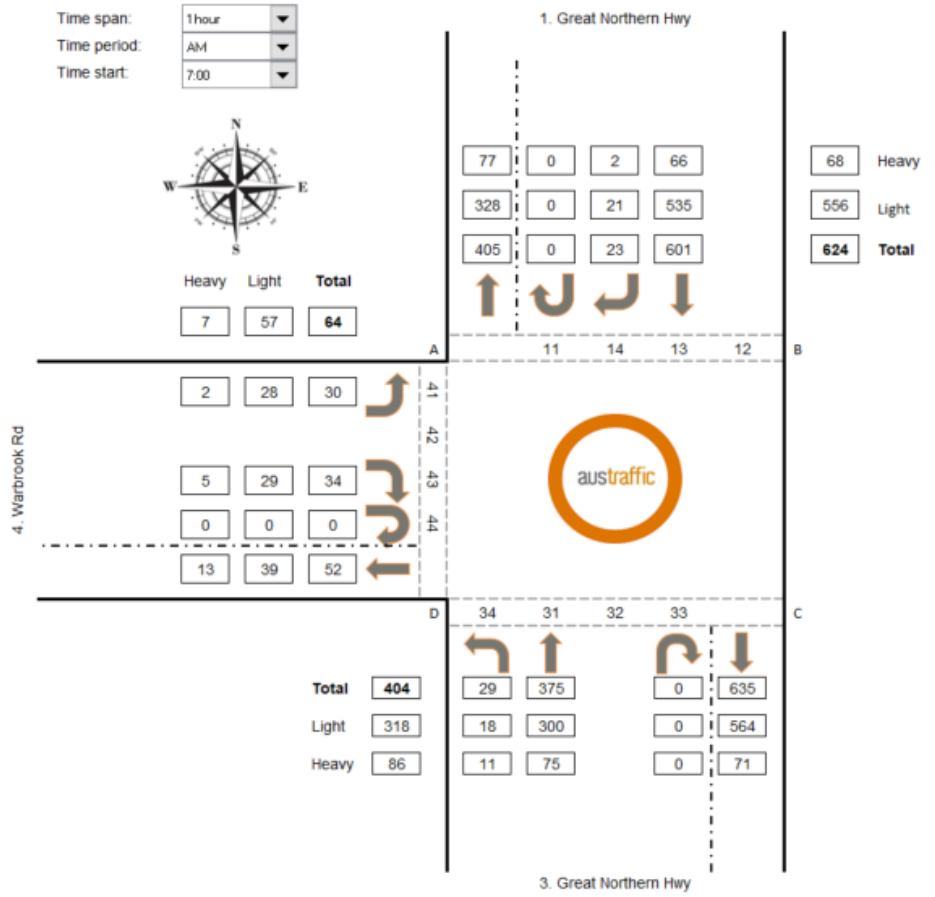
austraffic

Client :	**GHD**
Job :	**North Ellenbrook Traffic Survey**
Day/Date :	**Tuesday 6 August 2019**
Survey Location :	**Warbrook Rd & Great Northern Hwy**
Weather :	**Fine**

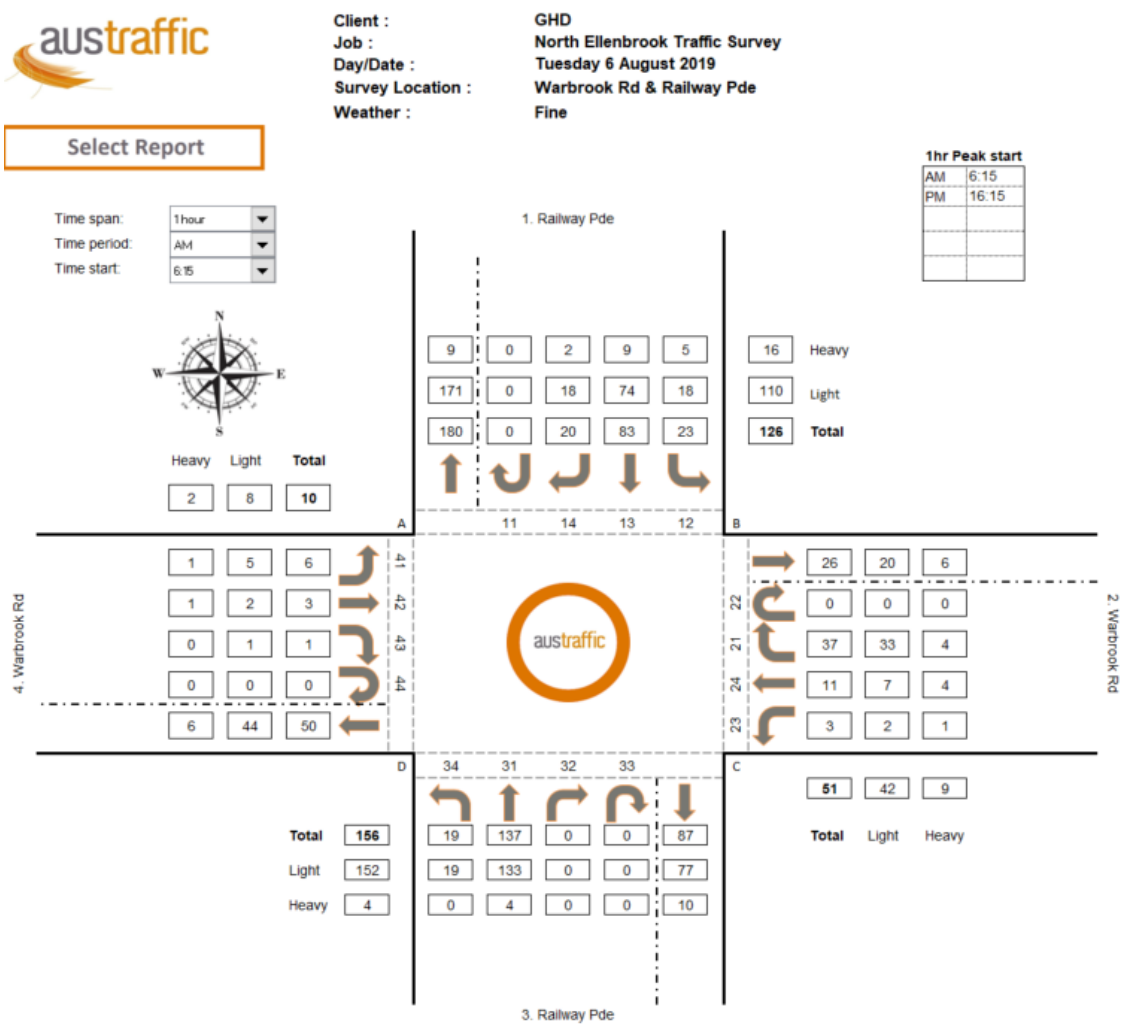
Select Report

1hr Peak start	
AM	7:00
PM	16:00

Time span: 1hour
Time period: AM
Time start: 7:00




austraffic
Client : GHD
Job : North Ellenbrook Traffic Survey
Day/Date : Tuesday 6 August 2019
Survey Location : Warbrook Rd & Great Northern Hwy
Weather : Fine
Select Report
1hr Peak start
AM 7:00
PM 16:00
Time span: 1hour
Time period: PM
Time start: 16:00
1. Great Northern Hwy
3. Great Northern Hwy
4. Warbrook Rd
Heavy Light Total
10 47 57
55 0 4 68
597 0 41 378
652 0 45 446
72 Heavy
419 Light
491 Total
11 14 13 12
4 24 28
6 23 29
0 0 0
7 80 87
41 42 43 44
34 31 32 33
Total 666
Light 612
Heavy 54
42 624 0 475
39 573 0 401
3 51 0 74
A B C D
austraffic


austraffic
Client : GHD
Job : North Ellenbrook Traffic Survey
Day/Date : Tuesday 6 August 2019
Survey Location : Warbrook Rd & Railway Pde
Weather : Fine
Select Report
1hr Peak start
AM 6:15
PM 16:15
Time span: 1hour
Time period: AM
Time start: 6:15
1. Railway Pde
2. Warbrook Rd
3. Railway Pde
4. Warbrook Rd
Heavy Light Total
2 8 10
9 0 2 9 5
171 0 18 74 18
180 0 20 83 23
16 Heavy
110 Light
126 Total
11 14 13 12
A
B
C
D
1 5 6
1 2 3
0 1 1
0 0 0
6 44 50
41 42 43 44
26 20 6
0 0 0
37 33 4
11 7 4
3 2 1
22 21 24 23
34 31 32 33
19 137 0 0 87
19 133 0 0 77
0 4 0 0 10
Total 156
Light 152
Heavy 4
51 42 9
Total Light Heavy
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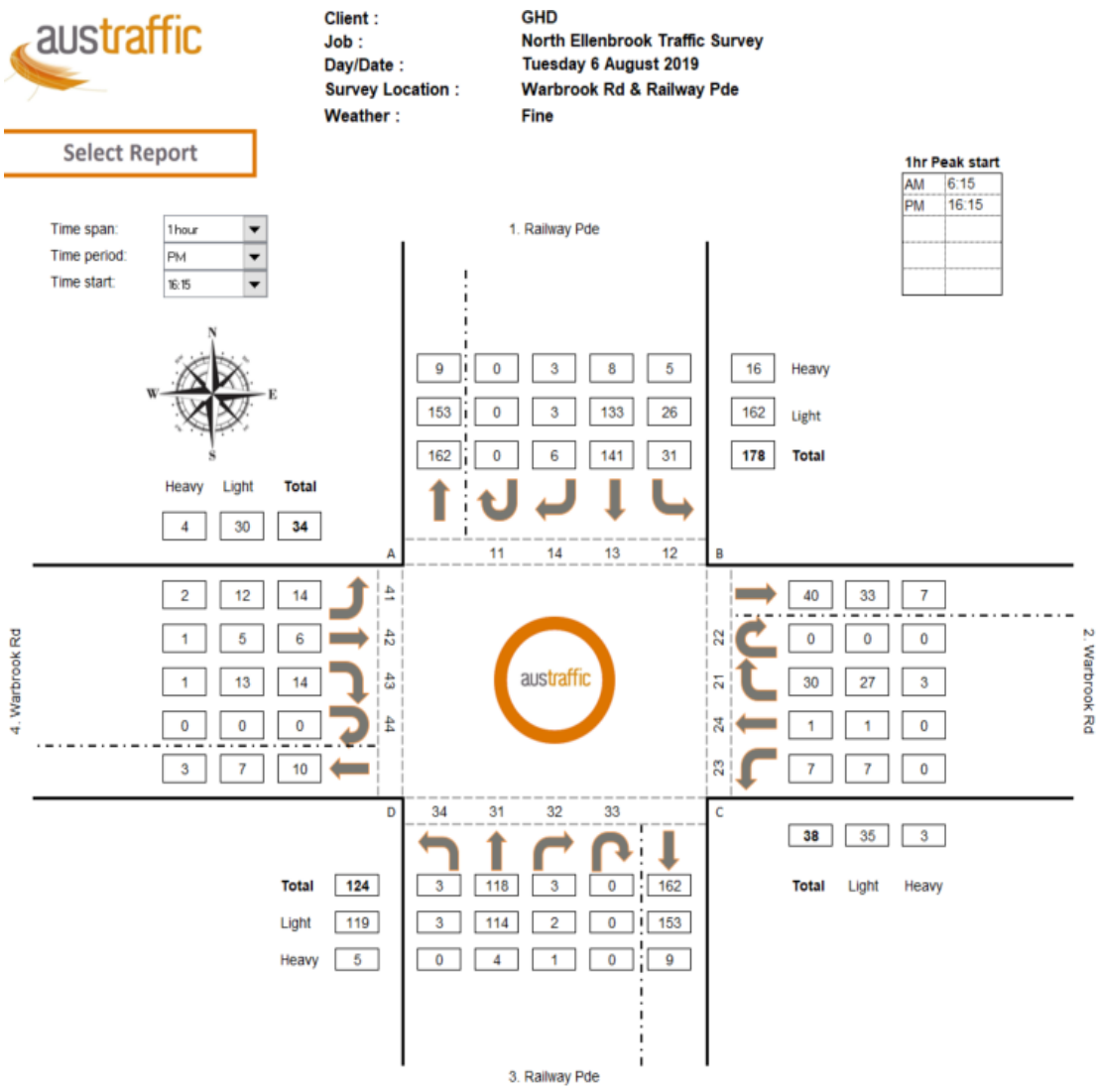
austraffic
Client : GHD
Job : North Ellenbrook Traffic Survey
Day/Date : Tuesday 6 August 2019
Survey Location : Warbrook Rd & Railway Pde
Weather : Fine
Select Report
1hr Peak start
AM 6:15
PM 16:15
Time span: 1hour
Time period: PM
Time start: 16:15
1. Railway Pde
2. Warbrook Rd
3. Railway Pde
4. Warbrook Rd
Heavy Light Total
4 30 34
9 0 3 8 5 16 Heavy
153 0 3 133 26 162 Light
162 0 6 141 31 178 Total
A 11 14 13 12 B
2 12 14
1 5 6
1 13 14
0 0 0
3 7 10
41 42 43 44
40 33 7
0 0 0
30 27 3
1 1 0
7 7 0
22 21 24 23
D 34 31 32 33 C
Total 124
Light 119
Heavy 5
3 118 3 0 162
3 114 2 0 153
0 4 1 0 9
38 35 3
Total Light Heavy
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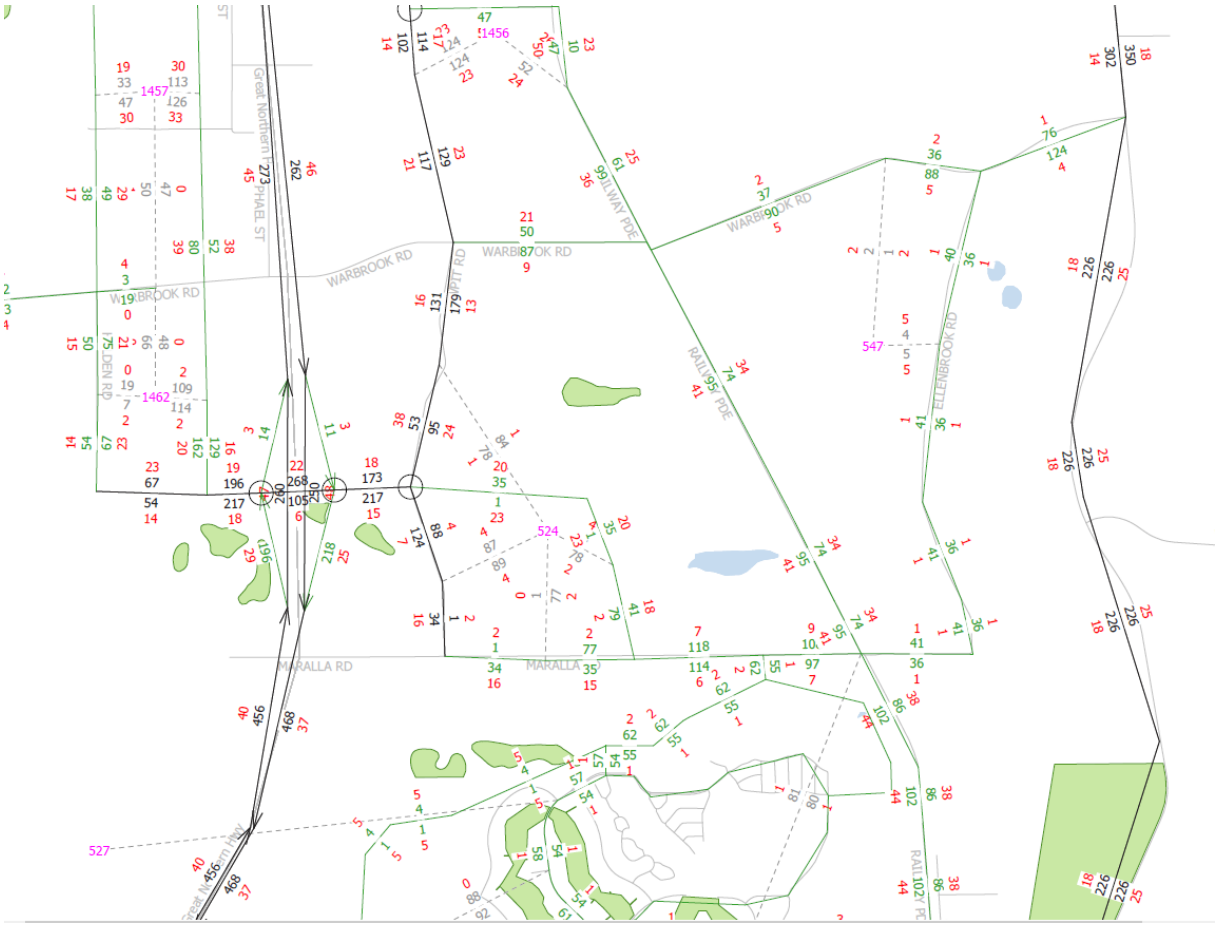
ROM24 Volumes 2041 Network ultimate land use



GHD

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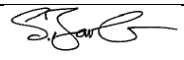
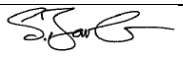
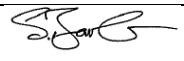
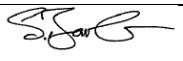
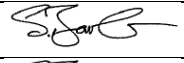
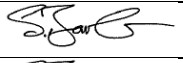
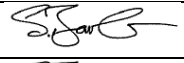
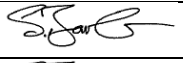
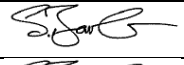
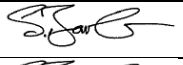
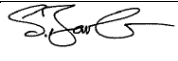
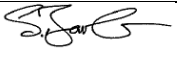
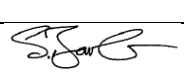
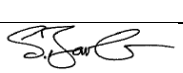
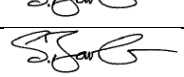
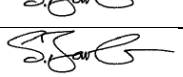
G/Projects/12511334/Tech/North Ellenbrook District Structure Plan TIA Lendlease

Document Status

Revision	Author	Reviewer		Approved for Issue		
		Name	Signature	Name	Signature	Date
A	S McDermott	S Barlow		S Barlow		15/11/2019
B	S McDermott	S Barlow		S Barlow		29/11/2019
C	S McDermott	S Barlow		S Barlow		05/12/2019
D	S McDermott	S Barlow		S Barlow		13/12/2019
E	S McDermott	S Barlow		S Barlow		17/12/2019
0	S McDermott, S Barlow	S Barlow		S Barlow		22/05/2020
1	S McDermott	S Barlow		S Barlow		09/02/2021
2	S McDermott, S Barlow	S Barlow		S Barlow		16/05/2022
3	S McDermott, S Barlow	S Barlow		S Barlow		07/07/2022

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