Client
City of Greater Geelong

Date
8 March 2023

Marshall Precinct Structure Plan

Traffic Impact Assessment

Armstrong Creek, Geelong

Planning
Transport
Urban Design
Waste Management

ratio:

ratio.com.au

Project
Armstrong Creek, Geelong

Prepared for
City of Greater Geelong

Our reference
19703T

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D01	14-12-2022	Draft	AW	AW
F01	15-02-2023	Final	AW	AW
F02	08-03-2023	Final	AW	AW

Table of Contents

Table of Figures

Table of Tables

1. Introduction

1.1. Background

Ratio Consultants has been engaged by the City of Greater Geelong (CoGG) to prepare a Traffic Impact Assessment (TIA) for the updated Marshall Precinct Structure Plan (the Marshall PSP).

The Marshall PSP is part of the Armstrong Creek growth area which covers approximately 2,500 hectares of land around the south of Geelong. The growth area will include residential, employment and activity precincts and will ultimately accommodate a projected 22,000 homes and 22,000 jobs.

This report describes the existing and planned future transportation and land use environments. It then describes the proposed land uses and transport networks within the Marshall PSP and estimates likely traffic generation and distribution.

1.2. Reference Documents

The following documents were provided by CoGG and used in the preparation of this assessment:

- The 2019 draft Marshall PSP
- The 2019 draft Marshall Future Urban Structure (FUS) plan
- The revised Marshall FUS plan (Revision 01, 13.02.23); and
- Marshall Precinct Structure Plan, Preliminary Transport Infrastructure Assessment, V190014, 9 July 2019, Cardno.

Reference was also made to the following documents[1]:

- Marshall station upgrade factsheet, Rail Projects Victoria (RPV)
- Shared user path upgrade fact sheet, RPV

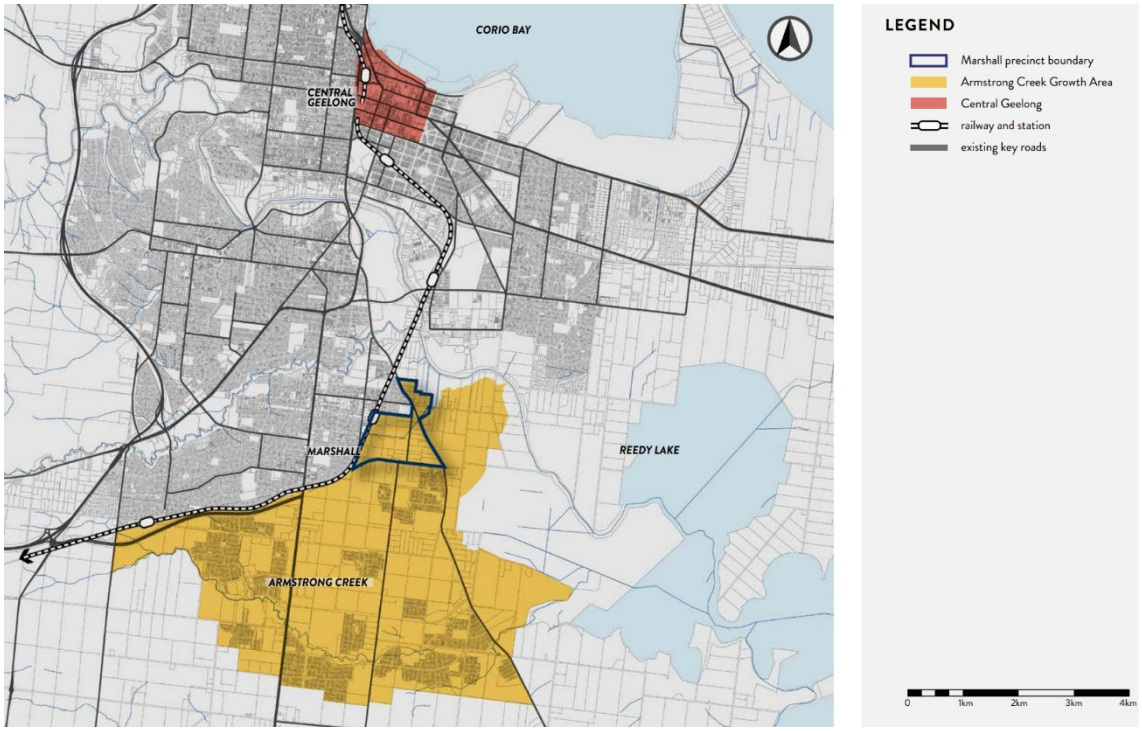
[1] All sourced from: https://engage.vic.gov.au/marshall-station-and-surf-coast-hwy-level-crossing-consultation

2. Existing Conditions

2.1. Location

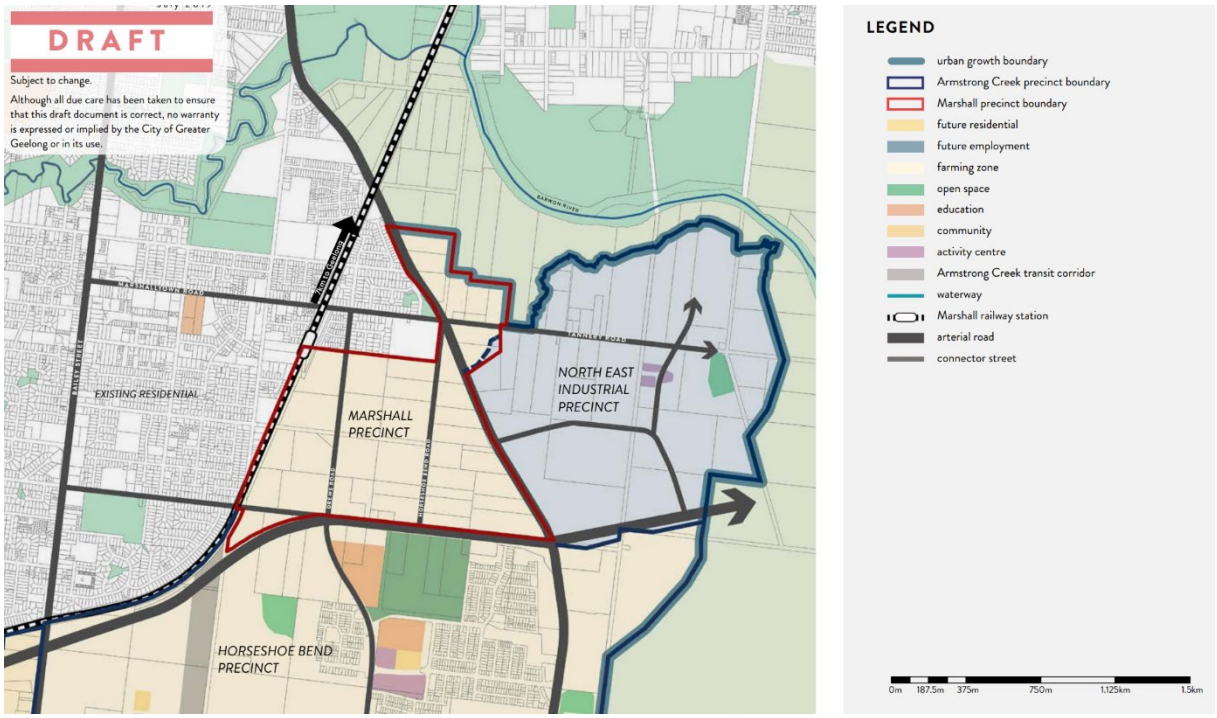
The Marshall PSP is the northern-most PSP in the Armstrong Creek Urban Growth Area (ACUGA). It is bounded by the established suburb of Grovedale to the west, the North East Industrial Precinct (NEIP) to the east and the Horseshoe Bend Precinct (HBP) to the south. The site location is shown below as Figure 2-1 and Figure 2-2.

Figure 2-1: Site Location (City Context)



Source: CoGG

Figure 2-2: Site Location (Local Context)



Source: CoGG

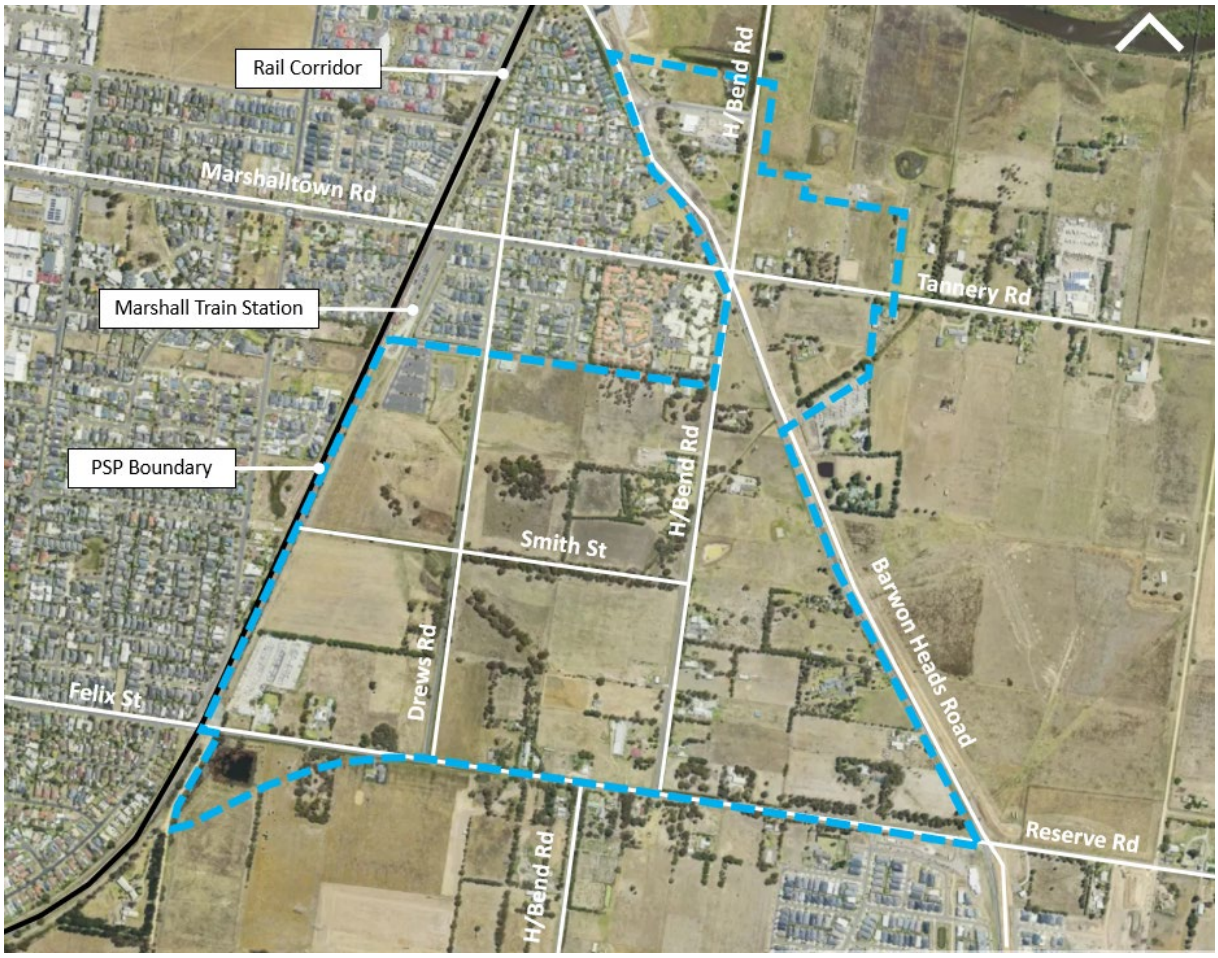
The Geelong-Warrnambool Rail Corridor forms the western boundary of the precinct. Marshall Train Station is located at the north-western corner of the precinct (straddling the PSP boundary). The station has vehicle access from Marshalltown Road and Drews Road. Torquay Road (the Surf Coast Highway) is located approximately 1.2km west of the precinct.

Barwon Heads Road forms the eastern boundary of most of the precinct, between Reserve Road in the south and Marshalltown Road in the north. The Marshall PSP also includes a pocket of land on the eastern side of Barwon Heads Road, around the northern section of Horseshoe Bend Road and Tannery Road.

Reserve Road (and the future Bellarine Link which is discussed later in Section 4.2) forms the southern boundary of the precinct. Other transport corridors in the precinct include Drews Road and Horseshoe Bend Road, which both run approximately north-south, and Smith Street (unformed) which runs east-west.

These corridors and the existing land use environment in and around the Marshall PSP area are shown as Figure 2-3 below.

Figure 2-3: Existing Environment



Source: www.landchecker.com.au (Aerial Dated January 2022)

Figure 2-3 illustrates that most of the land within the precinct is currently used for rural or rural-residential purposes. There are also some existing rural/commercial activities including caravan/boat storage and agricultural services. Development in the Horseshoe Bend PSP area can be seen on the southern side of Reserve Road.

2.2. Existing Road Network

Road Hierarchy

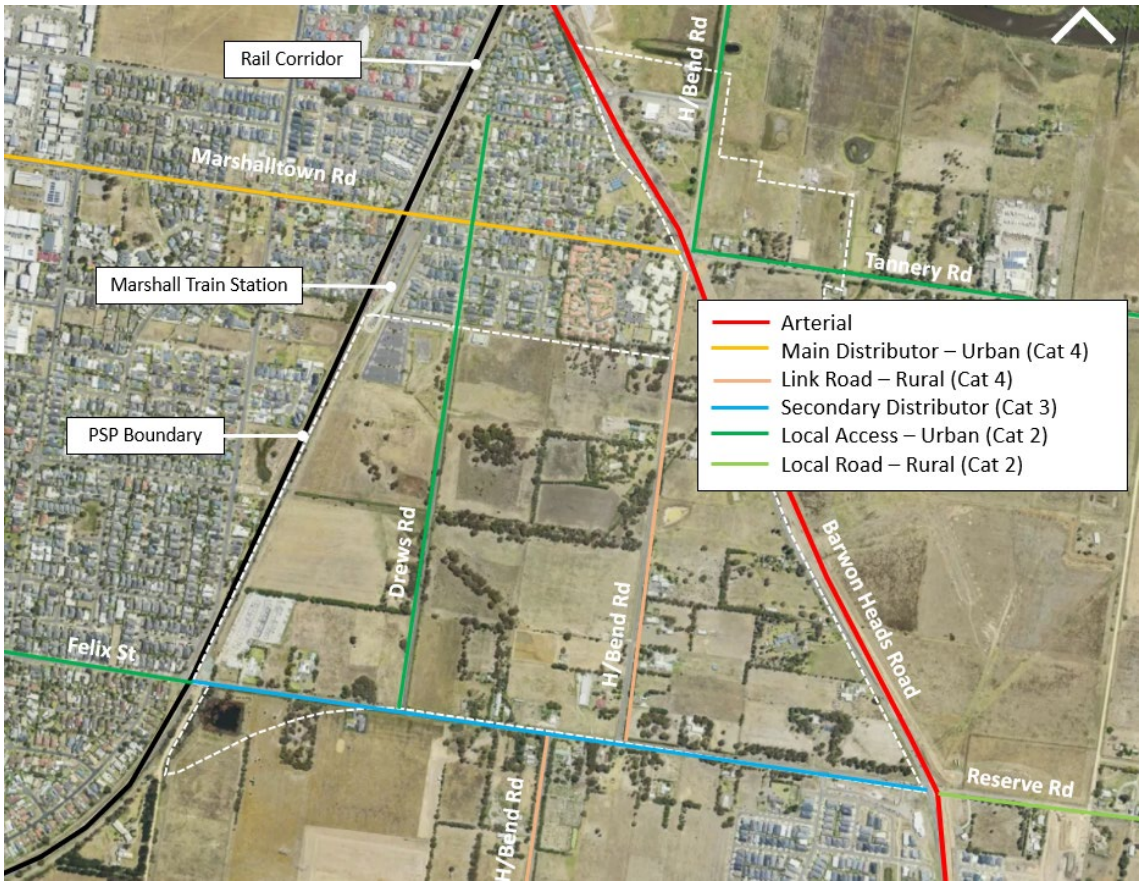
Torquay Road and Barwon Heads Road form the arterial transport network in this part of Geelong. They are both declared arterial roads managed by the Department of Transport (DoT).

Other roads in the area are managed by CoGG. Marshalltown Road and Horseshoe Bend Road carry the highest classifications, being a main distributor (urban) and link road (rural), respectively. Reserve Road is classified as a secondary distributor between Torquay Road and Barwon Heads Road. It reduces to local road status to the east of Barwon Heads Road.

Drews Road, Tannery Road and the northern section of Horseshoe Bend Road are classified as local access roads.

The hierarchical classification of key roads in and around the precinct is summarised as Figure 2-4.

Figure 2-4: Existing Road Hierarchy



Source: www.landchecker.com.au (Aerial Dated January 2022), annotations added.

Barwon Heads Road

Barwon Heads Road connects Geelong with Ocean Grove and Barwon Heads. Through the PSP area it was formerly a two-lane two-way rural road with a level crossing of the railway line located approximately 700m north of Marshalltown Road.

At the time of writing this report, the 4km section between Settlement Road (in Geelong) and Reserve Road was being duplicated by Major Road Projects Victoria (MRPV). The duplication project is discussed further at Section 4.1.

Figure 2-5 and Figure 2-6 show examples of the existing form of Barwon Heads Road around the Marshall PSP area.

Figure 2-5: Barwon Heads Road/Marshalltown Road Intersection (Under Construction)

Source: www.landchecker.com.au (Aerial Dated October 2022)

Figure 2-6: Barwon Heads Road/Reserve Road Intersection (Under Construction)

Source: www.landchecker.com.au (Aerial Dated October 2022)

Marshalltown Road

Marshalltown Road runs generally east-west from Torquay Road to Barwon Heads Road. Near the Marshall PSP area it is formed to a width of approximately 12m. This provides one traffic lane in each direction and shoulders that generally enable unrestricted on-street parking, with intermittent kerbside bus stops.

There is a level crossing adjacent to Marshall Train Station. The posted speed limit is 60km/h with some sections subject to 40km/h school zones.

Intersections along Marshalltown Road are treated mostly as priority T-intersections or crossroads. Single lane roundabouts are provided at Bailey Street and Barwarre Road. The latter has raised pedestrian crossings on all approaches. Examples of the existing form of Marshalltown Road are shown as Figure 2-7, Figure 2-8 and Figure 2-9.

Figure 2-7: Marshalltown Road, looking east from near Tamala Avenue

Figure 2-8: Marshalltown Road/Barwarre Road Roundabout

Figure 2-9: Marshalltown Road Level Crossing

Tannery Road

Tannery Road continues the alignment of Marshalltown Road on the eastern side of Barwon Heads Road. It has a rural formation with a sealed width of approximately 6m. It operates with

a posted speed limit of 80km/h. The first section was under a 40km/h temporary limit at the time of writing this report, due to works on Barwon Heads Road.

Consistent with the rural land use context, Tannery Road has no formal walking or cycling infrastructure. Tannery Road is shown below as Figure 2-10.

Figure 2-10: Tannery Road, looking west towards Barwon Heads Road

Reserve Road

Reserve Road runs generally east-west. It forms the southern boundary of the Marshall PSP area and the northern boundary of the Horseshoe Bend precinct. As it moves away from Barwon Heads Road it has a typical sealed width of 6-7m, with some wider sections associated with urban development in the Horseshoe Bend precinct.

The posted speed limit is 60km/h. Sideroad intersections including the intersection with Drews Road are priority controlled. Many of the roads that intersect with Reserve Road have been closed (either temporarily or permanently) as a result of urban transition and/or major infrastructure projects.

As Reserve Road moves west across the railway corridor it becomes more urban, with a formed width of around 10m. Reserve Road meets Torquay Road at a priority-controlled intersection where all turning movements are permitted. Felix Street forms the western leg and operates under Stop control.

Examples of the existing form of Reserve Road are shown as Figure 2-11, Figure 2-12, and Figure 2-13.

Figure 2-11: Reserve Road looking west from Barwon Heads Road

Figure 2-12: Reserve Road/Horseshoe Bend Road (North) Intersection

Figure 2-13: Reserve Road/Drews Road Intersection

Horseshoe Bend Road

Horseshoe Bend Road is in a state of transition because of development in the Horseshoe Bend PSP area and the Barwon Heads Road duplication. The section in the Marshall PSP area, between Barwon Heads Road and Reserve Road, has been closed at its northern end (see Figure 2-5) and is providing local property access only. This is a temporary traffic management measure that will become a permanent closure.

The road has a sealed width of 6-7m and a posted speed limit of 80km/h. North of Barwon Heads Road, Horseshoe Bend Road continues as an unsealed road, approximately 4m wide.

The existing form of Horseshoe Bend Road is shown as Figure 2-14.

Figure 2-14: Horseshoe Bend Road looking north, from north of Reserve Road

Drews Road

Drews Road runs approximately north-south between Marshalltown Road and Reserve Road. For its first 200m (approximately) south from Marshalltown Road it has an urban formation. It is sealed to a width of approximately 9.5m which enables two-way traffic movement and parking on both sides. Footpaths are provided on both sides of the road. The intersection with Marshalltown Road is a priority-controlled crossroads.

Drews Road provides access to an established residential area as well as Marshall Station and its carparks. It continues south to Reserve Road with a rural cross-section and a sealed width of approximately 7m. The posted speed limit is 60km/h.

Examples of the existing form of Drews Road are shown as Figure 2-15 and Figure 2-16.

Figure 2-15: Drews Road/Marshall Station Access

Figure 2-16: Drews Road looking north, from north of Reserve Road

Smith Street

Smith Street is an unmade road that runs east-west across the Marshall PSP area from the rail corridor to Horseshoe Bend Road.

The section between Drews Road and Horseshoe Bend Road includes a walkway and is partially covered by an Environmental Significance Overlay (ESO). This area is shown as Figure 2-17.

Figure 2-17: Smith Street, looking east from Drews Road

2.3. Existing Traffic Volumes

2.3.1 Daily Volumes

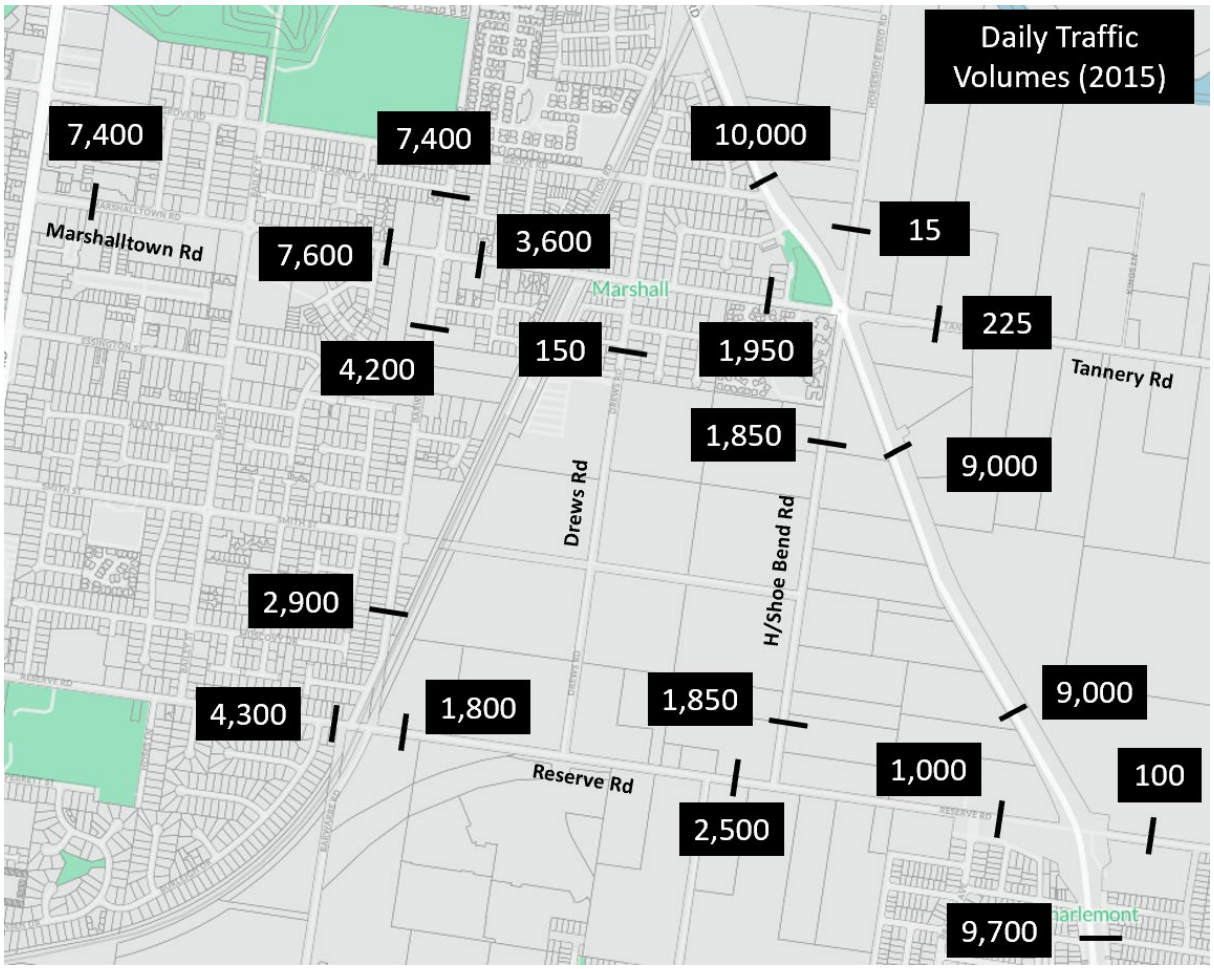
Traffic volumes on roads in and around the Marshall PSP area have previously been collected by CoGG for the purpose of other studies. This data represents conditions in the area as surveyed in 2015. Since this time the area has seen significant land use changes and a series of temporary and permanent changes to the road network. Conditions remain in a state of change at the time of writing this report and therefore more recent traffic volume data has not been collected.

These volumes are also summarised in Table 2-1 and on Figure 2 -18.

Table 2-1: Daily Traffic Volumes - Existing

Barwon Heads Road	
North of Marshalltown Road	10,000 vehicles per day (vpd)
South of Marshalltown Road	9,000 vpd
South of Reserve Road	9,700 vpd
Marshalltown Road	
West of Barwon Heads Road	1,950 vpd
East of Barwarre Road	3,600 vpd
West of Barwarre Road	7,600 vpd
Tannery Road	
East of Barwon Heads Road	225 vpd
Horseshoe Bend Road	
North of Barwon Heads Road	15 vpd
South of Barwon Heads Road	1,850 vpd
Drews Road	
South of Marshalltown Road	150 vpd
Reserve Road	
West of Barwon Heads Road	1,000 vpd
Between Horseshoe Bend Road North and South	2,500 vpd
East of Barwarre Road	1,800 vpd
West of Barwarre Road	4,300 vpd
Barwarre Road	
North of Marshalltown Road	7,400 vpd
South of Marshalltown Road	4,200 vpd
North of Reserve Road	2,900 vpd

Figure 2 -18: Existing Daily Traffic Volumes (2015)



Source: Base map from Landchecker, annotations added

2.4. Sustainable Transport

Public Transport

The public transport network in the area is centred on Marshall Station, which is on the V/Line Geelong-Warrnambool line. The following bus services also operate in the area and call at Marshall Station:

— 40 Geelong Station – Deakin Uni via Breakwater

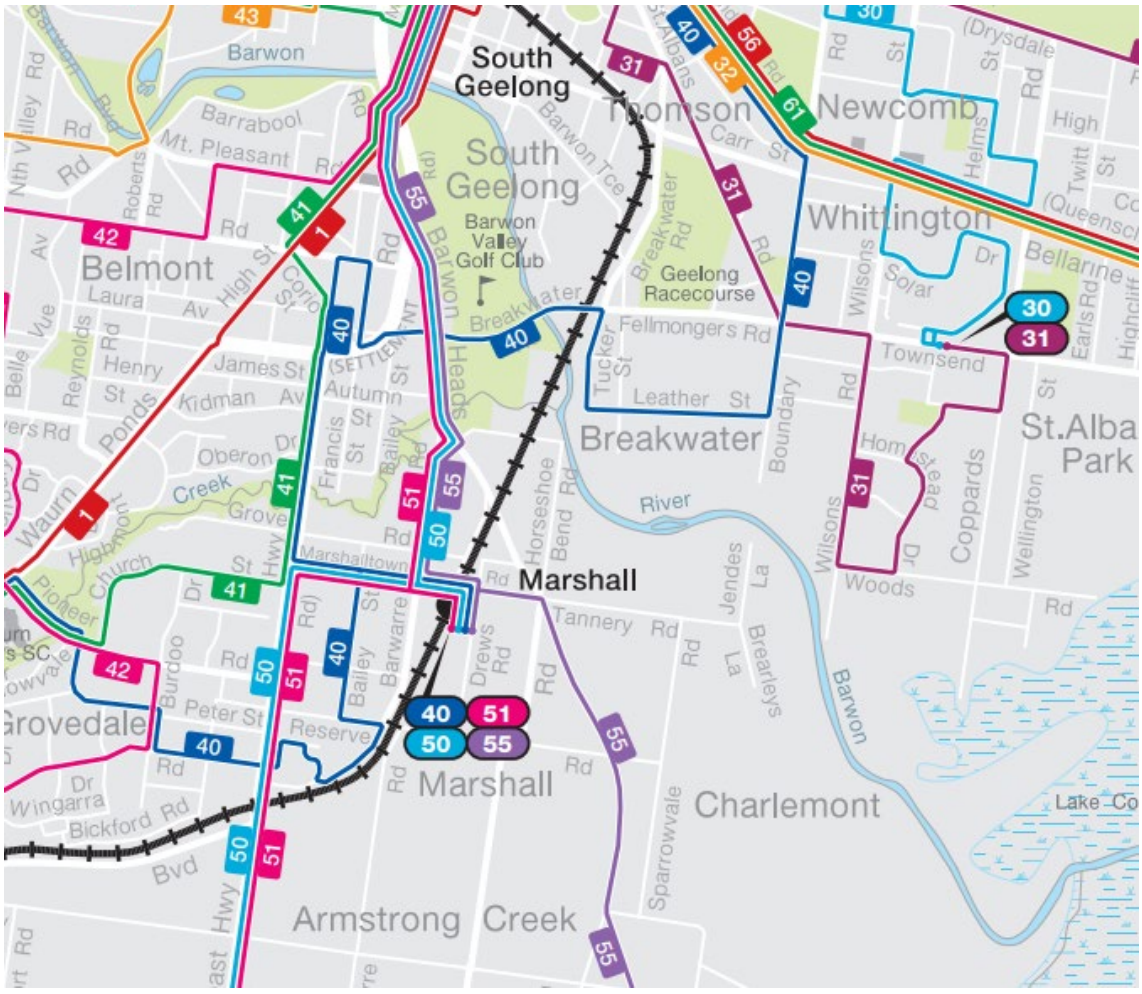
— 50 Geelong Station – Jan Juc via Marshall Station and Fischer Street

— 51 Geelong Station – Jan Juc via Marshall Station

— 55 Geelong Station – Ocean Grove via Barwon Heads

The public transport map for the area is shown as Figure 2-19.

Figure 2-19: Public Transport Map



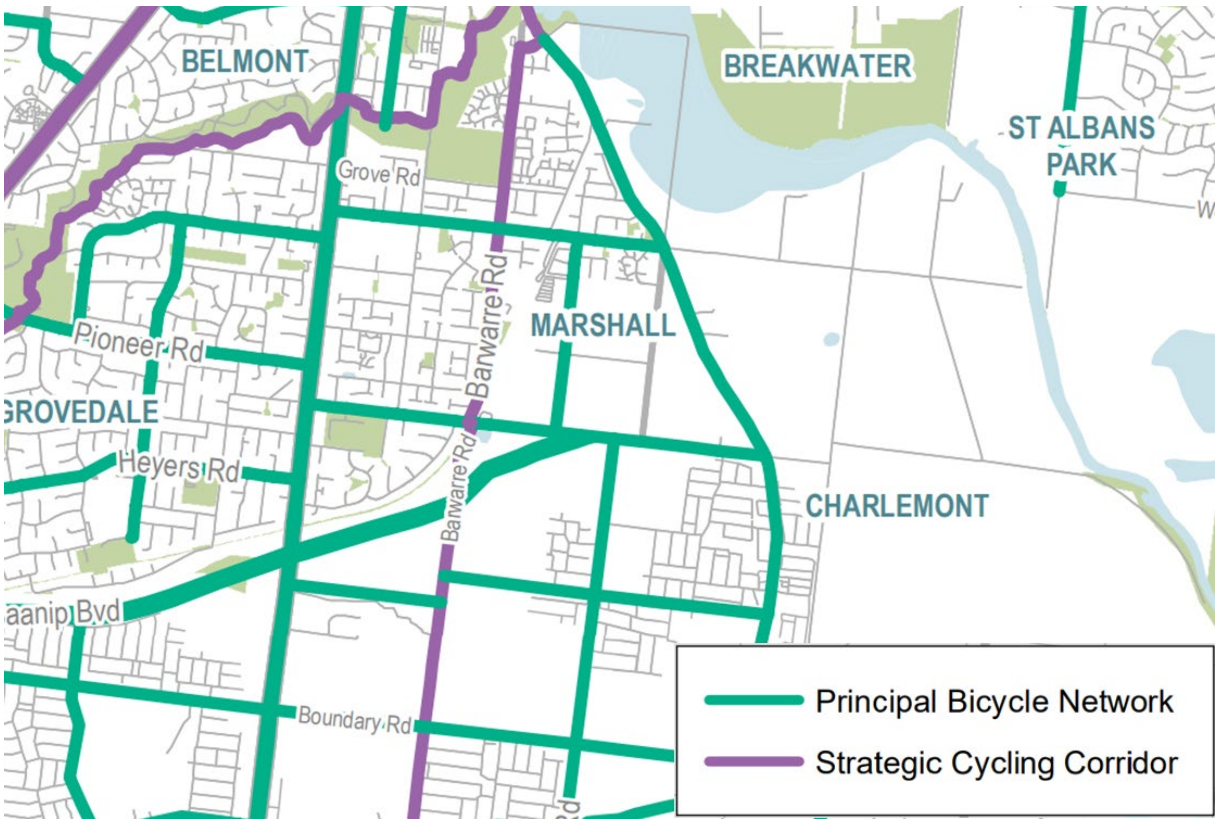
Source: PTV

Pedestrian and Cycle Network

There is limited pedestrian and cycling infrastructure in the PSP area, which reflects the existing rural character of the area. New footpaths and cycle paths are being introduced as part of the various upgrade projects described later in this report.

The Principal Bicycle Network (PBN) and Strategic Cycling Corridors (SCCs) in the area are shown below as Figure 2-20.

Figure 2-20: PBN and SCC



Source: CoGG

3. Armstrong Creek Urban Growth Plan

3.1. Vision and Objectives

The Armstrong Creek Urban Growth Plan (ACUGP) was adopted by CoGG in May 2008 and amended in May 2010 and September 2012. The overall movement and access vision for the area is:

— The potential will be explored for improvements to Marshall Station and for new, high-quality public transport services to serve the Armstrong Creek community.

— Public transport services will be provided from the outset, offering frequent and reliable services along dedicated corridors to key destinations including railway stations, central Geelong, Deakin University and Torquay.

— Development will be organised to ensure that all homes are within a short walk of public transport, reducing reliance on private cars.

— Torquay Road, Barwon Heads Road and a future link to the Geelong Ring Road will be developed as urban boulevards, continuing to provide good access into and out of the Armstrong Creek area without severing the communities on either side.

— Additional main roads will be developed to provide good vehicle access throughout the growth area. The streets will be designed to provide a comprehensive network of safe, direct and attractive cycle paths and footpaths for commuter and recreational purposes.

— This, in combination with the provision of daily needs close to all homes, will enable people to walk or cycle to local destinations such as neighbourhood shops, public transport, workplaces, primary schools and parks, supporting healthy lifestyles and avoiding social isolation.

Movement and access principles that are specifically relevant to the Marshall PSP include:

— (P 8.4) A comprehensive local public transport system should be provided. These services should:

- Travel on routes that link all activity nodes and pass within 600 metres of all dwellings;
- Be frequent enough that passengers are willing to just turn up without consulting a timetable;
- Incorporate stops with a high level of passenger amenity, including bicycle parking, real-time information, good lighting and compliance with the Disability Discrimination Act; in accordance with Clause 56 of the Greater Geelong Planning Scheme, and
- Be linked to central and North Geelong using SmartBus principles.

— (P 8.6) Public transport services should be provided at the outset of development.

— (P 8.7) A comprehensive pedestrian and bicycle path network should be provided, integrated with existing and proposed external municipal bicycle network links along Surf Coast Highway (Torquay Road), Mt Duneed Road, Barwon Heads Road, Horseshoe Bend Road and Boundary Road.

— (P 8.9) A network of connector streets should be provided across the growth area spaced approximately 800 metres apart and aligned to provide convenient access to the activity centres, as shown in Figure 4.8.1. In accordance with Clause 56 of the Greater Geelong Planning Scheme, these streets should have:

  - One traffic lane in each direction;
  - Generous footpaths on both sides;
  - Shared or dedicated cycle paths on both sides;
  - Kerbside parking on both sides; and
  - Development frontages on both sides.

— (P 8.10) The local street network should be highly interconnected, in accordance with Clause 56 of the Greater Geelong Planning Scheme, with most local streets connected at both ends.

— (P 8.11) A new link road (the "east-west link road") should be provided linking Anglesea Road (the Geelong Ring Road) with the Bellarine Highway, broadly on the alignment shown in Figure 4.8.1.

— (P 8.12) Provision should be maintained for Barwon Heads Road to be widened to two lanes in each direction.

— (P 8.13) Provision should be made for grade-separated crossings of the existing rail line at Barwon Heads Road, Torquay Road and the east-west link road.

— (P 8.15) All streets should be edged by development frontages or parks.

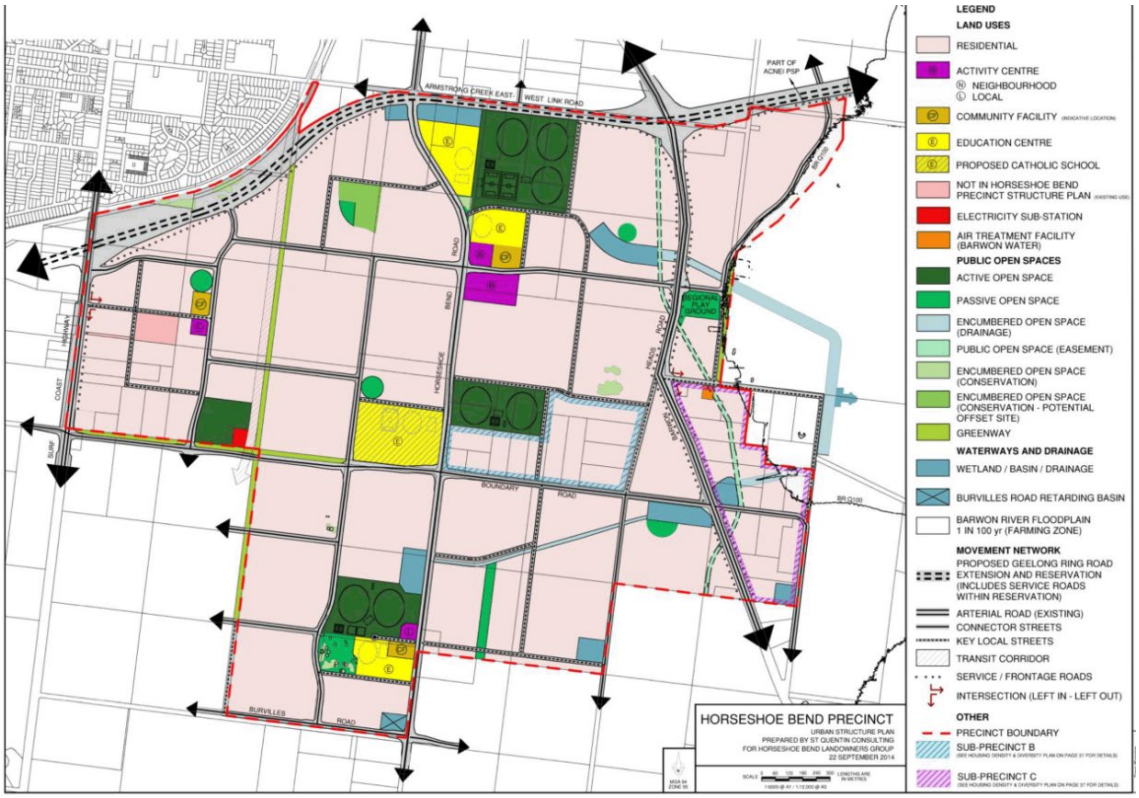
— (P 8.16) The design of all streets and roads should meet the requirements of Clause 56 of the Greater Geelong Planning Scheme.

3.2. Neighbouring PSP Areas

The **Horseshoe Bend PSP** area sits south of the Marshall PSP area on the opposite side of Reserve Road. The PSP for this area was adopted in September 2014. When fully developed, the area is expected to accommodate a population of around 20,500 people and community facilities including a Neighbourhood Activity Centre (NAC), Local Activity Centre (LAC), schools and open spaces.

The Structure Plan for the Horseshoe Bend precinct responses to the proposed Bellarine Link project. The spatial plan is shown as Figure 3-1.

Figure 3-1: Horseshoe Bend PSP

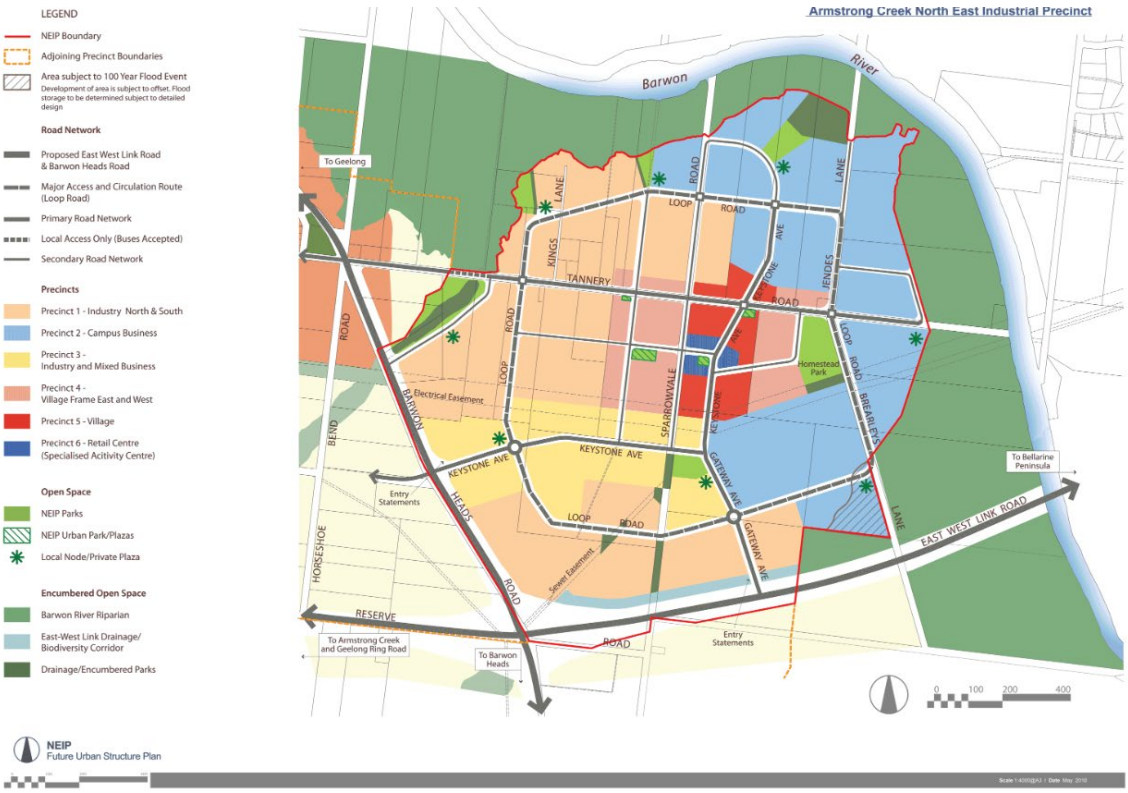


Source: CoGG

The North East Industrial Precinct (NEIP) sits east of the Marshall PSP area on the opposite side of Barwon Heads Road. It is bounded to the north by the Barwon River and to the south by the Bellarine Link. The PSP for this area was adopted in May 2010 but there has been little development in the area.

When fully developed, it is expected to include approximately 140 ha (net) of commercial, industrial and retail uses. The Structure Plan for the area, which is shown below as includes access from both the Bellarine Link and Barwon Heads Road.

Figure 3-2: NEIP PSP



Source: CoGG

4. Future Transport Network

4.1. Barwon Heads Road Duplication

The duplication of Barwon Heads Road, from Settlement Road to Reserve Road (4km), was under construction at the time of writing this report. The project is expected to be completed by the end of 2023.

The project generally involves:

— Duplication from two lanes to four;

— Grade separation of the level crossing near Marshall Station;

— Upgrades at the Settlement Road and Breakwater Road intersections;

— New signalised intersections at Crows Road, Barwarre Road, Marshalltown Road and Reserve Road;

— An off-road shared path for the full length of the project as well as on-road cycling provisions; and

— General improvements to lighting, signage, drainage, and landscaping.

Of specific relevance to the Marshall PSP area, the project includes:

— A left in, left out and right in priority intersection that provides access to the northern part of Horseshoe Bend Road (Figure 4-1).

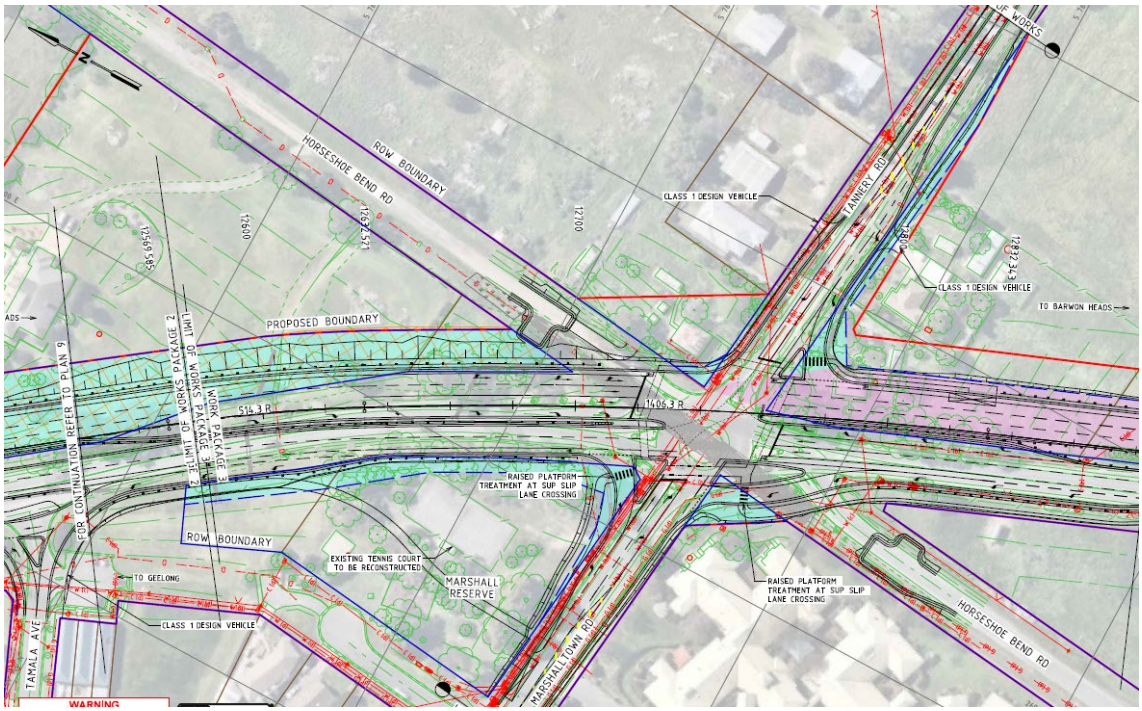
— A signalised intersection at Marshalltown Road/Tannery Road (Figure 4-2); and

— A signalised intersection at Reserve Road (Figure 4-3).

Figure 4-1: Barwon Heads Road/Connection to Horseshoe Bend Road (North)

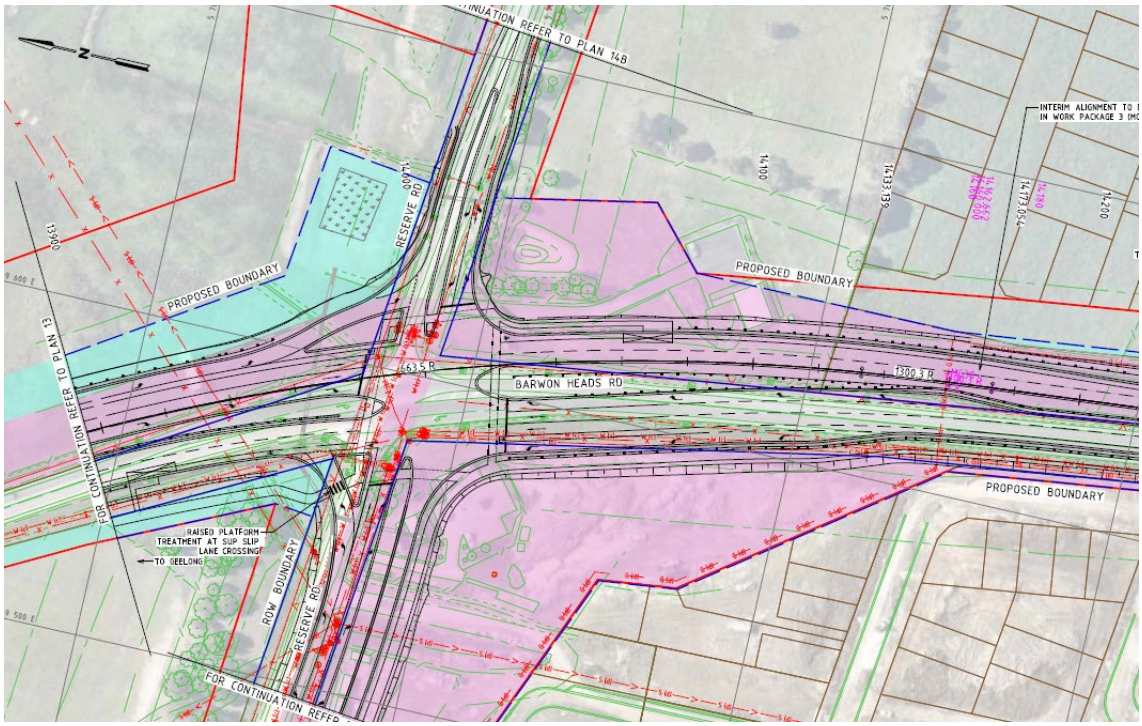
Source: MRPV

Figure 4-2: Barwon Heads Road/Marshalltown Road/Tannery Road



Source: MRPV

Figure 4-3: Barwon Heads Road/Reserve Road



Source: MRPV

4.2. Bellarine Link (Geelong Ring Road Extension)

The Bellarine Link is the extension of the Geelong Ring Road network from the Baanip Boulevard/Surf Coast Highway intersection to Portarlington Road. The project is being developed in two stages: from the Surf Coast Highway to Barwon Heads Road, and Barwon Heads Road to Portarlington Road.

The project is currently in planning phase and a Public Acquisition Overlay (PAO) is in place, running along the southern side of Reserve Road.

The overall scope of the project and the PAO are shown below as Figure 4-4 and Figure 4-5.

Of specific relevance to the Marshall PSP area, the project includes:

— Severing of Reserve Road, west Drews Road;

— A signalised intersection at Drews Road, with the realignment of Horseshoe Bend Road forming the southern leg;

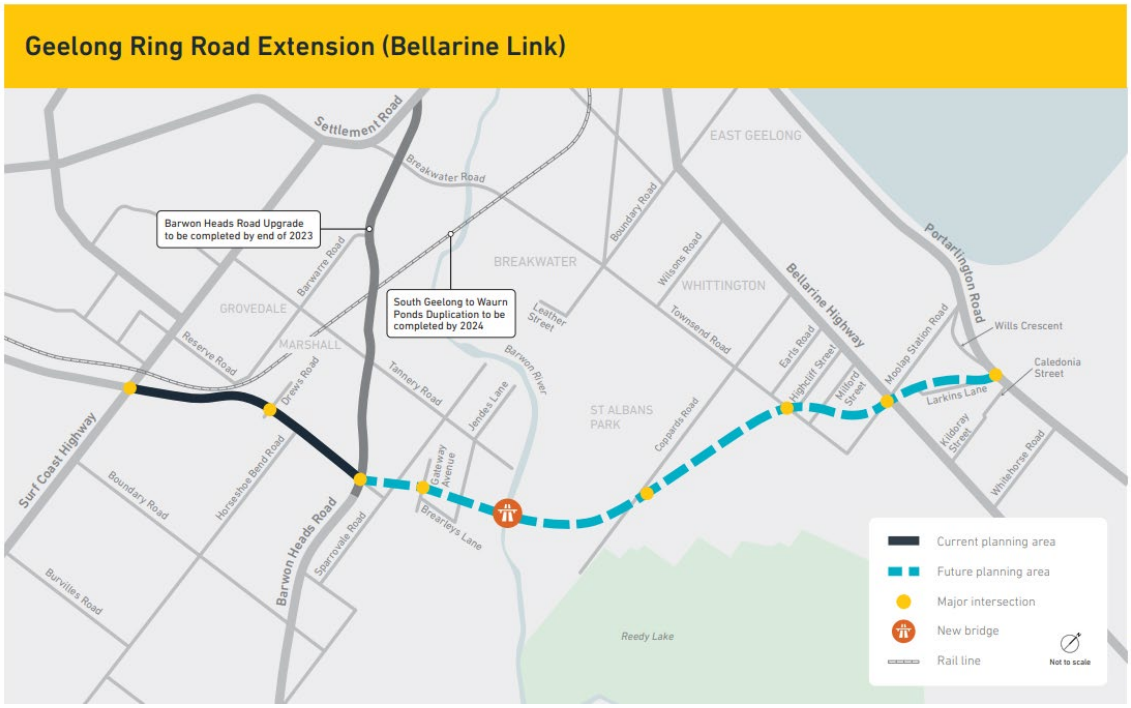
— A left in, left out (LILO) only intersection with the northern leg of Horseshoe Bend Road;

— Severing of Horseshoe Bend Road, south of Bellarine Link;

— A signalised pedestrian crossing west of the Horseshoe Bend Road LILO intersection; and

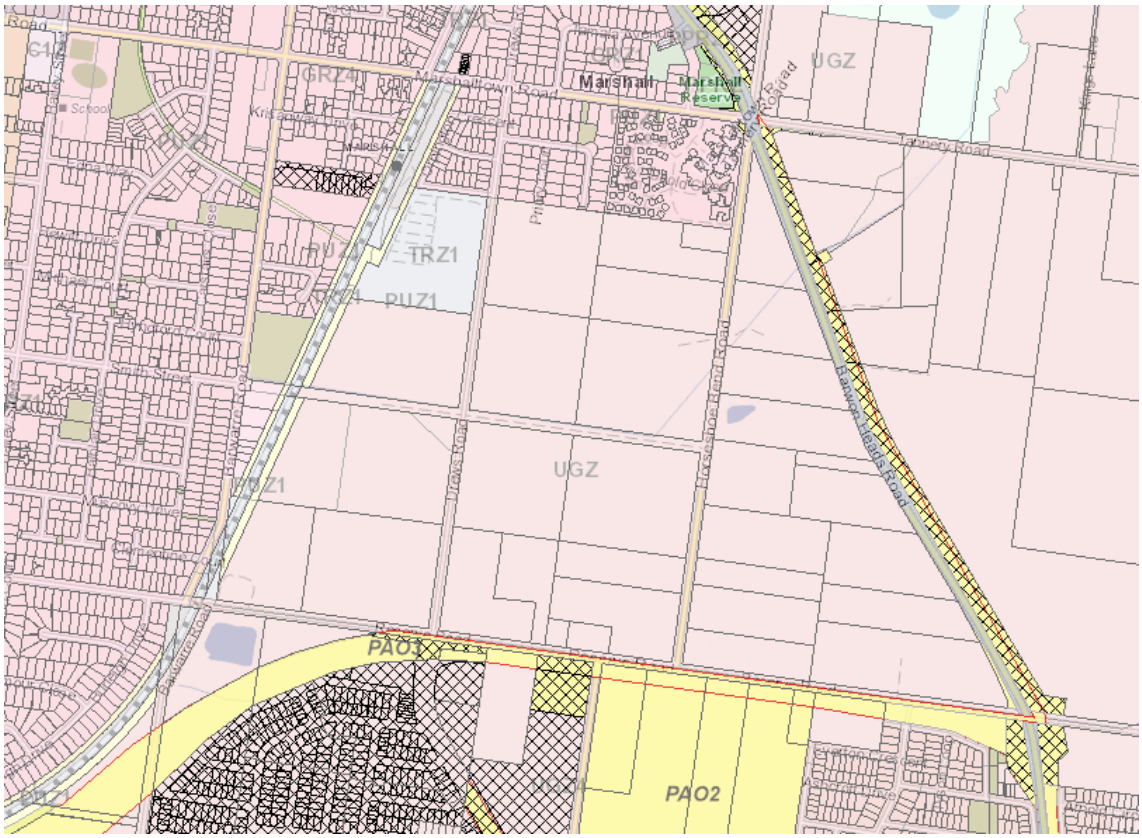
— Integration with the Barwon Heads Road/Reserve Road intersection being constructed by MRPV .

Figure 4-4: Bellarine Link Project



Source: MRPV

Figure 4-5: Bellarine Link PAO



Source: www.mapshare.vic.gov.au

4.3. Regional Rail Revival Projects

As part of the Regional Rail Revival project, Rail Projects Victoria (RPV) is upgrading Marshall Station and removing the existing level crossing on the Surf Coast Highway, north of Baanip Boulevard.

The works proposed at Marshall Station include:

— A second platform and accessible pedestrian overpass;

— Upgraded station building and forecourt; and

— 200 new parking spaces.

Local access changes (Figure 4-6) are proposed including:

— General station vehicle access on Drews Road;

— Bus only access on Marshalltown Road; and

— Turn bans at the Marshalltown Road/Station Road intersection.

The project was under construction at the time of writing this report and is expected to be complete by late 2024.

Figure 4-6: Marshall Station Upgrade Access Changes

Source: RPV

On the Surf Coast Highway, the existing level crossing north of Baanip Boulevard is proposed to be removed by elevating the railway line over the road. The project works (Figure 4-7) include 5km of shared walking and cycling path along the northern side of the rail corridor.

Figure 4-7: Surf Coast Highway Level Crossing Removal

Source: RPV

4.4. Adjacent PSP Interfaces

The Marshall PSP area has two interfaces with adjacent PSP areas. The key transport connections to these are:

— Horseshoe Bend PSP

- Signalised intersection at Bellarine Link/Drews Road/Realigned Horseshoe Bend Road; and
- Signalised intersection at Barwon Heads Road/Reserve Road/Bellarine Link.

— NEIP

- Signalised intersection at Barwon Heads Road/Marshalltown Road/Tannery Road
- Two new intersections along Barwon Heads Road; and
- Signalised intersection at Barwon Heads Road/Reserve Road/Bellarine Link.

Key connections along these interfaces are shown as Figure 4-8.

Figure 4-8: Adjacent PSP Connections

Key connection opportunities (in addition to those generally provided on all new urban roads) for walking and cycling include:

— The shared path on the western side of Barwon Heads Road;

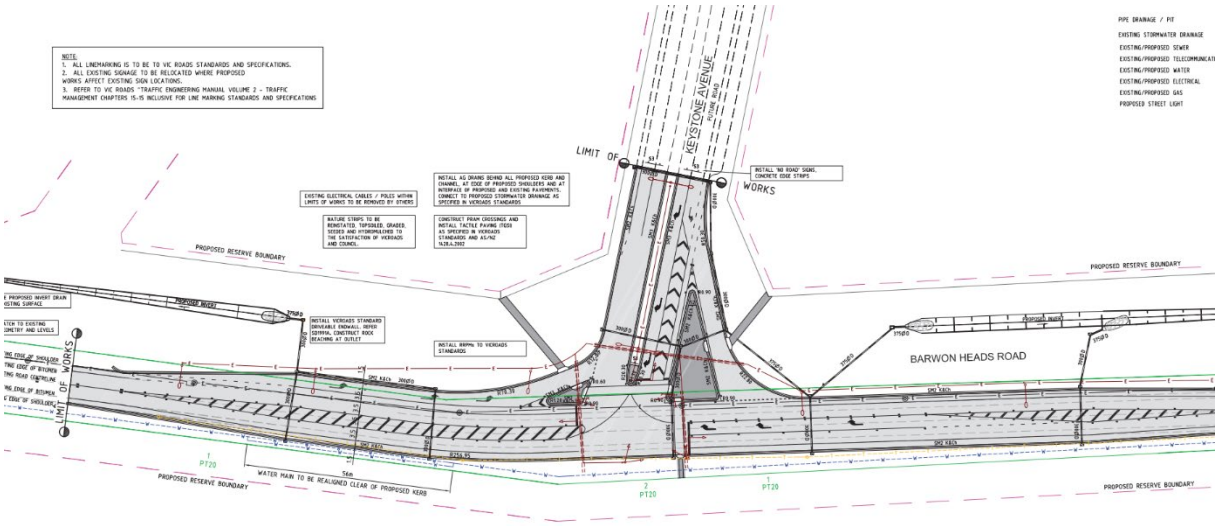
— The shared path in the Bellarine Link corridor; and

— The pedestrian signals across the Bellarine Link.

The Development Contributions Plan (DCP) for the NEIP includes a new intersection on Barwon Heads Road, where it meets a future road known as Keystone Avenue.

The layout of this intersection, as included as Item DI_RO_1 in the DCP is shown as Figure 4-9, but noting that this layout pre-dates the current MRPV Barwon Heads Road duplication project.

Figure 4-9: Barwon Heads Road/Keystone Avenue Intersection

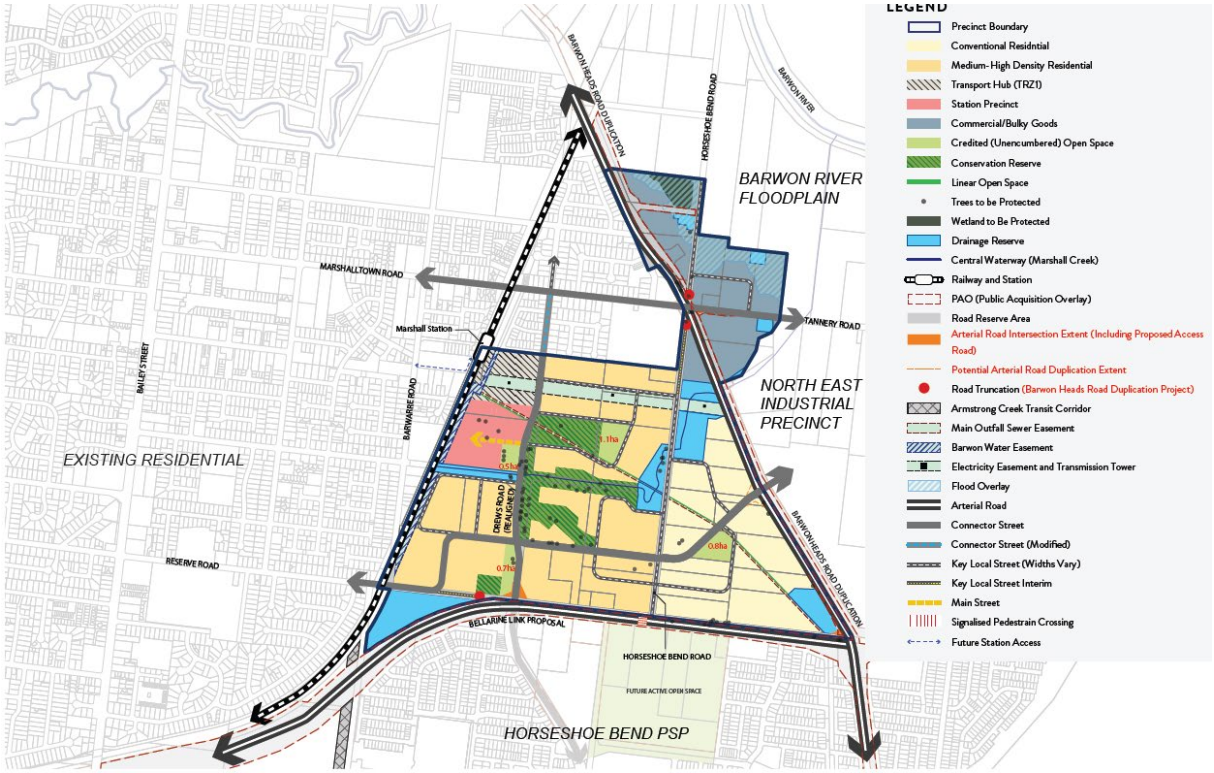


5. Marshall PSP

5.1. Land Use and Development Yield

The Marshall precinct is proposed to include standard and medium density residential areas, bulky goods retail in the north-eastern corner, a neighbourhood commercial centre (NAC), and a supporting network of open space. The proposed future urban structure for the Marshall PSP is shown below as Figure 5-1

Figure 5-1: Marshall PSP FUS



Source: CoGG (Revision 01, 13.01.2023)

Expected development yields are summarised in Table 5-1.

Table 5-1: Development Summary

Use	Description	Total
Residential	Standard (15-25 dwellings/ha)	442
	Medium (25-40 dwellings/ha)	1,250
	High (40-60 dwellings/ha)	291
	Total	1,983
Commercial/Bulky Goods	-	10.15 ha
Retail/Shop	Neighbourhood Commercial Centre (NAC)	2,500 sqm[2]

5.2. Road Network

The external connection opportunities for the Marshall PSP are largely fixed by development in adjacent PSP areas and other transport infrastructure upgrades including the Barwon Heads duplication and Bellarine Link.

The proposed network within the Marshall PSP responds to this by including:

— One north-south connector street, generally following the existing alignment of Drews Road and connecting from the Bellarine Link to the station precinct (and continuing to Marshalltown Road as a modified connector street);

— One east-west connector street, connecting from Barwon Heads Road to Reserve Road; and

— A second north-south connection in the form of a key local street following the alignment of Horseshoe Bend Road and connecting from the Bellarine Link into the PSP area.

5.3. PSP Cross-Sections

Where practical, road cross-sections within the Marshall PSP should be consistent with those adopted in the Horseshoe Bend PSP. The recommended widths and cross-section elements are shown in Table 5-2.

[2] For the purpose of this assessment it has been assumed that the bulky good areas will yield approximately 50,000 sqm of gross floor area (approximately 50% site coverage).

Table 5-2: Typical Cross-Sections

Road Type	Road Reserve	Carriageway	Bicycles	Parking	Pedestrians
Connector Street	25m	1 x 3.5m lane in each direction	2 x 1.7m on road lanes	2.3m parking lanes each side	1.5m footpath each side
Key Local Access Streets	20m	2 x 3.0m lane in each direction	On-road	2.3m parking lanes each side	1.5m footpath each side
Local Access Streets	16m	7.3m carriageway	On-road	On-road	1.5m footpath each side

5.4. Drews Road (Station Precinct to Marshalltown Road)

Drews Road is intended to be a connector street in the PSP area from the Bellarine Link (southern boundary of the PSP) to the station precinct.

The northern section of Drews Road (between the station access and Marshalltown Road) is built through an established residential area. It has a corridor width of 20m, a sealed carriageway width of approximately 9.5m, and footpaths on both sides of the road. It is noted in the PSP as a connector street (modified).

A transition would be required inside the PSP area to move from the cross-section of a connector street within the PSP to this existing cross section and reconfiguration of the existing carriageway of the northern section of Drews Road may be warranted subject to the considerations of road function and modal hierarchy.

This transition could be readily achieved through the detailed design of one of the intersections in the area around the station precinct. Options that could be considered include:

— Retain as a key local street but formalise lane markings. This would result in 3.0 metre wide traffic lanes with some separate provision for parking and/or cyclists.

— Line mark with wider traffic lanes (3.5m) so that a connector street cross-section (in terms of provision for vehicular traffic) is also available from the station precinct to Marshalltown Road. This would be at the expense of on-street parking (one-side) and/or cycle lanes.

The potential need to consider this arises primarily from the Marshall Station upgrade and the relocation of its vehicle access to Drews Road. These works and the increase in car parking capacity at the station can be expected to increase the volume of traffic using this section of Drews Road.

Either cross-section (unchanged or with different markings) could provide appropriate traffic capacity (as discussed later in Section 7.1) and be compatible with future use by buses (as discussed later in Section 5.6).

Neither would require any change to the existing corridor width and therefore would not impact the residential areas either side. This is considered to be a broader traffic management issue that can be monitored by CoGG, and not something that is required to support the Marshall PSP.

5.5. Bicycle Networks

The recommended bicycle connections in the Marshall PSP are shown below as Figure 5-2. These include a combination of on-road bicycle lanes on the connector street network, and off-road paths that take advantage of green spaces, utility corridors and existing road reserve widths that are no longer needed.

Key integration opportunities for cycling around the PSP area include the new shared path along Barwon Heads Road, the proposed shared path along the rail corridor proposed by RPV, and the signalised crossing of the future Bellarine Link.

Recommended bicycle connections within the Marshall PSP include:

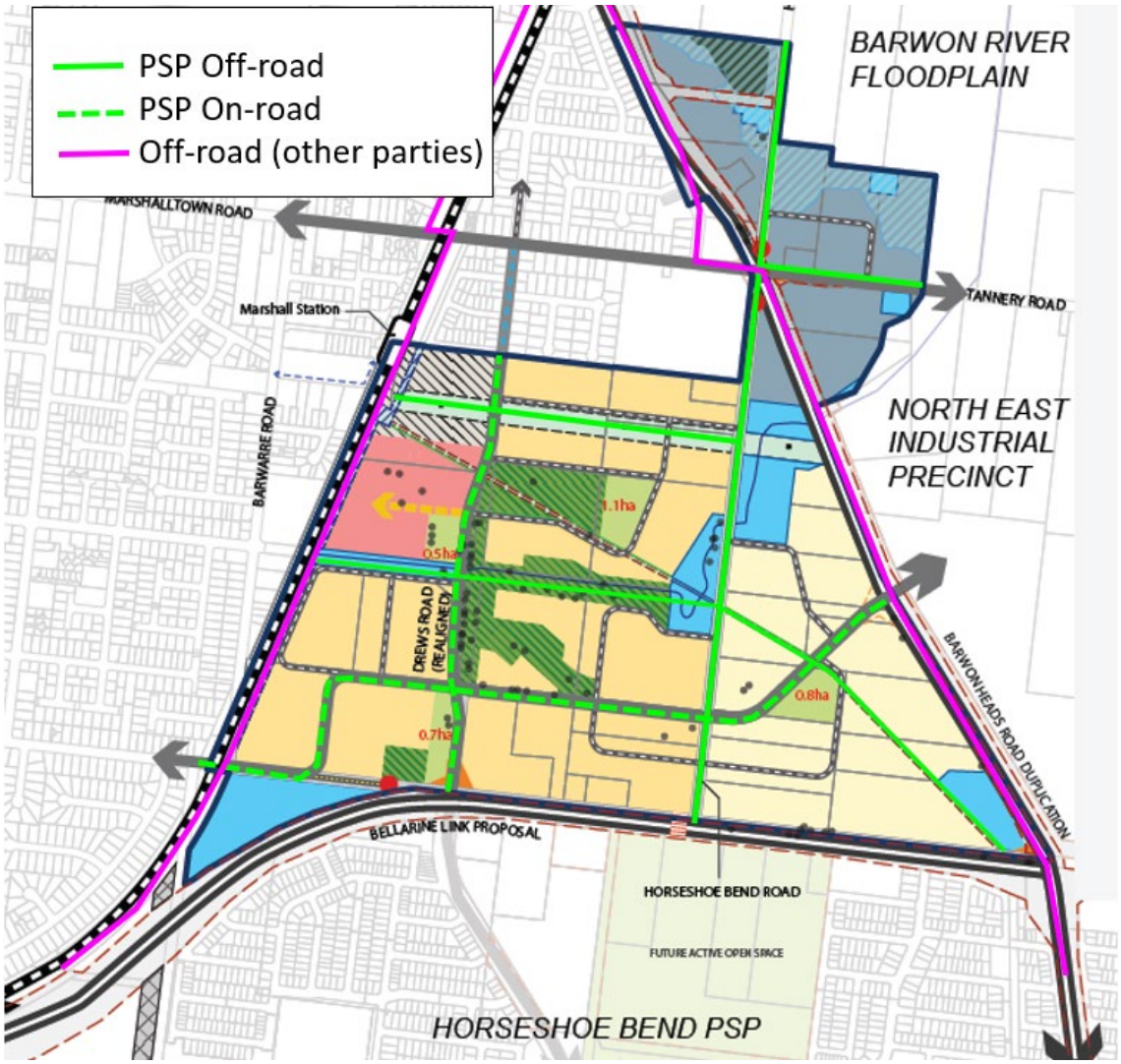
— On-road north-south and east-west connectivity on the connector street network;

— An off-road path along Horseshoe Bend Road, taking advantage of the existing 20m road reservation (as a local access street it would require only a 16m reserve);

— Off-road shared paths in the Smith Street corridor and other drainage, open space, and utility corridors; and

— An off-road path on the northern side of Tannery Road, connecting to paths in the NEIP.

Figure 5-2: PSP Bicycle Network

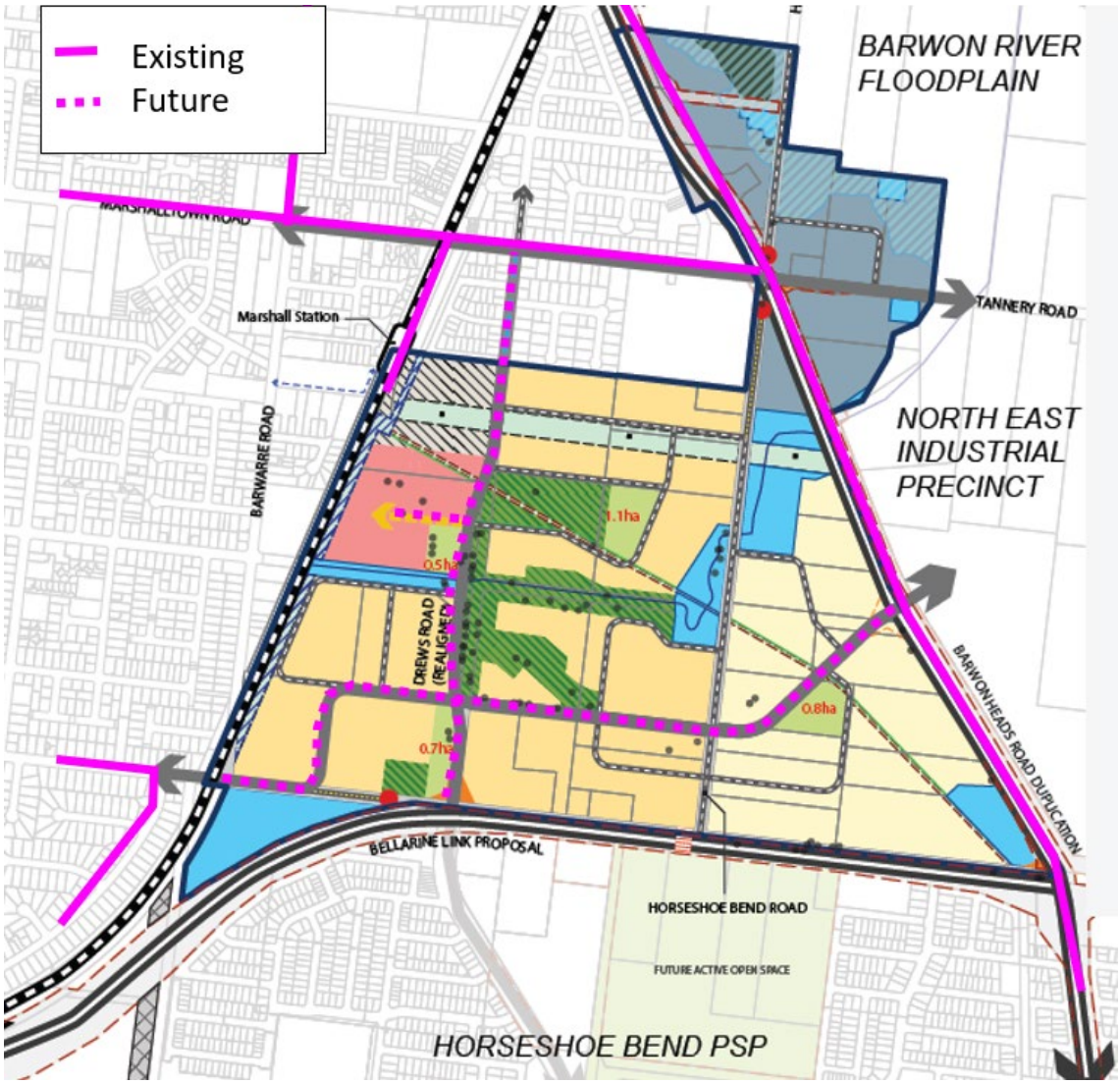


Source: CoGG, Annotations Added

5.6. Public Transport

The public transport network in the Marshall PSP area focusses on Marshall Station and generally utilises the planned connector street network. This enables future public transport routes to integrate with existing routes and the adjacent PSP areas. The intended network is shown as Figure 5-3.

Figure 5-3: PSP Public Transport Routes



Source: CoGG, Annotations Added

The Victorian Planning Authority (VPA) guidelines for Precinct Structure Planning (October 2021) target 95% of dwellings being within an 800m walk of a train station or a 400m walk of a bus route (or a bus compatible street). The movement and access principles in the ACUGP (Section 3.1) target all dwellings being within 600m of a public transport route.

All parts of the PSP area are within a 400m buffer of the existing and future bus routes. Approximately two thirds of the PSP area would also be within 800m of the Marshall Train Station.

The northern section of Drews Road (a key local access street) is proposed to form part of the public transport network. This enables public transport routes to move through the Marshall PSP area and connect with Marshalltown Road which provides the only point of access to the bus interchange in Marshall Station.

Acknowledging that it is typically desirable to provide bus services along connector streets, bus routes can and do operate on local streets. The established section of Drews Road has a sealed width of approximately 9.5m and can accommodate bus movements. As noted earlier at Section 5.4, there are options available to remark the carriageway (within the existing corridor width) if this proves necessary or beneficial in future.

6. Traffic Modelling

6.1. Assumptions/Methodology

The following analysis has assumed that:

— The Barwon Heads Duplication is complete; and

— The Bellarine Link is complete from Baanip Boulevard to Barwon Heads Road.

Forecast turning movement volumes for the year 2046 have been sourced from the traffic modelling referenced in the Cardno[3] report.

6.2. Trip Generation

Trip generation has been assessed using the rates accepted by CoGG in the planning and assessment of other PSP areas in Armstrong Creek. These rates reflect the intent of the ACUGP to encourage update of sustainable transport modes in preference to private car travel. The rates and resulting trip estimates are presented in Table 6-1

Table 6-1: Trip Generation

Use	Description	Total	Daily		Peak Hour	
			Rate	Trips (vpd)	Rate	Trips
Residential	Standard	442	8 vpd/dwelling	3,536	0.8 vph/dwelling	354
	Medium	1,250	6 vpd/dwelling	7,500	0.6 vph/dwelling	750
	High	291	4 vpd/dwelling	1,164	0.4 vph/dwelling	116
Commercial/ Bulky Goods[4]	-	10.15 ha	17 vpd/100sqm	6,988	2.7 vph/100 sqm	1,110[5]

[3] Based on Jacobs modelling of the Geelong Ring Road Extension, as described in Table 7-1 of the Marshall Precinct Structure Plan, Preliminary Transport Infrastructure Assessment, V190014, 9 July 2019, Cardno.

[4] Trip rates of 13.8 vpd/100 sqm and 2.2 vph/100 sqm have been applied to allow for 19% of trips to be pass-by trips, made as part of another trip already on the network.

[5] Applied during the PM peak period only since retail sees limited activity in the morning commuter peak.

Retail/Shop	NAC	2,500 sqm[6]	-[7]	-	-	-
TOTAL	-	-	-	19,188	-	1,220 (AM) 2,330 (PM)

In total, the Marshall PSP area is expected to generate approximately 19,200 vpd including up to 2,330 vph during the peak hours of the day.

6.3. Trip Distribution

Traffic generated by the Marshall PSP has been broadly distributed across the precinct and externally based on expected trip purposes and the location of local and regional destinations.

Vehicle trip purpose has been sourced from the Department of Transport VISTA Victorian Integrated Survey of Travel and Activity) dataset for Geelong, with the following broad trip purposes adopted for the purposes of this assessment.

Table 6-2: Trip Purpose

Purpose	% of Total
Work Related	29%
Shopping	23%
Social/Recreational	27%
Education	9%
Personal Business	10%
Other	1%
TOTAL	100%

Generated trips were then distributed considering internal and external destinations (such as employment centres, local and major shopping destinations, recreational destinations, schools and other education centres), and with regard also had for the available transport networks. The overall distribution by area is summarised in Table 6-3.

[6] For the purpose of this assessment, it has been assumed that the bulky good areas will yield approximately 50,000 sqm of gross floor area (approximately 50% site coverage).

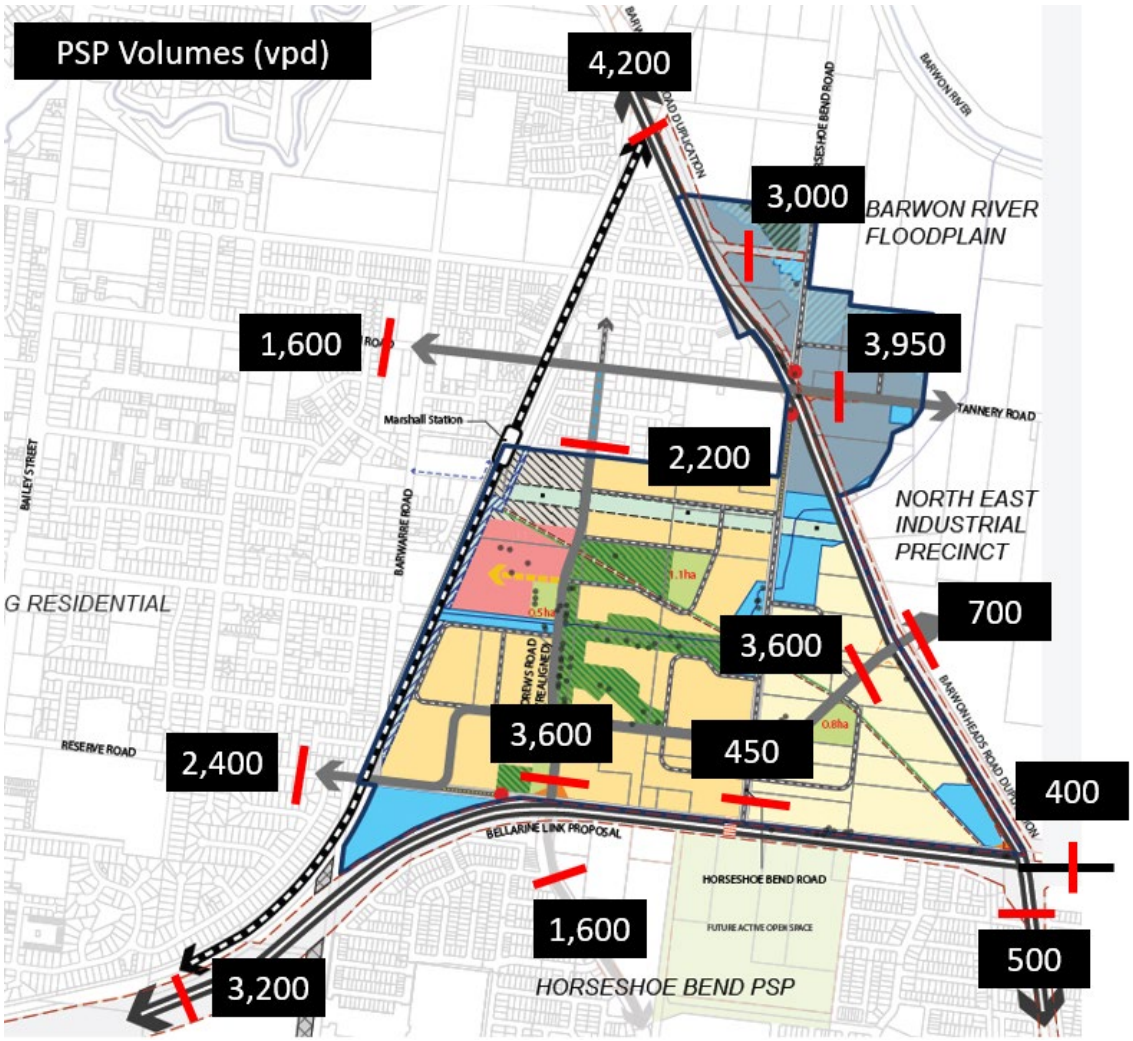
[7] No additional trips have been allowed for the NAC because this is not expected to attract a significant number of external trips.

Table 6-3: Trip Distribution

Origin/Destination	% of Total
Internal	24%
South-West (GRR)	6%
North (Barwon Heads Road)	22%
West	13%
South	10%
South-East	3%
Armstrong Creek Town Centre (ACTC)	16%
NEIP	4%
West Employment	2%
TOTAL	100%

The resulting assignment of these trips to the main transport connections in the area is summarised as Figure 6-1. This Figure shows expected volumes on the internal PSP network and the incremental changes expected on the external network.

Figure 6-1: PSP-Generated Daily Volumes



7. Network Assessment

7.1. Transport Corridors

The proposed PSP transport network includes seven connections to the external transport network. The five serving the residential area are Drews Road, Reserve Road (West), one new connection on Barwon Heads Road and two new connections on the Bellarine Link. The bulky goods retail area has a LILO intersection on Barwon Heads Road and access via Tannery Road.

These areas and corridors are discussed individually below. Reference is made to the CoGG Planning Scheme (Clause 56.06-8 Table C1) which gives typical daily volume ranges for different road classifications. Access streets (Level 2) carry up to 3,000 vpd. Connector streets (Level 2) carry up to 7,000 vpd.

Bulky Goods Retail Area

This area is expected to generate approximately 7,000 vpd. It has two transport connections, one connecting to a new intersection on Barwon Heads Road and one on Tannery Road. These are expected to carry in the order of 3,000-4,000 vpd each. Tannery Road currently carries 225 vpd which means its total volume remains within the appropriate range for a connector street.

Drews Road

Drews Road is expected to carry around 3,600 vpd when the Marshall PSP area is fully developed. It carried minimal traffic in 2015 (150 vpd). Since this time, it has been sealed and it has replaced Horseshoe Bend Road as a local north-south route and a route to Marshall Station.

The 2015 traffic counts (Figure 2 -18) showed a daily volume of 1,850 vpd on Horseshoe Bend Road (north of Reserve Road). If this is all assumed to be local traffic that transfers to Drews Road, Drews Road would carry up to 5,450 vpd. This remains below the 7,000 vpd threshold for a connector street, with capacity to absorb some additional local traffic.

Horseshoe Bend Road (Reserve Road to Marshalltown Road)

Horseshoe Bend Road (north of Reserve Road) is expected to carry less than 500 vpd. This reflects the limited connectivity it provides to the north and the anticipated left in, left out only treatment at the Bellarine Link.

As noted above, it carried around 1,850 vpd in 2015 but has since been closed at its north end and now provides only private property access. The local movement function it previously provided is now met by Drews Road. Demand for longer-distance north-south travel will have transferred to Barwon Heads Road.

Reserve Road (Western End)

The Marshall PSP area is expected to generate approximately 2,400 vpd on Reserve Road, west of the railway line. This section of Reserve Road carried some 4,300 vpd in 2015. Review of the traffic volumes on Figure 2 -18 indicates that most of this demand was moving west-north (and vice versa), to and from Barwarre Road. This a local demand pattern that is

unrelated to the Marshall PSP area and not likely to transferred to either the Bellarine Link or Barwon Heads Road projects.

The balance of the existing volume (1,000-1,800 vpd) appears to be moving east-west through the area. This demand is likely to be transferred to the Bellarine Link when it becomes available.

Combining the existing (2015) volume on Reserve Road with the PSP volume results in a total volume of 6,700 vpd. Considering other growth that has occurred in the area since 2015, Reserve Road is likely to exceed the volume threshold for a connector street if the Marshall PSP is fully developed ahead of the Bellarine Link. Staging implications are discussed further at Section 7.4.

Once the Bellarine Link is available and the arterial east-west demand is removed from Reserve Road, its volume would return to within the appropriate range for a connector street.

New East-West Connector Street

A new east-west connector street is proposed to start at Reserve Road and move through the Marshall PSP area to Barwon Heads Road. This link is expected to carry some 3,600 vpd in PSP-generated movements. It may also attract some local-west movement that was previously accommodated by Reserve Road.

Th expected volume remains below the 7,000 vpd threshold for a connector street, with capacity to absorb some additional local traffic if required.

Summary

Overall, the Marshall PSP is expected to generate in the order of 19,200 vpd. Some roads in the PSP area can also be expected to attract local through traffic movements either east-west or north-south. The PSP is also a gateway for the Marshall Station precinct.

Reliance on the PSP network for anything more than local through movement is expected to be minimal. The duplication of Barwon Heads Road and the proposed Bellarine Link are intended to accommodate arterial north-south and east-west demands, respectively.

Assessment of PSP traffic generation combined with demand for local through movement indicates that four connector street connections are appropriate. These are the northern and southern ends of Drews Road, the new connection to Barwon Heads Road, and Reserve Road (west). The Horseshoe Bend Road connection is expected to play a lesser role and is appropriately classified as a local access street.

7.2. External Intersections

7.2.1 Resolved Intersections

The following intersections have not been assessed here because their designs have been resolved (or will be resolved) by either the Barwon Heads Road Duplication or the Bellarine Link project, considering the needs of the Marshall PSP area.

— Barwon Heads Road/access to bulky goods retail area;

— Barwon Heads Road/Marshalltown Road/Tannery Road;

— Barwon Heads Road/Reserve Road (interim and ultimate);

— Bellarine Link/Drews Road; and

— Bellarine Link/Horseshoe Bend LILO.

The two external intersections that require further assessment as a result of the Marshall PSP are:

— Marshalltown Road/Drews Road; and

— Barwon Heads Road/New Connector Street/NEIP (Keystone Avenue).

These intersections are addressed individually in the following sections. SIDRA results for all scenarios are included as Appendix A.

7.2.2 Marshalltown Road/Drews Road

Modelling of the Marshalltown Road/Drews Road intersection in SIDRA 9 shows that it is expected to operate at a good level of service under forecast 2046 traffic volumes during the AM and PM peak.

It is noted that the parking and access changes being made as part of the RPV Marshall Station upgrade will change local movement patterns around the station and through this intersection. This would logically include a transfer of vehicle movements from the existing station access on Marshalltown Road to the Marshalltown Road/Drews Road intersection.

This is not an outcome of the Marshall PSP and is noted here as a network issue CoGG may wish to monitor or address with the relevant stakeholders.

7.2.3 Barwon Heads Road/New Connector Street/Keystone Avenue

The required layout for this intersection was developed using the following targets:

— No worse than level of service (LOS) D on any approach;

— 95th percentile queue lengths contained within left and right turn bay lengths[8]; and

— Overall degree of saturation (DoS) of 0.9 or better.

Other assumptions made in modelling the intersection included:

— Maximum cycle time of 120 seconds;

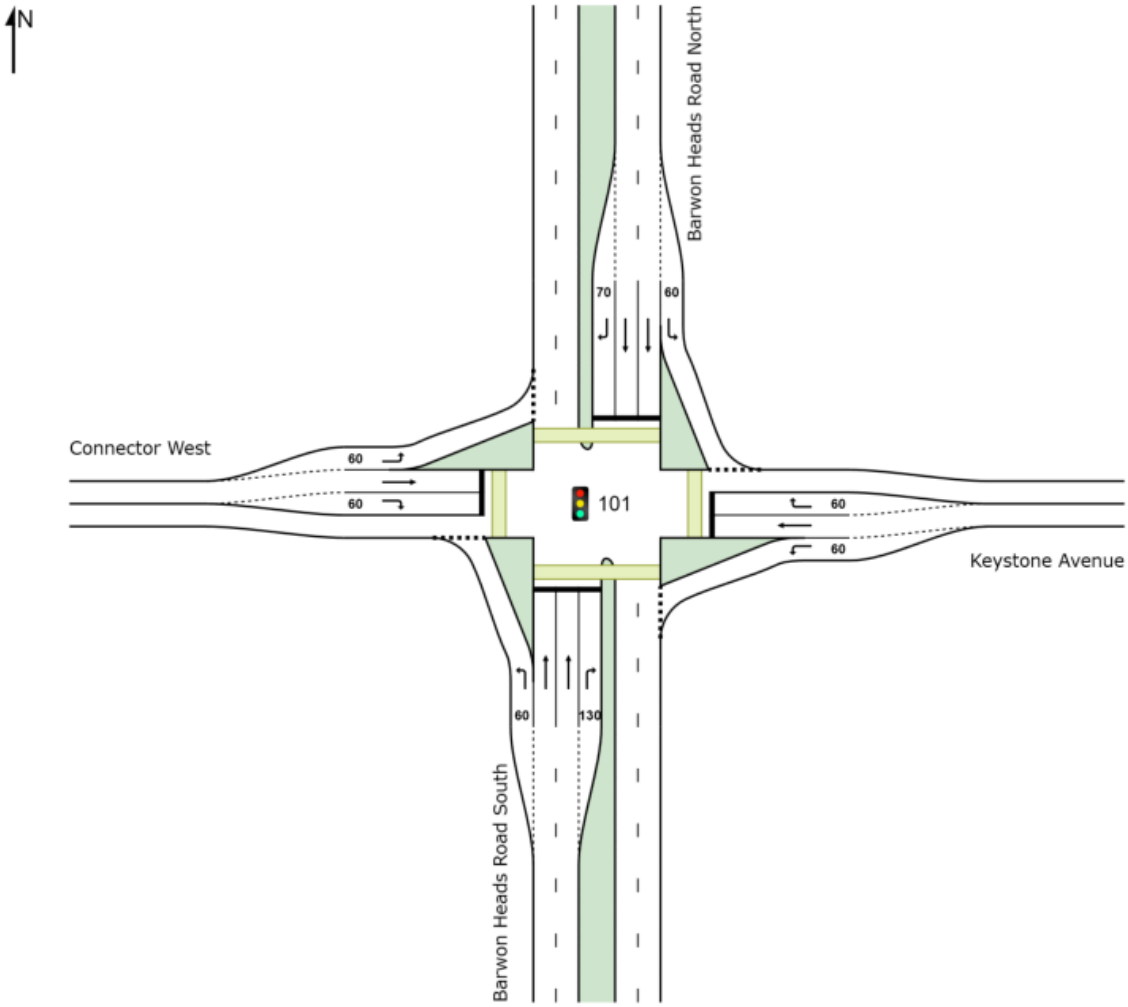
— No right turn filtering permitted; and

— Pedestrian crossings provided on all legs of the intersection.

The layout shown below was able to meet the above criteria in the AM and PM peaks, using the 2046 'Ultimate' volumes from the Cardno report.

[8] Lanes were specified as 60m minimum and increased if required to match 95th queues. Lengths may need to be increased in the design phase to meet minimum geometric standards.

Figure 7-1: Barwon Heads Road/Connector Street/Keystone Avenue Indicative Layout



7.3. Internal Intersections

Inside the Marshall PSP area, a single lane roundabout is recommended where the connector streets intersect. This location, and others where roads either meet the PBN, a SCC or an area of high pedestrian/cycle activity, should be treated with pedestrian/cycle priority treatments. All other intersections are recommended to be priority-controlled T-intersections. Some staggering of the indicative access roads may be required to achieve this.

7.4. Interim Intersection Treatments

Ultimately the Bellarine Link will provide an east-west arterial connection along the southern boundary of the Marshall PSP area. In the interim, this connection is provided by Reserve Road. If the Marshall PSP area develops ahead of Bellarine Link project, interim treatments will be required on Reserve Road, where it meets:

— Drews Road/Realigned Horseshoe Bend Road (South); and

— Horseshoe Bend Road (North).

The DCP for the Horseshoe Bend Precinct includes an interim upgrade at Reserve Road/Drews Road/Realigned Horseshoe Bend Road (referred to in the DCP as Item DI_RD_2).

The interim treatment is a signalised four-leg intersection. The DCP notes that the Marshall Precinct has been apportion 30% of the cost of these works.

The Reserve Road/Horseshoe Bend Road (North) intersection is ultimately intended to be a left-in, left-out intersection with the Bellarine Link. It is currently a priority-controlled T-intersection. It is carrying minimal turning movements (compared to historically) because Horseshoe Bend Road is closed at its northern end and is providing access to a limited number of properties only.

In the interim period before the Bellarine Link is in place, this intersection could accommodate an increase in traffic movements as a priority-controlled T-intersection, with all turning movements permitted.

Because this intersection is ultimately to be restricted to left in, left out movements, no interim capacity upgrades are recommended. The intersection could be monitored and if safety or capacity issues are evident, it could be converted to left in and left out operation, ahead of the Bellarine Link project.

8. Conclusions

The findings of this assessment can be summarised as:

— At full development, the Marshall Precinct Structure Plan (PSP) area is expected to include in the order of 1,983 residential lots, approximately 50,000 sqm of bulky goods retail floor area, and a small neighbourhood activity centre.

— The Marshall PSP area is expected to generate approximately 19,200 vehicle movements per day, with approximately 14,500 vehicle movements per day external to the area.

— The proposed transport network provides a well-connected and permeable road network, taking advantage of committed and planned investments in surrounding transport infrastructure.

— An extensive and well-connected bicycle and pedestrian network is provided across the precinct that connects and integrates with the pedestrian and bicycle networks within the adjacent PSP areas.

— In addition to the internal transport network components, the following transport improvements are recommended to be included in the DCP framework:

- A contribution towards a signalised intersection at Barwon Heads Road/Connector Street/Keystone Avenue in general accordance with that shown as Figure 7-1 (including the elements that are additional to the DCP Item for the NEIP); and
- A contribution towards the interim upgrade of Reserve Road/Drews Road/Realigned Horseshoe Bend Road (already identified in the Horseshoe Bend DCP).

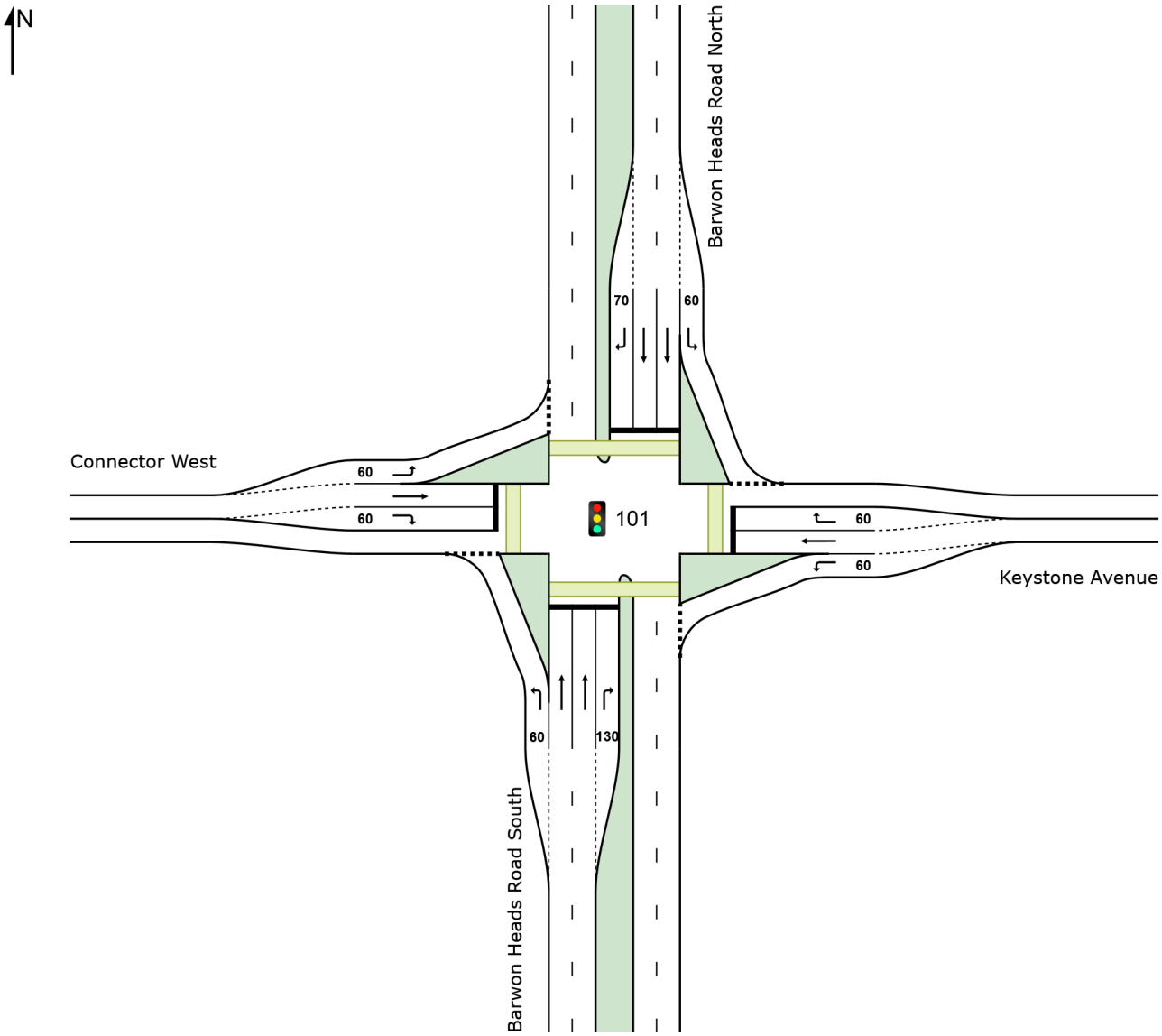
Appendix A SIDRA Summaries

SITE LAYOUT

Site: 101 [Barwon Heads Road/Connector/Keystone AM Ult (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Barwon Heads Road/Connector/Keystone AM Ult (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Barwon Heads Road South														
1	L2	8	2.0	8	2.0	0.006	6.5	LOS A	0.1	0.4	0.16	0.57	0.16	53.4
2	T1	1348	8.0	1419	8.0	* 0.886	41.3	LOS D	45.4	339.7	0.95	0.97	1.09	35.8
3	R2	240	5.0	253	5.0	* 0.890	71.7	LOS E	16.9	123.2	1.00	0.98	1.33	27.3
Approach		1596	7.5	1680	7.5	0.890	45.7	LOS D	45.4	339.7	0.95	0.97	1.12	34.2
East: Keystone Avenue														
4	L2	157	5.0	165	5.0	0.130	7.1	LOS A	1.5	10.6	0.22	0.61	0.22	52.9
5	T1	62	2.0	65	2.0	* 0.254	51.2	LOS D	3.5	24.9	0.94	0.72	0.94	32.7
6	R2	41	5.0	43	5.0	0.481	70.0	LOS E	2.6	19.3	1.00	0.74	1.00	27.7
Approach		260	4.3	274	4.3	0.481	27.5	LOS C	3.5	24.9	0.51	0.66	0.51	41.0
North: Barwon Heads Road North														
7	L2	62	5.0	65	5.0	0.051	8.8	LOS A	0.8	6.2	0.28	0.61	0.28	51.6
8	T1	315	8.0	332	8.0	0.195	20.5	LOS C	5.7	42.5	0.63	0.53	0.63	44.9
9	R2	56	2.0	59	2.0	0.203	53.5	LOS D	3.0	21.7	0.91	0.75	0.91	31.6
Approach		433	6.8	456	6.8	0.203	23.1	LOS C	5.7	42.5	0.62	0.57	0.62	43.4
West: Connector West														
10	L2	219	2.0	231	2.0	0.268	21.1	LOS C	7.4	52.4	0.62	0.73	0.62	44.1
11	T1	47	2.0	49	2.0	0.193	50.6	LOS D	2.6	18.7	0.93	0.70	0.93	32.9
12	R2	63	2.0	66	2.0	* 0.724	72.5	LOS E	4.2	30.0	1.00	0.83	1.21	27.2
Approach		329	2.0	346	2.0	0.724	35.1	LOS D	7.4	52.4	0.73	0.75	0.77	37.8
All Vehicles		2618	6.4	2756	6.4	0.890	38.8	LOS D	45.4	339.7	0.83	0.84	0.93	36.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Barwon Heads Road South												
P1	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
East: Keystone Avenue												
P2	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	217.3	211.9	0.98

North: Barwon Heads Road North											
P3	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
West: Connector West											
P4	Full	50	53	54.3	LOS E	0.2	0.2	0.95	0.95	217.3	211.9	0.98
All Pedestrians		200	211	54.3	LOS E	0.2	0.2	0.95	0.95	220.6	216.2	0.98

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Barwon Heads Road/Connector/Keystone PM Ult (Site Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Barwon Heads Road South														
1	L2	24	2.0	25	2.0	0.019	8.0	LOS A	0.3	1.8	0.27	0.60	0.27	52.3
2	T1	1247	8.0	1313	8.0	*0.872	38.2	LOS D	34.5	258.3	0.98	1.01	1.14	36.9
3	R2	13	5.0	14	5.0	0.076	50.9	LOS D	0.6	4.6	0.94	0.69	0.94	32.3
Approach		1284	7.9	1352	7.9	0.872	37.8	LOS D	34.5	258.3	0.97	1.00	1.13	37.0
East: Keystone Avenue														
4	L2	217	5.0	228	5.0	0.258	16.0	LOS B	5.4	39.2	0.57	0.72	0.57	46.9
5	T1	125	2.0	132	2.0	*0.456	43.0	LOS D	6.0	42.9	0.96	0.77	0.96	35.3
6	R2	139	5.0	146	5.0	*0.816	60.1	LOS E	7.8	57.2	1.00	0.93	1.29	29.9
Approach		481	4.2	506	4.2	0.816	35.8	LOS D	7.8	57.2	0.79	0.79	0.88	37.5
North: Barwon Heads Road North														
7	L2	15	5.0	16	5.0	0.011	6.1	LOS A	0.1	0.4	0.14	0.57	0.14	53.6
8	T1	1091	8.0	1148	8.0	0.813	31.2	LOS C	28.1	210.0	0.92	0.88	1.00	39.7
9	R2	151	2.0	159	2.0	*0.868	63.2	LOS E	8.8	62.9	1.00	0.98	1.41	29.1
Approach		1257	7.2	1323	7.2	0.868	34.7	LOS C	28.1	210.0	0.92	0.89	1.04	38.2
West: Connector West														
10	L2	99	2.0	104	2.0	0.128	18.6	LOS B	2.6	18.6	0.59	0.70	0.59	45.5
11	T1	27	2.0	28	2.0	0.098	40.1	LOS D	1.2	8.6	0.89	0.65	0.89	36.3
12	R2	79	2.0	83	2.0	0.454	53.6	LOS D	4.0	28.6	0.98	0.77	0.98	31.6
Approach		205	2.0	216	2.0	0.454	34.9	LOS C	4.0	28.6	0.78	0.72	0.78	37.9
All Vehicles		3227	6.7	3397	6.7	0.872	36.1	LOS D	34.5	258.3	0.91	0.91	1.03	37.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Barwon Heads Road South												
P1	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	213.9	220.5	1.03
East: Keystone Avenue												
P2	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	207.3	211.9	1.02

North: Barwon Heads Road North											
P3	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	213.9	220.5	1.03
West: Connector West											
P4	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	207.3	211.9	1.02
All Pedestrians		200	211	44.3	LOS E	0.1	0.1	0.94	0.94	210.6	216.2	1.03

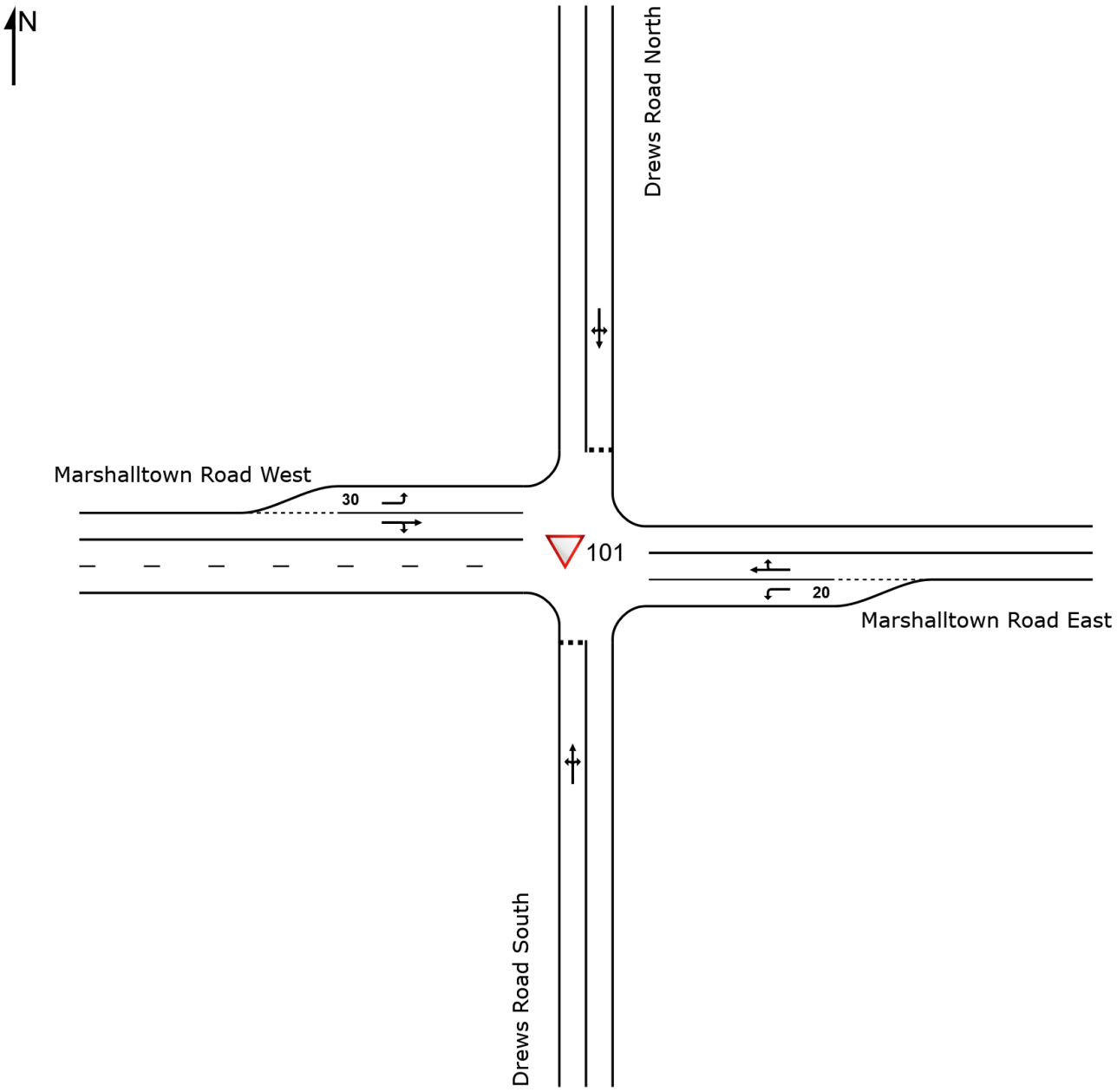
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: 101 [Marshalltown Drews AM Ultimate (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Marshalltown Drews AM Ultimate (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Drews Road South														
1	L2	192	2.0	202	2.0	0.484	8.9	LOS A	3.0	21.6	0.59	0.88	0.83	50.4
2	T1	79	2.0	83	2.0	0.484	10.1	LOS B	3.0	21.6	0.59	0.88	0.83	50.8
3	R2	99	2.0	104	2.0	0.484	11.3	LOS B	3.0	21.6	0.59	0.88	0.83	50.2
Approach		370	2.0	389	2.0	0.484	9.8	LOS A	3.0	21.6	0.59	0.88	0.83	50.4
East: Marshalltown Road East														
4	L2	10	2.0	11	2.0	0.006	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.5
5	T1	325	5.0	342	5.0	0.190	0.0	LOS A	0.1	0.7	0.02	0.02	0.02	59.7
6	R2	10	2.0	11	2.0	0.190	6.4	LOS A	0.1	0.7	0.02	0.02	0.02	57.4
Approach		345	4.8	363	4.8	0.190	0.4	NA	0.1	0.7	0.02	0.03	0.02	59.5
North: Drews Road North														
7	L2	22	2.0	23	2.0	0.140	6.3	LOS A	0.5	3.6	0.46	0.71	0.46	50.9
8	T1	22	2.0	23	2.0	0.140	7.8	LOS A	0.5	3.6	0.46	0.71	0.46	51.4
9	R2	44	2.0	46	2.0	0.140	11.0	LOS B	0.5	3.6	0.46	0.71	0.46	50.7
Approach		88	2.0	93	2.0	0.140	9.1	LOS A	0.5	3.6	0.46	0.71	0.46	50.9
West: Marshalltown Road West														
10	L2	10	2.0	11	2.0	0.006	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.5
11	T1	165	5.0	174	5.0	0.117	0.4	LOS A	0.3	1.9	0.14	0.08	0.14	58.7
12	R2	23	2.0	24	2.0	0.117	7.4	LOS A	0.3	1.9	0.14	0.08	0.14	56.8
Approach		198	4.5	208	4.5	0.117	1.5	NA	0.3	1.9	0.13	0.10	0.13	58.2
All Vehicles		1001	3.5	1054	3.5	0.484	4.8	NA	3.0	21.6	0.29	0.42	0.38	54.8

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

MOVEMENT SUMMARY

Site: 101 [Marshalltown Drews PM Ultimate (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Drews Road South														
1	L2	127	2.0	134	2.0	0.311	7.2	LOS A	1.4	9.9	0.48	0.73	0.52	51.5
2	T1	69	2.0	73	2.0	0.311	9.1	LOS A	1.4	9.9	0.48	0.73	0.52	51.9
3	R2	47	2.0	49	2.0	0.311	10.1	LOS B	1.4	9.9	0.48	0.73	0.52	51.3
Approach		243	2.0	256	2.0	0.311	8.3	LOS A	1.4	9.9	0.48	0.73	0.52	51.6
East: Marshalltown Road East														
4	L2	10	2.0	11	2.0	0.006	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.5
5	T1	245	5.0	258	5.0	0.146	0.1	LOS A	0.1	0.8	0.04	0.02	0.04	59.6
6	R2	10	2.0	11	2.0	0.146	6.8	LOS A	0.1	0.8	0.04	0.02	0.04	57.3
Approach		265	4.8	279	4.8	0.146	0.5	NA	0.1	0.8	0.04	0.05	0.04	59.3
North: Drews Road North														
7	L2	13	2.0	14	2.0	0.077	6.6	LOS A	0.3	1.9	0.48	0.72	0.48	51.1
8	T1	13	2.0	14	2.0	0.077	8.1	LOS A	0.3	1.9	0.48	0.72	0.48	51.5
9	R2	23	2.0	24	2.0	0.077	10.5	LOS B	0.3	1.9	0.48	0.72	0.48	50.9
Approach		49	2.0	52	2.0	0.077	8.8	LOS A	0.3	1.9	0.48	0.72	0.48	51.1
West: Marshalltown Road West														
10	L2	10	2.0	11	2.0	0.006	5.6	LOS A	0.0	0.0	0.00	0.58	0.00	53.5
11	T1	234	5.0	246	5.0	0.212	0.6	LOS A	0.8	5.9	0.24	0.17	0.24	57.6
12	R2	83	2.0	87	2.0	0.212	7.0	LOS A	0.8	5.9	0.24	0.17	0.24	55.7
Approach		327	4.1	344	4.1	0.212	2.4	NA	0.8	5.9	0.24	0.18	0.24	57.0
All Vehicles		884	3.6	931	3.6	0.311	3.8	NA	1.4	9.9	0.26	0.32	0.27	55.7

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