




Figure 4.7
Road Network Performance
AM Peak 2009 Existing


CALDERWOOD
URBAN DEVELOPMENT PROJECT


Legend


 Site Boundary


 Lake Illawarra (LPMA)

 Local Roads (LPMA)

 Mid-Block Road Sections

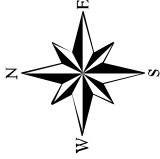
 Priority Control

 Roundabout

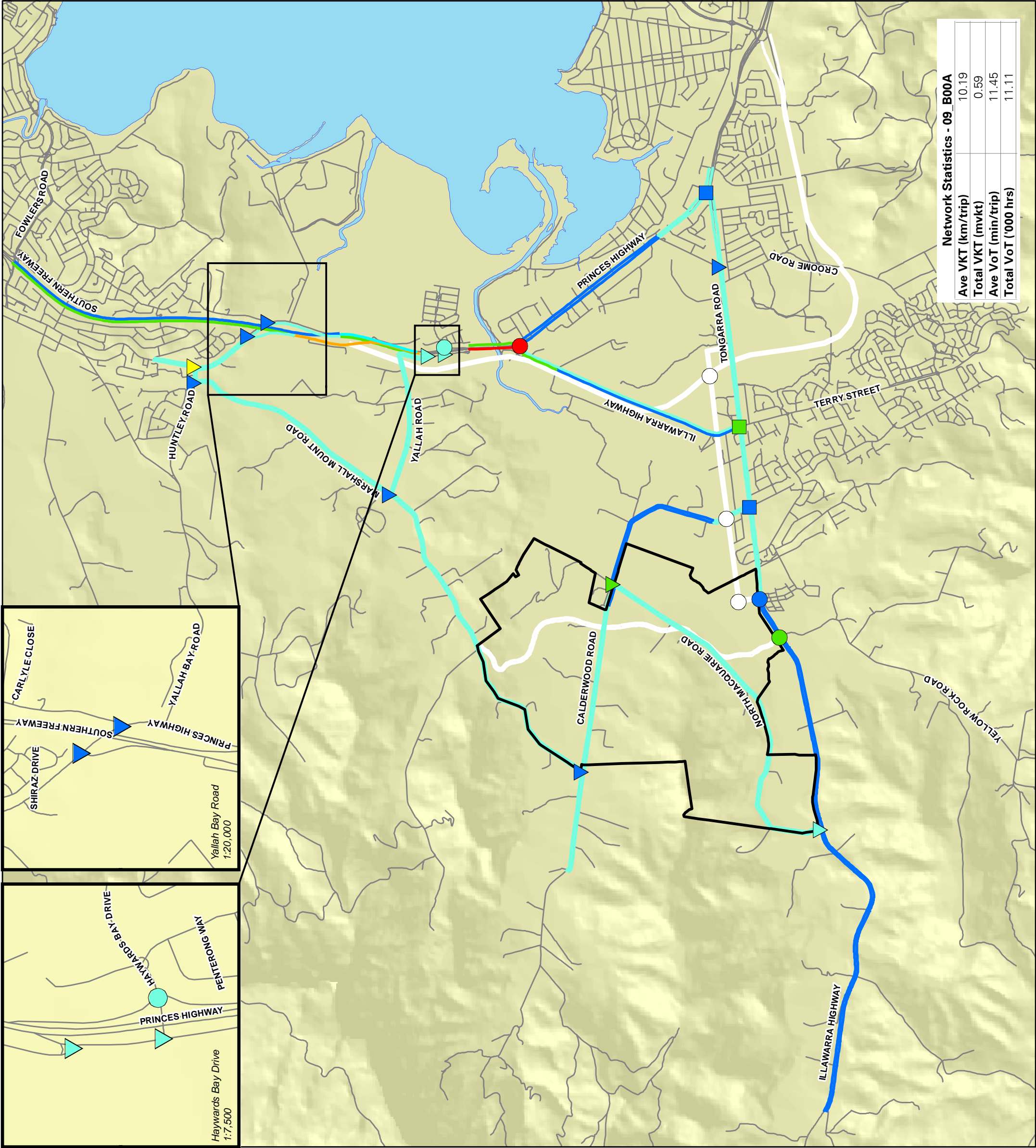
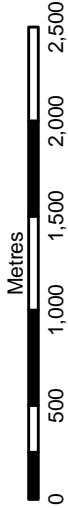
 Traffic Signals

Model Ref No. 09_B00

Level of Service (LoS)



Scale 1:40 000 (at A3)



Network Statistics - 09_B00A	
Ave VKT (km/trip)	10.19
Total VKT (mvkt)	0.59
Ave VoT (min/trip)	11.45
Total VoT ('000 hrs)	11.11

Figure 4.8

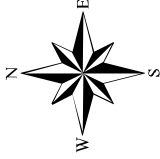
**Road Network Performance
PM Peak 2009 Existing**

CALDERWOOD
URBAN DEVELOPMENT PROJECT

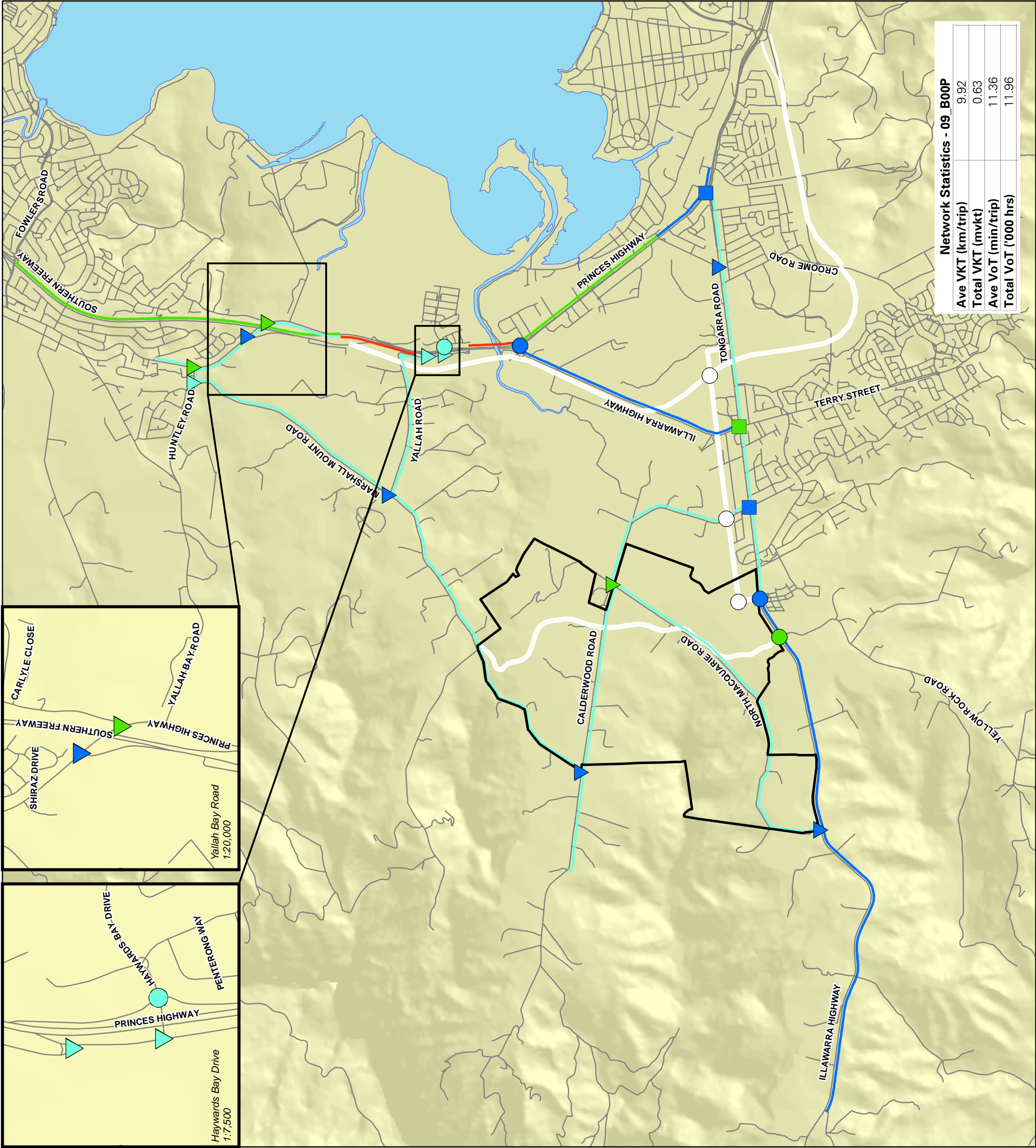
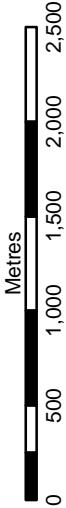
- Legend**
- Model Ref No.: 09_B00
- Site Boundary
 - Lake Illawarra (LPMA)
 - Local Roads (LPMA)
 - Mid-Block Road Sections
 - Priority Control
 - Roundabout
 - Traffic Signals

Level of Service (LoS)

- No Data
- A
- B
- C
- D
- E
- F



Scale 1:40 000 (at A3)



4.1.8 EXISTING ROAD NETWORK DEFICIENCIES

The existing transport network contains a number of deficiencies which limit the level of service provided to existing peak period traffic. These include:

Mid-block performance

- Princes Highway between Southern Freeway and Illawarra Highway:
 - Southbound operates at LoS F during the PM Peak.
 - Northbound operates at LoS E/F during the AM Peak.

Intersection performance

- Intersection of Princes Highway and Illawarra Highway operates at LoS F during the AM Peak period.

Rural Roads

The existing rural roads within the study area are generally adequate for present traffic volumes, with some exceptions:

- North Macquarie Road - not wide enough for two vehicles to pass in some sections, including the ford across Macquarie Rivulet, and the pavement is in poor condition in some sections.
- Marshall Mount Road - section of very poor pavement between Calderwood Road and Marshall Mount Creek.
- Marshall Mount Road - has a single-lane bridge and a narrow two-lane bridge across a branch of Duck Creek.

4.1.9 POTENTIAL IMPROVEMENTS TO ADDRESS EXISTING ROAD NETWORK DEFICIENCIES

It is to be recognised that the development at CUDP should not be required to contribute to the improvement of road network deficiencies which exist in advance of any development occurring. Since the assessment of the existing condition identified that the Princes Highway (between Illawarra Highway and Southern Freeway) and the intersection of Princes Highway and Illawarra Highway provide an unsatisfactory level of performance.

Therefore, to remedy this existing deficiency, additional traffic capacity by the addition of a lane in either direction would be appear to resolve the existing deficiency. From an inspection of aerial photography there appears the potential to convert current adjacent verge/parking areas to traffic lanes. This may also require the creation of peak period clearways to ensure traffic capacity is available at the times of most need whilst providing some carriageway to meet the parking needs of adjacent frontage developments. For areas where the available highway corridor may be insufficient to form a desirable road cross section (frontage developments etc) government could seek to utilize compulsory purchase powers.

However, considering the scale of anticipated land use changes within the local area a more appropriate solution, considering the sub regional transport task, would be for the construction of the F6 freeway extension from Tallawarra to Oak Flats and effectively provide a bypass to these over capacity existing sections and provide amenity benefit to those affected frontage residents.

Network improvements recommended to address existing deficiencies are detailed in Table 4.1. In conjunction with the construction of the F6 freeway extension carriageway associated ramps and access roads must be provided. The complimentary freeway extension works are detailed in Table 4.2. No other road network improvements were identified as being required to address existing network deficiencies.

Table 4.1 Proposed Road Network Improvements to Address Existing Deficiencies

Upgrade Number	Location	Proposed Network Improvement
Road Link Upgrades		
Upgrade 1	F6 Extension from Tallawarra Interchange to Tripoli Way Interchange	Construction of a four-lane divided carriageway to freeway standard
Upgrade 2	F6 Extension from Tripoli Way Interchange to Croome Road Interchange	
Upgrade 3	F6 Extension from Croome Road Interchange to Oak Flats Interchange	

Table 4.2 Proposed F6 Extension Complimentary Road Network Improvements

Upgrade Number	Location	Proposed Network Improvement
Road Link Upgrades		
Upgrade 4	F6 Extension Tripoli Way North Facing Ramps	Single lane ramps on all approaches with double roundabouts and single central structure
Upgrade 5	F6 Extension Tripoli Way South Facing Ramps	
Upgrade 6	Tripoli Way extension from Illawarra Highway (East) to F6 Extension	Construct divided two way-four lane carriageway with minimum 3.5m lane widths with kerb and gutter.
Upgrade 7	Tripoli Way extension from F6 Extension to Tongarra Road	
Upgrade 8	F6 Extension Croome Road Ramps	Single lane ramps
Upgrade 9	F6 Extension Complimentary Measures	Install LATM treatments along Princes Highway between F6 extension limits
Intersection Upgrades		
Upgrade 10	Tripoli Way/Illawarra Highway	New signalised intersection
Upgrade 11	Tripoli Way/Tongarra Road	New signalised intersection

Timing for implementation of these measures is discussed in Section 10.2 and 11.3.1.

4.2 CURRENT PUBLIC TRANSPORT PROVISION

As the Calderwood area is primarily a rural area at the present time public transport services are non-existent within the area. The nearest bus and rail services are located in the suburb of Albion Park, to the south of the site, for bus services and 3-5 kilometres to the east for rail services. This section provides an outline of the public transport accessibility to the locality.

4.2.1 RAIL INFRASTRUCTURE AND SERVICES

The South Coast Railway Line is located approximately 3km east of the study area on a north-south axis, running parallel to, and east of, the Princes Highway. It is currently a single, electrified track with a number of at-grade and grade separated road crossings. A review of the rail infrastructure and services is provided in Appendix 4-H.

Key issues to note are:

- Dapto, Albion Park and Oak Flats are the closest railway stations to the proposed development. The development site is located outside of the walking catchment of the stations and consequently it is expected that persons travelling to or from the site by rail will interchange to bus services at Dapto, Albion Park or Oak Flats, or proceed to the site via bicycle or car.
- Dapto Station will most likely be used for journeys to or from Wollongong and Sydney, depending on the availability of connecting bus services, as it sits on the desire line for these journeys.
- Albion Park and Oak Flats Stations are located to the east and would require travellers to/from the north to make a significant detour. It is likely that these stations would be used mainly for journeys to/from the Kiama, Gerringong and Shoalhaven districts.
- Currently, services on the South Coast railway line generally operate as through services between Sydney Terminal and the end of the electrified track at Kiama, although some diesel services commence from Bomaderry and terminate at Dapto with connecting electric services commencing at Dapto and heading to Sydney.

As part of planning for the West Dapto Urban Release Area, a new railway station was proposed adjacent to the Huntley Road Bridge over the South Coast railway line; 3km south of Dapto (refer to Figure 4.9). Should the proposed Huntley railway station be constructed, the Calderwood development would be brought significantly closer to the rail network. It would avoid the necessity for bus passengers or park-and-riders to travel into Dapto to transfer to or from the rail network, potentially improving the attractiveness of the rail network for journeys within the Illawarra. The present time taken to reach Dapto by bus or car versus the travel time to Wollongong via the Southern Freeway reduces the attractiveness of public transport for such journeys.

4.2.2 BUS SERVICES

Premier Illawarra operates bus services in the Wollongong area, with routes stretching from Kiama in the south to Bellambi in the north. A review of the bus services is provided in Appendix 4-I. Due to the rural nature of Calderwood, no bus routes presently serve the immediate area. The closest bus routes are located at Albion Park. Figure 4.10 presents the bus routes operating within the area.

Bus services will need to be extended or created to serve the Calderwood development. An overview of the public transport network deficiencies is provided in Section 4.2.4, Key issues to note are:

- Services are infrequent.
- The routes are circuitous, which increases travel time significantly.
- Public transport information is poor, with network maps and timetables difficult to decipher.
- The interchange arrangements at Albion Park Railway Station are difficult to understand.

4.2.3 ILLAWARRA BUS NETWORK REVIEW






The state government's bus network review for the Illawarra Region 10 was released for public comment in October 2009 and an excerpt of the relevant area is provided in Appendix 4-J. A frequency guide has not been provided so preliminary comments can only be made on the proposed route structure.

It should be noted that this review did not consider the inclusion of CUDP. The proposed route structure retains the separation between Dapto and Albion Park services with only routes 37/57 providing a bus link across Macquarie Rivulet. Services in Albion Park are altered to all run clockwise around the loop and the number of different routes linking Albion Park to Shellharbour City Centre is rationalised from three to two. Some rationalisation of routes is also proposed for the Dapto area.

Figure 4.9
**Site of proposed
Huntley Railway Station**

CALDERWOOD
URBAN DEVELOPMENT PROJECT

Legend

-  Site Boundary
-  Local Roads (LPMA)
-  Watercourse (LPMA)
-  Lake Illawarra (LPMA)
-  Existing Built Up Areas (LPMA)

Scale 1:40,000 (at A3)

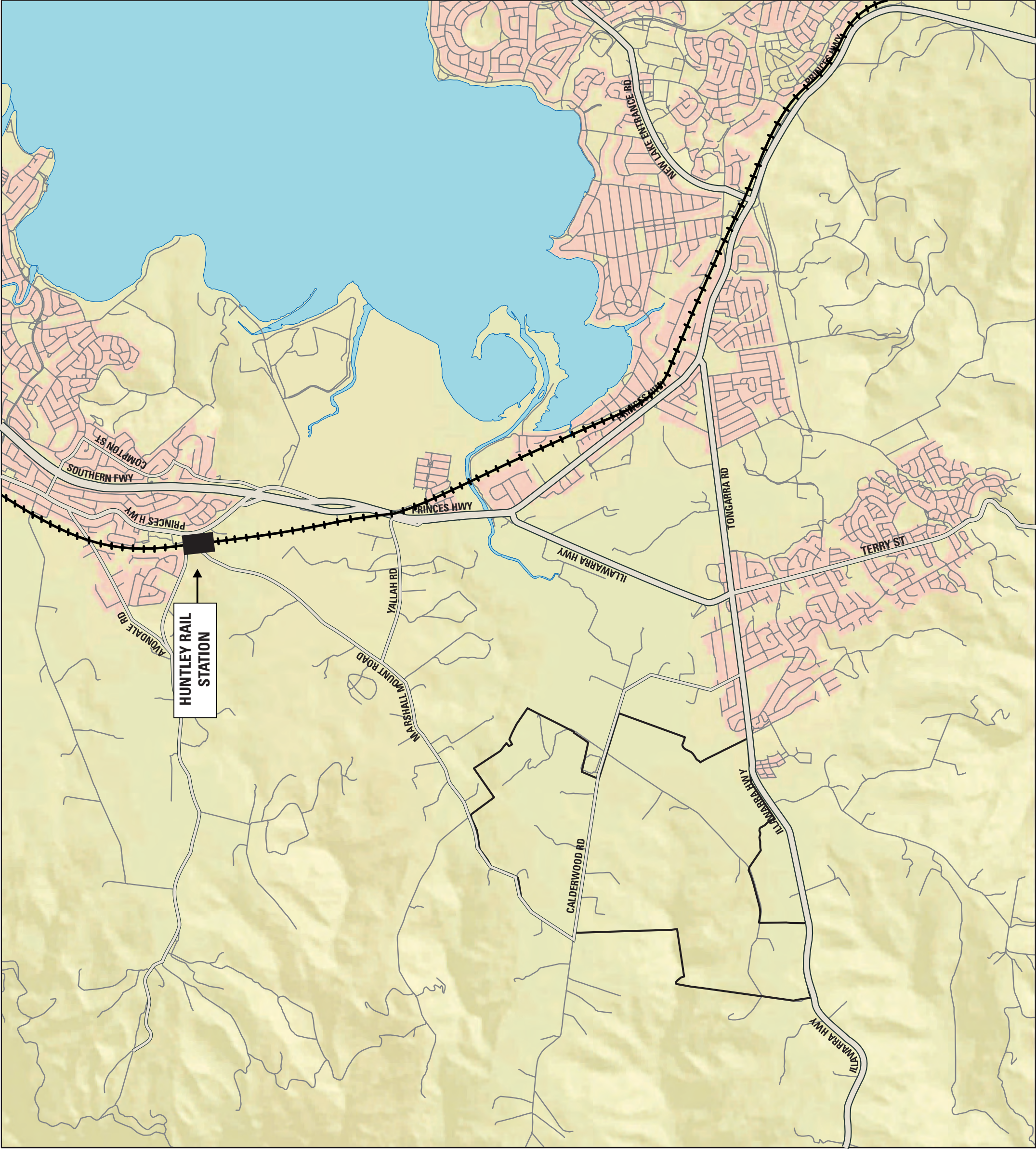


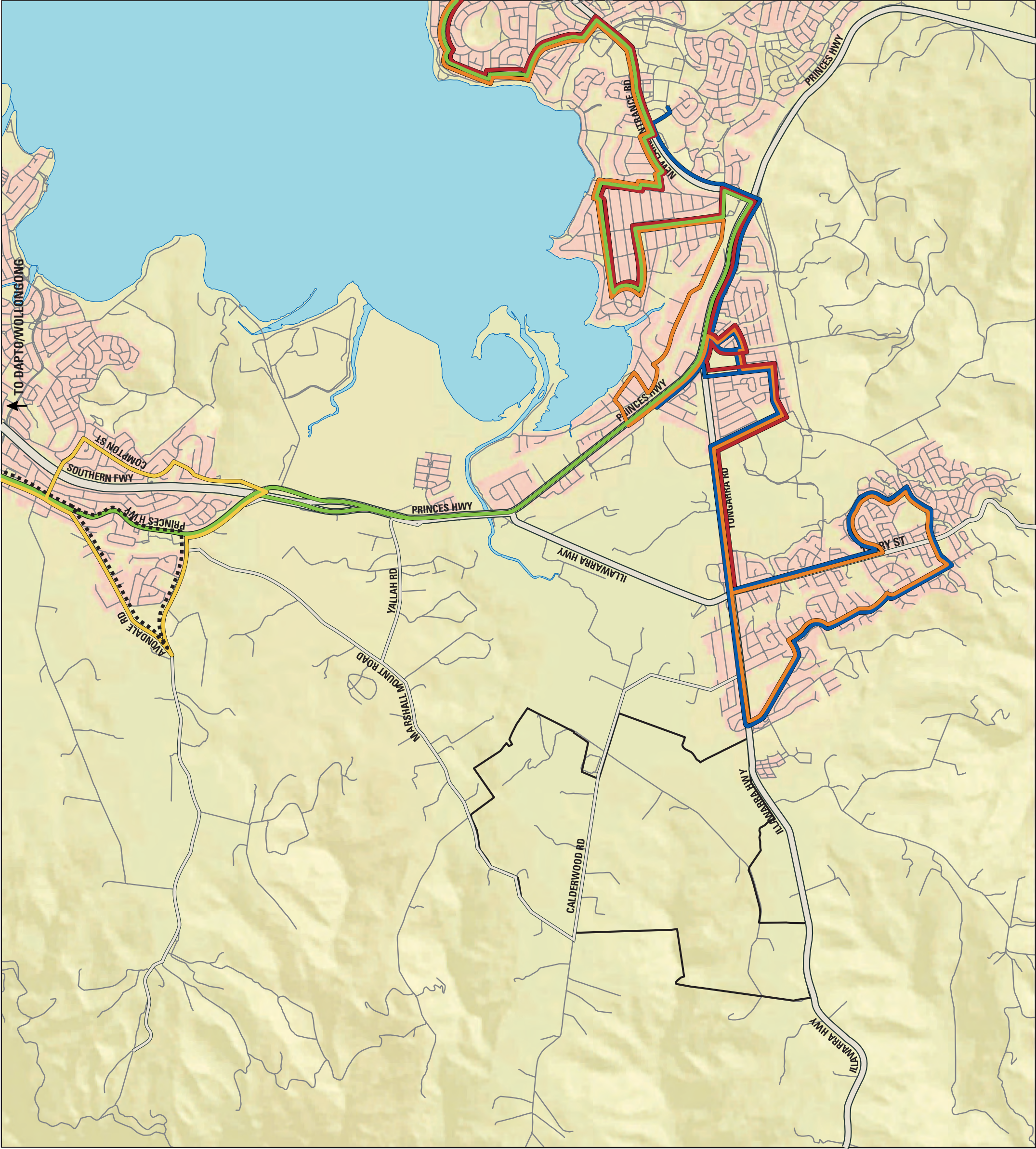
Figure 4.10
Existing Bus Network

CALDERWOOD
URBAN DEVELOPMENT PROJECT

Legend

- Site Boundary
- Local Roads (LPMA)
- Watercourse (LPMA)
- Lake Illawarra (LPMA)
- Existing Built Up Areas (LPMA)
- Bus Route 37 and 57
- Bus Route 51
- Bus Route 76
- Bus Route 70 and 73
- Bus Route 33
- Bus Route 43

Scale 1:40,000 (at A3)



4.2.4 SUMMARY OF EXISTING PUBLIC TRANSPORT DEFICIENCIES

The existing transport network contains a number of deficiencies which pose significant barriers to the use of public transport. These include:

- As the development site is presently rural land, no regular public bus services are provided.
- Bus routes serving nearby urban areas are generally poorly patronised. Routes are typically circuitous and indirect with generally only one bus per hour provided on each route.
- Bus and rail services operate mostly as segregated systems. The low and irregular service frequency of both bus and rail services is an impediment to encouraging transfers and their integration as part of a public transport network. The absence of an integrated fare structure is also a strong discouragement to integrating bus and rail services.
- Urban development is generally located distant from railway stations so the rail line is generally not used for local journeys. It functions mainly as a commuter service to Wollongong and Sydney.

4.3 CURRENT ACTIVE TRANSPORT FACILITIES

As the development site is presently rural land there are no existing pedestrian or cyclist facilities. The closest footpaths are located in the Albion Park urban area, on Calderwood Road at Taylor Road.

Footpaths are generally not provided in the Albion Park urban area. Only Illawarra Highway, Tongarra Road, Terry Street and Taylor Road have footpaths in the older part of Albion Park, whilst some streets in the newest subdivisions are being provided with footpaths.

Albion Park has a small network of off-road shared paths, linking dead-end streets or utilising riparian corridors. Linkages to the wider cycle network are provided only via Tongarra Road and a shared path through the Croome Regional Sporting Complex to Croome Road.

An overview of the City of Wollongong Bicycle Plan is provided in Appendix 4-K and an overview of the Shellharbour LGA Shared Use Path Strategy 2008 is provided in Appendix 4-L

4.3.1 SUMMARY OF EXISTING ACTIVE TRANSPORT DEFICIENCIES

The existing transport network contains a number of deficiencies which pose significant barriers to the use of active transport modes. These include:

- There are presently no pedestrian or cyclist facilities provided within the development site due to the rural nature.
- Existing connections to the development site are difficult due to the presence of Macquarie Rivulet.
- Mansons Bridge on Calderwood Road makes no provision for pedestrians and there is limited sight distance at its southern end which makes it difficult for pedestrians to use the roadway.

4.4 EXISTING TRAVEL DEMAND

An assessment of the existing travel demands in the region was undertaken by analysing the Transport Data Centre's (TDC) 2006 Journey to Work (JTW) data taken from the 2006 Australian Census. An explanation of the JTW data is provide in Appendix 4-M. The assessment of JTW data has been undertaken at a regional, local and site-specific level.

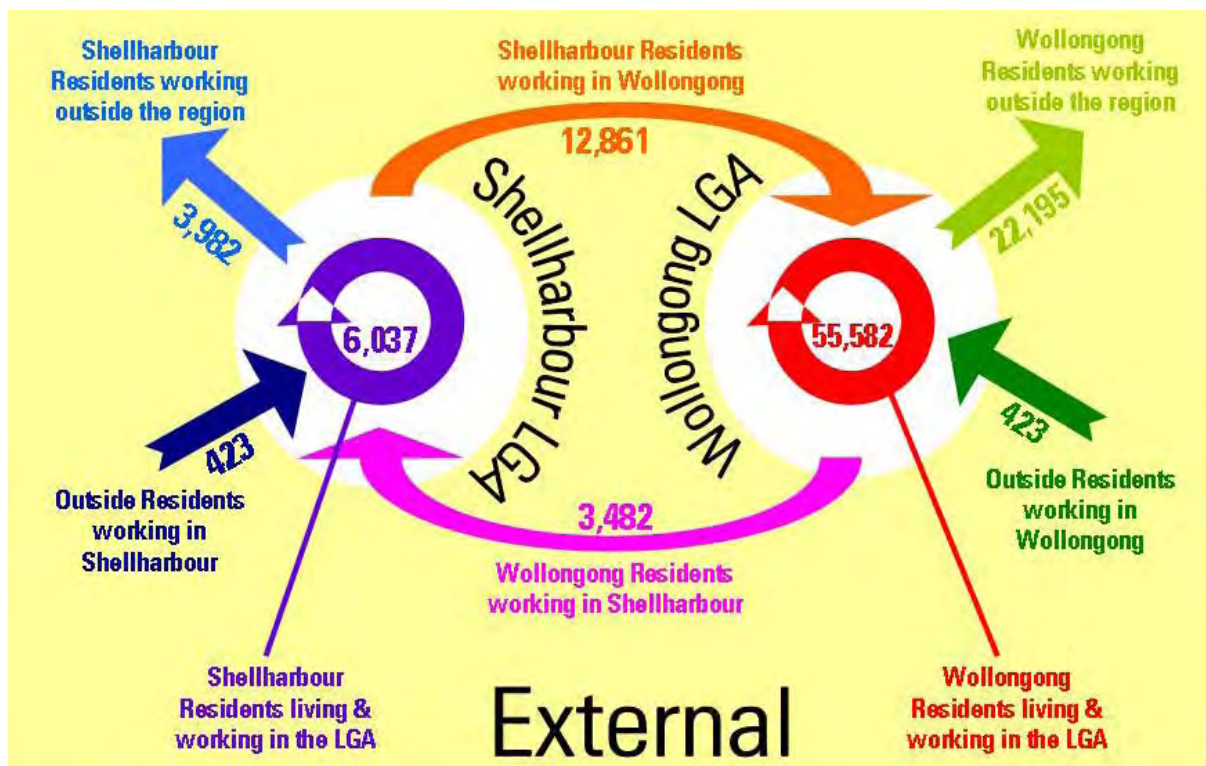
4.4.1 REGIONAL

The regional assessment covers the Wollongong and Shellharbour local government areas.

Workforce and Employment

An analysis of travel patterns of the existing Wollongong and Shellharbour LGA employment and workforce was undertaken. Trips originating within the LGA are considered to be the LGA workforce (living within the LGA). Trips ending in the LGA are considered to be representing employment (jobs within the LGA). Each LGA was divided into CBD and non-CBD areas. The analysis is documented in detail in Appendix 4-N. The net movement of workforce to jobs into, out of, within and between the LGA's is depicted in Figure 4.11.

Figure 4.11 2006JTW: Workforce – Employment Flows

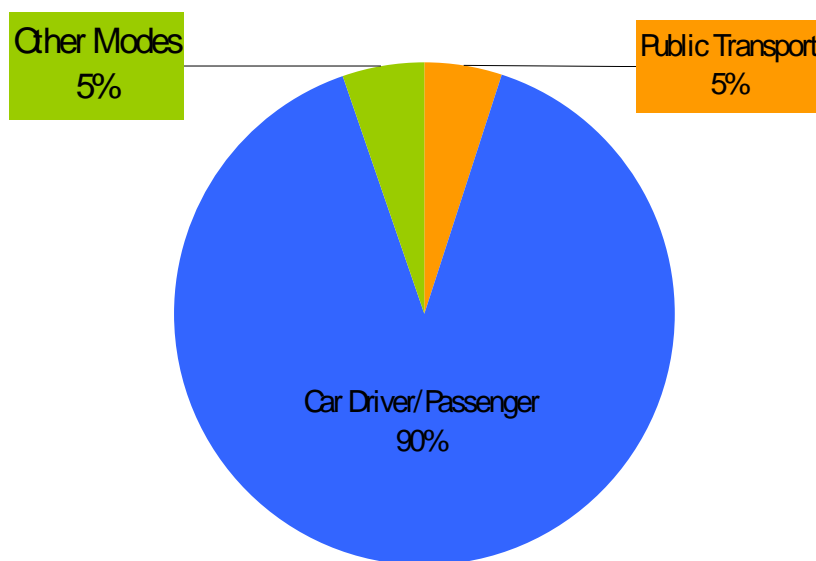


Mode of Travel

The assessment of JTW mode of travel in to and out of the LGAs provides a broad overview of regional travel patterns. The analysis is documented in detail in Appendix 4-N. Car is the predominant model of travel for work trips for both origin and destination trips within both LGA's.

Overall when considering in the total JTW trips into and out of both LGA's the mode share is summarised in Chart 4.1. This shows that there is a total of around 90% of trips made by car (driver or passenger) with 5% of trips made by public transport. The balance of trips by other modes, are assumed to be active transport trips (walking and cycling).

Chart 4.1 2006 JTW: Wollongong and Shellharbour LGA Mode of Travel



The mode share for trips originating in Wollongong or Shellharbour LGA (Workforce Trips) is 89% car based trips and 6.4% public transport trips. The mode share for trips ending in Wollongong or Shellharbour LGA (Employment Trips) is 91% of trips were car based trips and 3.4% public transport trips.

4.4.2 LOCAL

A more detailed analysis of travel patterns in the Travel Zones (TZ) surrounding the site was undertaken to establish the local travel behaviour already established in similar urban residential and employment areas. The assessment provides a broad overview of the following areas:

- Albion Park (TZ 3662, 3664, 3671).
- Albion Park Rail/Croome (TZ 3655, 3666, 3667, 3652).
- Haywards Bay (TZ 3636).

The analysis is documented in detail in Appendix 4-0. Based on the local travel patterns it is observed that majority of the trips (90-97%) within the local areas are undertaken by car. The remaining modes contain very small percentages compared to the car mode. It can be assumed that the reasoning behind this skewed proportion is due to the large car dependency from the lack of public transport facilities available in the local area and, the nature and distance of the trips.

4.4.3 SITE-SPECIFIC

The Calderwood area is rural in nature and lies within travel zone TZ 3661, which represents the areas of Calderwood, North Macquarie, Tongarra and Macquarie Pass. Based on the 2006 JTW Census data there is a workforce of 115 within this area (TZ 3661) and a corresponding 57 jobs. These numbers are very low and cannot be considered representative. It is observed that there is larger number of people travelling from the zone rather than to the zone, this could be because people living in this zone may not be necessarily working in this zone and may need to travel outside this zone for work purposes. However, it can be noted that 96% of departing trips were by car as driver with the remaining 4% by other modes. Whereas for arriving trips, 80% were car driver and 20% other modes.

05

Future Transport Context



5.1 BACKGROUND

The RTA, in collaboration with Wollongong Council and Shellharbour Council, has been planning the necessary transport infrastructure upgrades for the Illawarra Region for some time. This upgrade planning is in response to both existing traffic capacity issues as well as the anticipated travel demands resulting from the substantial growth in population planned in the region.

To inform these infrastructure upgrade plans the Councils and the RTA has been making use of the WOLSH TRACKS traffic model. This model is a three-step generation, distribution and assignment model which covers the whole of the Illawarra Region, as shown in Figure 5.1.

To aid in the assessment of the Calderwood development the RTA provided Cardno with a 2006 and 2026 model of the region. The 2026 model predates the Growth Centres Commission review of West Dapto release Area. As a result the 2026 model contains several upgrade proposals and land use planning assumptions which have now been discounted by the planning authorities.

For Cardno to make use of the models provided it was necessary to use the 2006 model as a base network and extract the background growth assumptions of the 2026 model to extrapolate to a new 2026 model without any infrastructure upgrades. The new 2026 model then had to be factored to reach the model assessment year of 2031. This was done by applying a linear growth factor in line with the growth trend between the 2006 and 2026 models.

5.2 FUTURE GROWTH

Future growth in vehicle trips within and through the WOLSH TRACKS model area has been considered to be as a result of growth in four key areas:

- Regional Growth – major development of new residential and employment areas such as West Dapto (excluding Calderwood).
- Infill Growth – general growth in existing residential and employment areas such as Wollongong CBD.
- External Growth – general background growth in through traffic.
- Calderwood Development Growth – development of DLL's Calderwood site.

The land use planning assumptions for each of these growth areas is discussed in the following sections.



5.2.1 REGIONAL GROWTH

For the purposes of this assessment it was necessary to define some key planning assumptions on future land uses, their likely yields and whether or not these developments would be realised by the 2031 assessment year. Cardno and DLL reviewed all relevant planning documents relating to new developments in the region and compiled a list of these schemes, broken down by:

- Approved developments.
- Planned developments likely to occur within the 2031 assessment period.
- Planned developments/schemes that are considered to fall outside the 2031 timeframe.

This list of developments can be found in Appendix 5-A. The RTA also provided a list of approved and planned developments in the Illawarra Region, compiled by the Department of Planning (DoP). This list of RTA/DoP developments can be found in Appendix 5-B. This list was reconciled against the list drawn up by Cardno and where discrepancies were noted a review of available information was undertaken to determine the most appropriate assumption to be taken. The comparison and reconciled list of schemes can be seen in Appendix 5-C.

The final reconciled list of development sites has been used as the basis for the cumulative impact assessment and the apportionment of responsibility for future traffic impacts. These sites were agreed with the RTA for modeling purposes. Table 5.1 provides a summary of the proposed developments included in the assessment and gives a breakdown of their expected yields. The proposed sites are presented in

Figure 5.2.

Table 5.1 Regional Land Use Planning Assumptions

Proposal	Development by 2031
Approved projects	
Delmo Albion Park	1650 jobs
Tullimbar	1978 dwellings
Haywards Bay	318 dwellings
Shellharbour Town Centre	282 dwellings
Dapto Town Centre	5200 jobs / 21,600sqm employment
Shell Cove	1135 dwellings ²
Proposed Projects	
West Dapto Stage 1 - Kembla Grange Employment Land	175Ha Employment land (assumed to be 10,355 jobs ³)
West Dapto Stage 1 - Sheaffes/ Wongawilli	3667 dwellings
West Dapto Stage 2 - West Horsley	2496 dwellings
Tallawarra	700 dwellings
Illawarra International Health Precinct	100,000 sqm medical/hospital (approximately 1,383 jobs ⁴)
Avondale Golf Course	Golf course + 400 dwellings
Yallah/Marshall Mount	900 dwellings

² Under review

³ Based on SGS Economics assessment of the West Dapto job creation potential.

⁴ Based on Cardno's EA in support of the Illawarra International Health Precinct

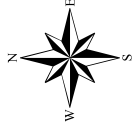
Figure 5.2

Future Growth Areas

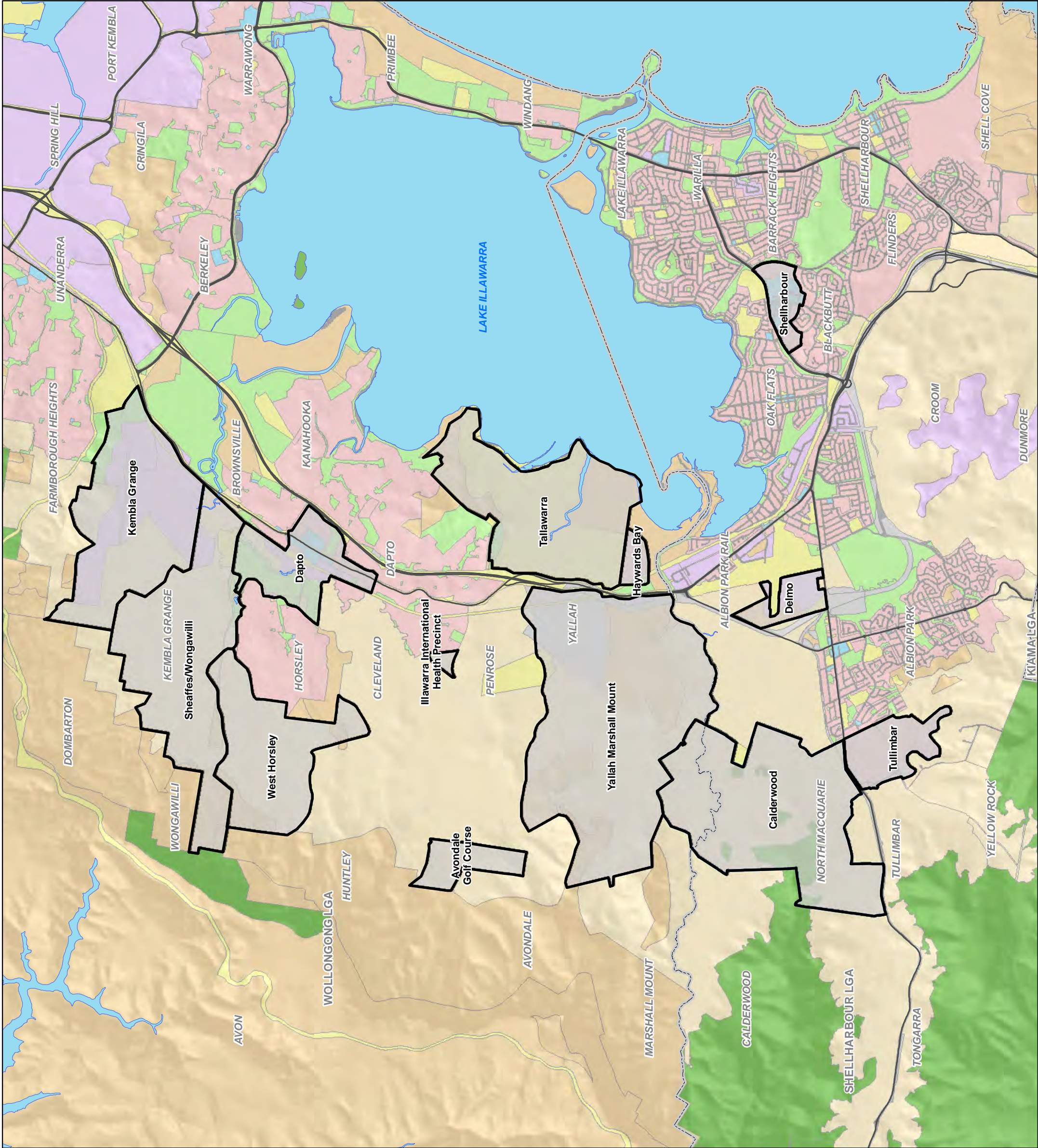
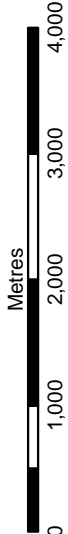
CALDERWOOD
URBAN DEVELOPMENT PROJECT

Legend

- Site Boundary
- Major Roads (LPMA)
- LGA Boundary (LPMA)
- Major Waterbodies (LPMA)
- Regional Growth Areas
- General Zoning (WCC and SCC LEPs)
- Other
- Rural
- Residential
- Commercial
- Industrial
- Special Uses
- Public/Private Recreation
- Environmental Protection
- National Parks/State Forest



Scale 1:60 000 (at A3)



5.2.2 INFILL GROWTH

In addition to the new development sites defined in Section 5.2.1 it was necessary to make allowances for the natural background traffic growth in the region resulting from gradual redevelopment, infill development and population growth. This level of background growth was established by undertaking an equivalence assessment between the 2006 and 2026 model zones. This provided the level of growth from 2006 to 2026. This was then extrapolated to determine the potential growth to 2031.

5.2.3 EXTERNAL GROWTH

As well as the increase in population as a direct result of the new developments and regional growth in the TRACKS model there was also an amount of external traffic growth in the model. As with the regional background growth, this external increase in traffic volumes was calculated by examining the equivalent external zones in the 2006 and 2026 models then applying a linear growth factor to this to achieve a 2031 external growth level.

5.2.4 CALDERWOOD DLL

The Calderwood site, the site under assessment, is in the south-west of the Illawarra region and has a planned yield of approximately 4,800 dwellings. Detailed descriptions are provided in Section 3.

5.3 FUTURE REGIONAL TRANSPORT NETWORK

5.3.1 DO MINIMUM UPGRADES

Significant planning for future road network upgrades has been undertaken in the Dapto-Albion Park area over the past ten years. Three major road upgrades were initially assumed to occur before 2031 for the purposes of modelling as follows:

- F6 Freeway extension: Yallah to Oak Flats.
- Tripoli Way (Albion Park Bypass).
- North-facing ramps at Tallawarra interchange.

This package of works was considered to be the 'do minimum' upgrades by 2031. In addition, it has been assumed that the intersection of Princes Highway and Colden Drive will be signalised by 2031 (this work is currently being undertaken in November 2009). No other background or 'do minimum' road network upgrades were assumed.

A detailed description of the above three major projects are included in Appendix 5-D and the 'do minimum' upgrade works are presented in Figure 5.3.

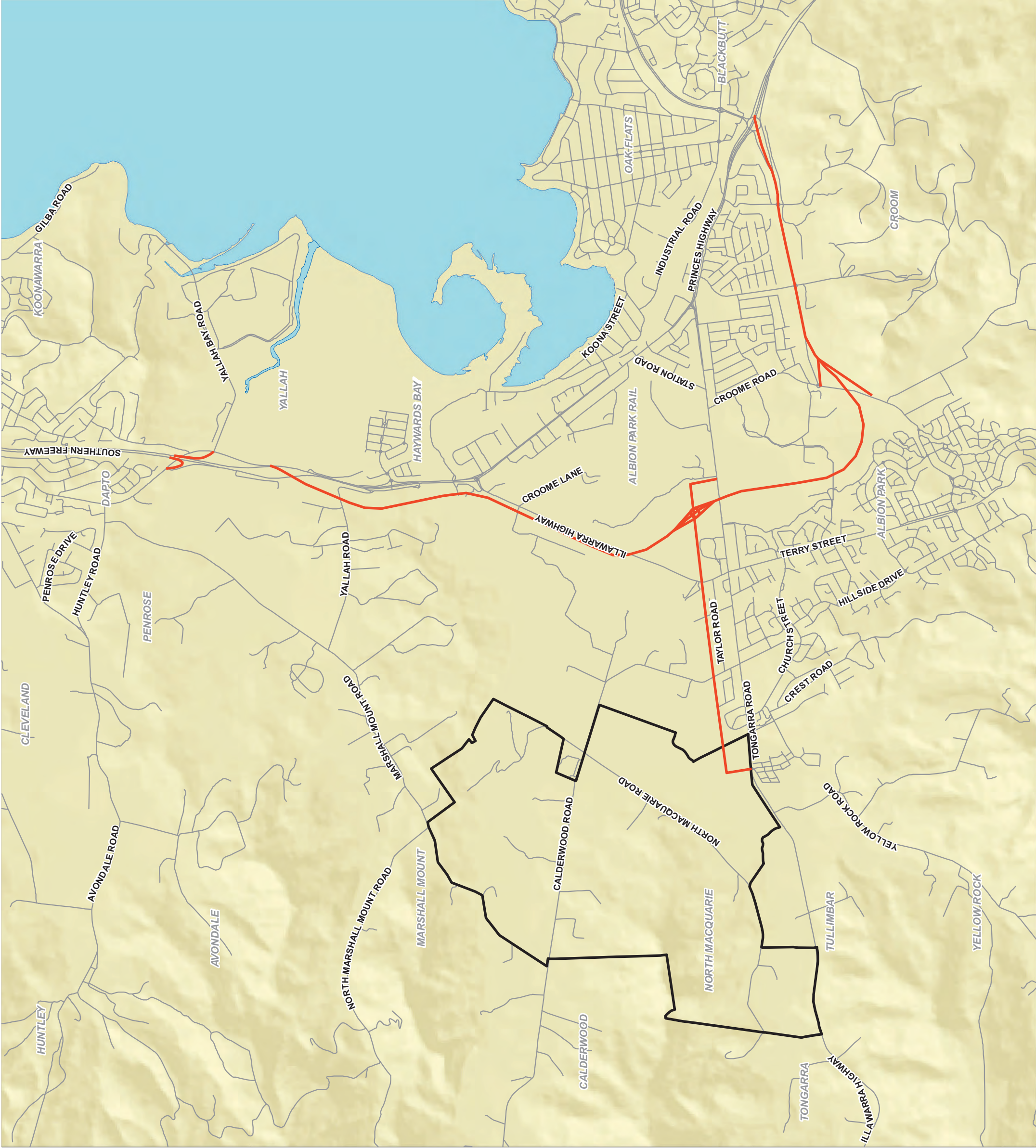


Figure 5.3
**2031 "Do Minimum"
Future Road Network
Upgrades**

CALDERWOOD
URBAN DEVELOPMENT PROJECT

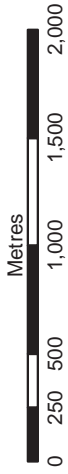
Legend

- Site Boundary
- Existing Road Network (LPMA) - Do Nothing
- Proposed Major Road Network Upgrades
- Lake Illawarra (LPMA)

Albion Park bypass is indicative



Scale 1:35,000 (at A3)



5.3.2 DO ABSOLUTE MINIMUM UPGRADES

Preliminary modelling identified that the north-facing ramps at Tallawarra interchange were not required in 2031. Further modelling then proceeded without these ramps but with the other works remaining (F6 extension and Tripoli Way).

The West Dapto Master Plan identifies both Marshall Mount Road and Yallah Road as part of the primary movement structure. Such road connections are particularly required to form the principal road connections between the Yallah/Marshall Mount areas, planned to accommodate 900 dwellings at full development, and the strategic road network. As described in Appendix 4-B both Marshall Mount and Yallah Roads are rural roads and upgrades would be necessary to bring them to a reasonable urban standard given the intensification in traffic movements associated with the planned urbanisation of the surrounding land uses.

In addition, the preliminary modelling investigations also revealed that Marshall Mount Road did accommodate an amount of traffic inappropriate for its 6.0 metre wide unsealed and line-marked condition. Therefore, included within the 'do absolute minimum' infrastructure upgrades was an upgrade of both Marshall Mount Road and Yallah Road to two-lane two-way (i.e. one lane in either direction) with minimum lane widths of 3.5 metres and appropriate width sealed shoulders.

These works were then referred to as the 'do absolute minimum':

- F6 Freeway extension: Yallah to Oak Flats.
- Tripoli Way (Albion Park Bypass).
- Marshall Mount Road and Yallah Road upgrade.

Detailed descriptions of the above projects are included in Appendix 5-D and presented in Figure 5.4.

5.4 FUTURE CUDP ROAD NETWORK

As shown within the CUDP Concept Plan an initial assessment of the road network and external connections to the future road network has been undertaken. This provides an internal road hierarchy suitable for modelling purposes to enable potential further road network development and refinement. The extent of the modelled CUDP road network is modelled in accordance with the indicative Concept Plan layout. A detailed description of the internal CUDP road network and the external road connections is provided in Appendix 5-E.

5.5 FUTURE TRAVEL DEMANDS

Existing travel behaviour data indicates that the current mode share of car based travel is 90% in both the Wollongong and Shellharbour LGA's. The concept plan for the CUDP master planned community development contains a number of key principles relating to transport as follows:

- A modified grid that promotes connectivity and accessibility.
- A movement network that promotes trip containment, walking, cycling and public transport.
- Residential neighbourhoods that provide a mix of dwelling types.
- Inclusion of a range of retail, community, education and employment uses that meet community needs and promotes trip containment.
- Provision of an extensive passive and active open space network.

Through these and other sustainable travel principles DLL expects the Calderwood development to achieve a 10% mode shift from car based to non car-based travel modes.

Figure 5.4

2031

"Do Absolute Minimum"
Future Road Network
Upgrades

CALDERWOOD
URBAN DEVELOPMENT PROJECT

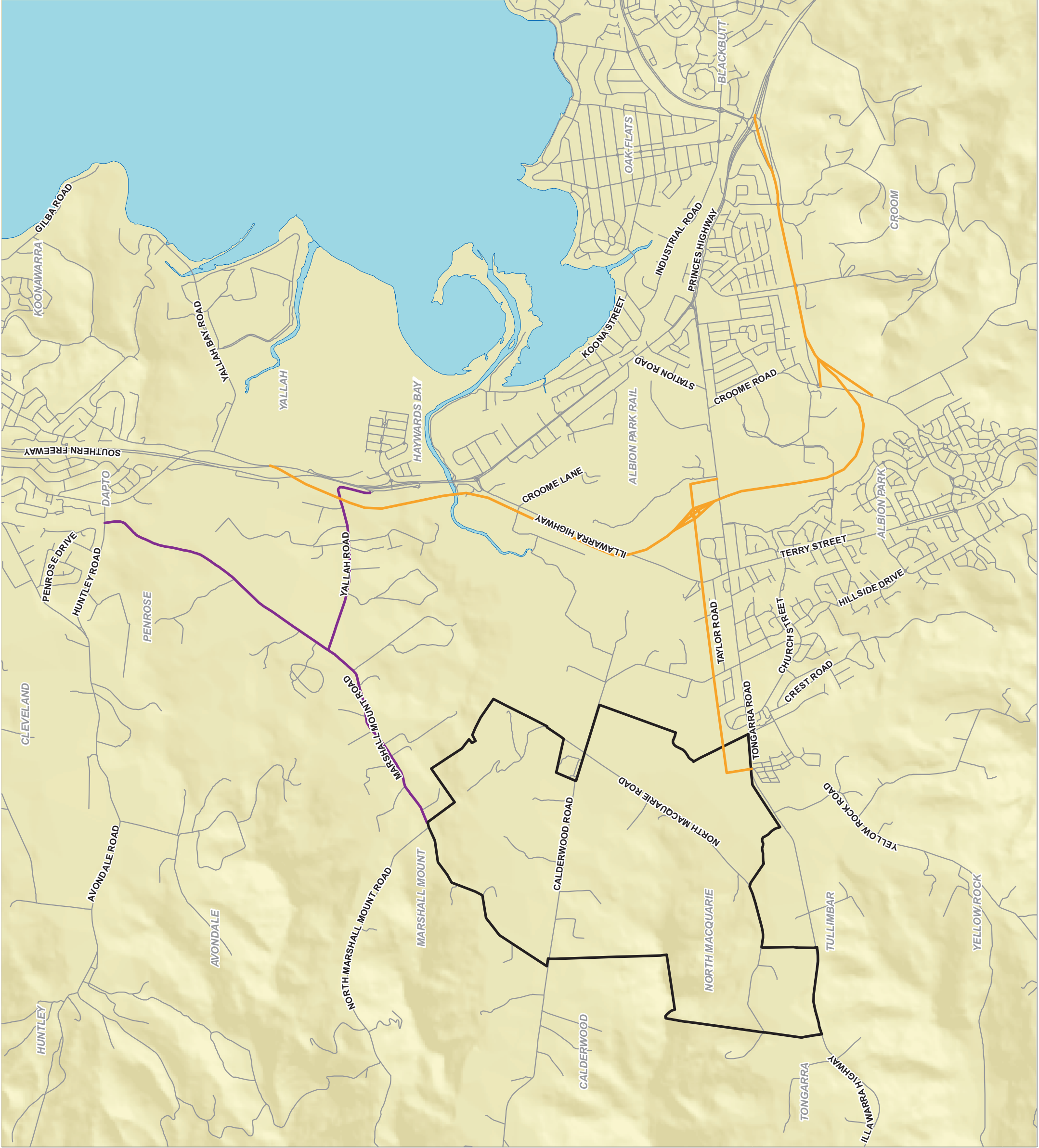
Legend

- Site Boundary
- Proposed Major Road Network Upgrades
- Proposed Minor Road Network Upgrades
- Existing Road Network (LPMA) - 'Do Nothing'
- Lake Illawarra (LPMA)

Albion Park bypass is indicative



Scale 1:35,000 (at A3)



06

Transport Modelling



6.1 OBJECTIVE OF THE MODELLING

Transport modelling provides the means by which the road infrastructure requirements of the proposed CUDP can be identified taking into account other planned significant land use and road infrastructure changes in the Shellharbour and Wollongong region.

The 2031 WOLSH CUDP traffic model will be used to generate a range of outputs under a range of land use/infrastructure scenarios which will be used to define transportation impacts and assist in the identification of appropriate ameliorative measures if undesirable outcomes are identified, for example unacceptable levels of traffic queues and delays on the road network.

Specific model outputs used within the TMAP include:

- Road link traffic volumes.
- Intersection turning volumes.
- Road network and intersection operational performance statistics.
- Network vehicle kilometres travelled (VKT).
- Network vehicle operating time (VOT).

The traffic model outputs will thus enable the identification of the overall contribution to transport demand within the region that the CUDP will have, once fully constructed. This enables the appropriate cost allocation to be made towards the State Infrastructure Contributions delivered via the Voluntary Planning Agreement mechanism.

6.2 MODELLING METHODOLOGY

To accord with Director General's requirements for land use/road infrastructure assessment the WOLSH TRACKS strategic traffic model was made available for study purposes by the RTA and Wollongong Council. The TRACKS model provides a representation of the regional, state and local road network and provides forecast traffic demands over the combined LGA areas. The use of the TRACKS traffic model is Council and the RTA's preferred assessment tool to undertake assessments of infrastructure requirements necessary to support land use changes.

Different combinations of land use and road network assumptions (explained below in section 6.4) are used as input to the 2031 TRACKS model to generate, distribute and assign traffic movements within the model area and provide outputs resolved to intersection turning movement level. These intersection turning movements can then be more accurately modelled in the SIDRA intersection modelling software which enables assessment of isolated intersections performance using NSW RTA level of service criteria under a given set of traffic demands.

Subsequent modelling iterations allow the formulation of appropriate intersection configurations/controls to achieve the desired level of intersection performance. Comparisons of 'with' and 'without' CUDP transport demands for comparable road network options allow the impact upon operational performance of road links and intersections to be made for cost allocation purposes.

6.2.1 2009 BASE MODEL

The 2006 TRACKS model supplied by Wollongong Council was recalibrated using current (2009) traffic counts within the area of influence to reflect current traffic conditions. The resultant appropriately calibrated model (2009 WOLSH CUDP Model) provides a satisfactory base for future assessments. Details relating to the model calibration process and results are included within Appendix 6-A.

6.2.2 2031 BASE MODEL

The 2031 design year represents a 20 year construction period for the CUDP. The 2031 Base model was developed to assess background traffic without the CUDP at the design year. The 2031 Base model was developed from the two models provided by the Council's 2006 model and 2026 model. The methodology is detailed in Appendix 6-A. The agreed regional developments growth, infill growth and external background growth (described in section 5.2 above) were incorporated into the 2031 base model.

6.2.3 2031 CUDP MODEL

The 2031 CUDP model was developed to reflect likely transport conditions at the development completion time with the full CUDP development.

6.3 MODELLING SCENARIOS

Each modelling scenario requires a combination of input data:

- Road network options - presented in Figure 6.1.
- Travel demand – developed from model trip generation rates⁵ and land use planning assumptions (detailed in Section 5.2) including:
 - Regional release area growth excluding CUDP.
 - Regional Infill growth.
 - External growth
 - CUDP Growth.
- Mode shift assumptions :
 - Existing and infill areas assumed to have the same mode share as is currently in the base models described as the 'business as usual' (BAU) case.
 - Regional release area growth excluding CUDP and the CUDP were tested in various scenarios under the BAU case or with a 10% modal shift from car based to non car based modes of transport.

Each of these input options are described in Appendix 6-B.

To undertake assessments of the various combinations of the options identified above a range of scenario options were developed for testing. This is summarised in a matrix format in Table 6.1 and detailed in Appendix 6-C.

Initially a range of 2009 and 2031 base models were run to determine the likely road network improvements in 2031 without CUDP development. This was followed by a testing a significant range of scenarios to assess the road network performance with full 2031 future development including the Calderwood project. This was an iterative process that allowed development of an optimum package of measures.

⁵ Trip generation rates are inherent to the TRACKS model

Figure 6.1
Road Network Options

CALDERWOOD
URBAN DEVELOPMENT PROJECT

Legend

- Site Boundary
- Existing Road Network (LPMA) - Do Nothing
- Proposed Major Road Network Upgrades - Do Minimum
- Indicative CUDP Internal Road Network
- Lake Illawarra (LPMA)

Albion Park bypass is indicative

Scale 1:35,000 (at A3)

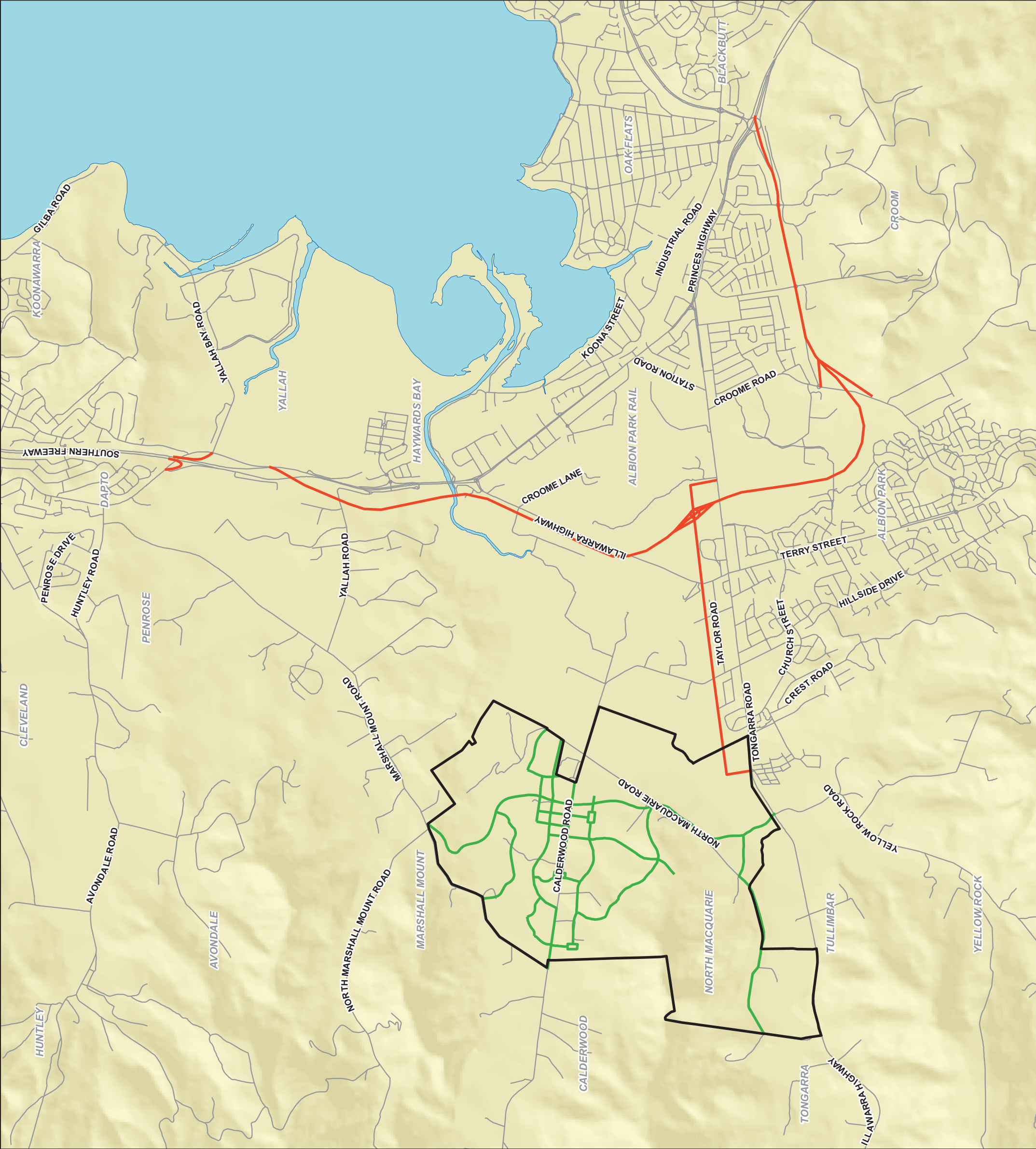


Table 6.1 Key Scenario Summary Matrix

Year/ Scenario Name		2009 Base (BAU)	2031 Base 'do nothing' (BAU)	2031 Base 'do minimum' (BAU)	2031 Base 'do minimum' (mode shift)	2031 Base 'do abs. minimum' (BAU)	2031 Base 'do base upgrades' (BAU)	2031 CUDP 'do nothing' (BAU)	2031 CUDP 'do nothing' (mode shift)	2031 CUDP 'do minimum' (mode shift)	2031 CUDP 'do abs. minimum' (mode shift)	2031 CUDP 'do base upgrades' (mode shift)	2031 CUDP 'full dev. upgrades' (mode shift)
Scenario Ref No.		09_B0	31_B01	31_B02	31_B03	31_B04	31_B05	31_D01	31_D02	31_D04	31_D08	31_D11	31_D12
Road Network	2009 Existing/ 'Do Nothing'	y	y	y	y	y	y	y	y	y	y	y	y
	2031 'Do Minimum'	n	n	y	y	y	y	n	n	y	y	y	y
	2031 'Do Absolute Minimum'	n	n	n	n	y	y	n	n	y	y	y	y
	2031 'Base Upgrades'	n	n	n	n	n	n	y	y	y	y	y	y
	2031 CUDP Internal	n	n	n	n	n	n	y	y	y	y	y	y
	2031 'Full Dev Upgrades'	n	n	n	n	n	n	n	n	n	y	y	y
Planning Assumptions/ Growth & Mode Share	2009 Development	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
	2031 Regional Infill Growth	n	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
	2031 External Growth	n	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
	2031 Regional New Development	n	BAU	BAU	10%	BAU	BAU	BAU	BAU	BAU	BAU	BAU	BAU
	2031 CUDP	n	n	n	n	n	n	BAU	10%	10%	10%	10%	10%

Mode Share: BAU = business as usual -x% = x% shift to non-car based transport modes
Other: CUDP = Calderwood Urban Development Project

07

Road Network Impact Assessment



7.1 BASE NETWORK ASSESSMENT

In order to establish the characteristic of the future road network without the CUDP a range of base model scenarios was run (as detailed in Section 6.3). This assessment provides a base for comparison against changes required as a result of the CUDP.

For each scenario the following information was extracted from the relevant AM and PM 2031 Base TRACKS models:

- Mid-block and turning traffic volumes.
- Network VKT and VOT.

The mid-block and turning traffic volumes were used to then assess mid-block carriageway capacity and intersection performance. A summary of each peak period for each scenario was produced to graphically represent mid-block LoS, intersection LoS and network VKT/VOT.

Table 7.1 provides an overview of the base model scenarios, detailing the scenario description and key outcomes for the scenario. Results of each scenario are then summarised in the figures in this chapter with detailed results presented in a series of appendices as identified in Table 7.1.

Table 7.1 2031 Base Model Scenario Outcomes

Scenario Description		Key Outcomes	Results Summary
2031 BASE 'DO NOTHING' BAU SCENARIO {31_B01}			
<ul style="list-style-type: none">➤ 2009 road network only with no upgrades.➤ Regional infill growth, external growth and regional new development growth with no CUDP.➤ BAU modal splits.		Overall under 2031 base future growth scenario with no 'do minimum' upgrades the road network will be under considerable strain with key road sections and intersections failing.	Figure 7.1 AM peak Figure 7.2 PM peak Appendix 7A
2031 BASE 'DO MINIMUM' BAU SCENARIO {31_B02}			
<ul style="list-style-type: none">➤ 2009 road network with 'do minimum' upgrades.➤ Regional infill growth, external growth and regional new development growth with no CUDP.➤ BAU modal splits.		Overall the introduction of the 'do minimum' upgrades provides significant benefits to the 2031 road network. However some issues will still need to be resolved. It was established that under the base 2031 scenario there is insufficient demand to warrant the Tallawarra Freeway ramps.	Figure 7.3 AM peak Figure 7.4 PM peak Appendix 7B
2031 BASE 'DO MINIMUM' MODE SHIFT SCENARIO {31_B03}			
<ul style="list-style-type: none">➤ 2009 road network with 'do minimum' upgrades.➤ Regional infill growth and external growth with BAU modal splits.➤ Regional new development growth with (no CUDP) including a 10% modal shift.		Overall the consideration of a 10% mode shift on regional growth areas has little impact on the road network within the Calderwood area of influence.	Figure 7.5 AM peak Figure 7.6 PM peak Appendix 7C
2031 BASE 'DO ABSOLUTE MINIMUM' BAU SCENARIO {31_B04}			
<ul style="list-style-type: none">➤ 2009 road network with 'do absolute minimum' upgrades i.e. 'do minimum' excluding the Tallawarra Freeway ramps.➤ Regional infill growth, external growth and regional new development growth with no CUDP.➤ BAU modal splits.		<p>Overall the introduction of the 'do absolute minimum' upgrades provides significant benefits to the 2031 road network. However some issues will still need to be resolved. The section of Princes Hwy between Mount Brown Rd and Southern Fwy (including the southern freeway southbound on-ramp and northbound off-ramp) would operate at a poor LoS during both modelled peak periods. Additional traffic capacity would need to be provided by constructing an additional southbound traffic lane on Princes Hwy to the Southern Fwy. Associated freeway merge /diverge widening works would also need to be undertaken on the Southern Fwy.</p> <p>The introduction of the following road network improvements to address the 2031 base road network deficiencies will be required:</p> <ul style="list-style-type: none">➤ Duplication of Princes Highway (adding an additional traffic lane):<ul style="list-style-type: none">▪ Northbound from Mount Brown Road to the F6 off-ramp.▪ Southbound from Mount Brown Road to the F6 on-ramp.➤ In conjunction with the above upgrade to traffic signal control of the following existing intersections:<ul style="list-style-type: none">▪ Princes Highway / Huntley Road▪ Princes Highway / Southern Freeway northbound off slip▪ Princes Highway / Cormack Avenue➤ Southern Freeway southbound on-slip road upgrade to two lanes and associated freeway merge widening works to accommodate.➤ Southern Freeway northbound off-slip road upgrade to two lanes and associated freeway diverge widening works to accommodate.➤ Marshall Mount and Yallah Road upgrades to satisfactory one lane width in either direction with sealed shoulders. <p>(The above upgrades in addition to the 'do absolute minimum' upgrades are referred to as the 'do base upgrades'.)</p>	Figure 7.7 AM peak Figure 7.8 PM peak Appendix 7D
2031 BASE 'DO BASE UPGRADES' MODE SHIFT SCENARIO {31_B05}			
<ul style="list-style-type: none">➤ 2009 road network with 'do absolute minimum' upgrades i.e. 'do minimum' excluding the Tallawarra Freeway ramps plus the 'do base upgrades', as detailed in previous section➤ Regional infill growth and external growth with BAU modal splits.➤ Regional new development growth with (no CUDP) including a 10% modal shift.		The 2031 future base road network will perform satisfactorily with the 'do base upgrade' package of measures.	Figure 7.9 AM peak Figure 7.10 PM peak Appendix 7E

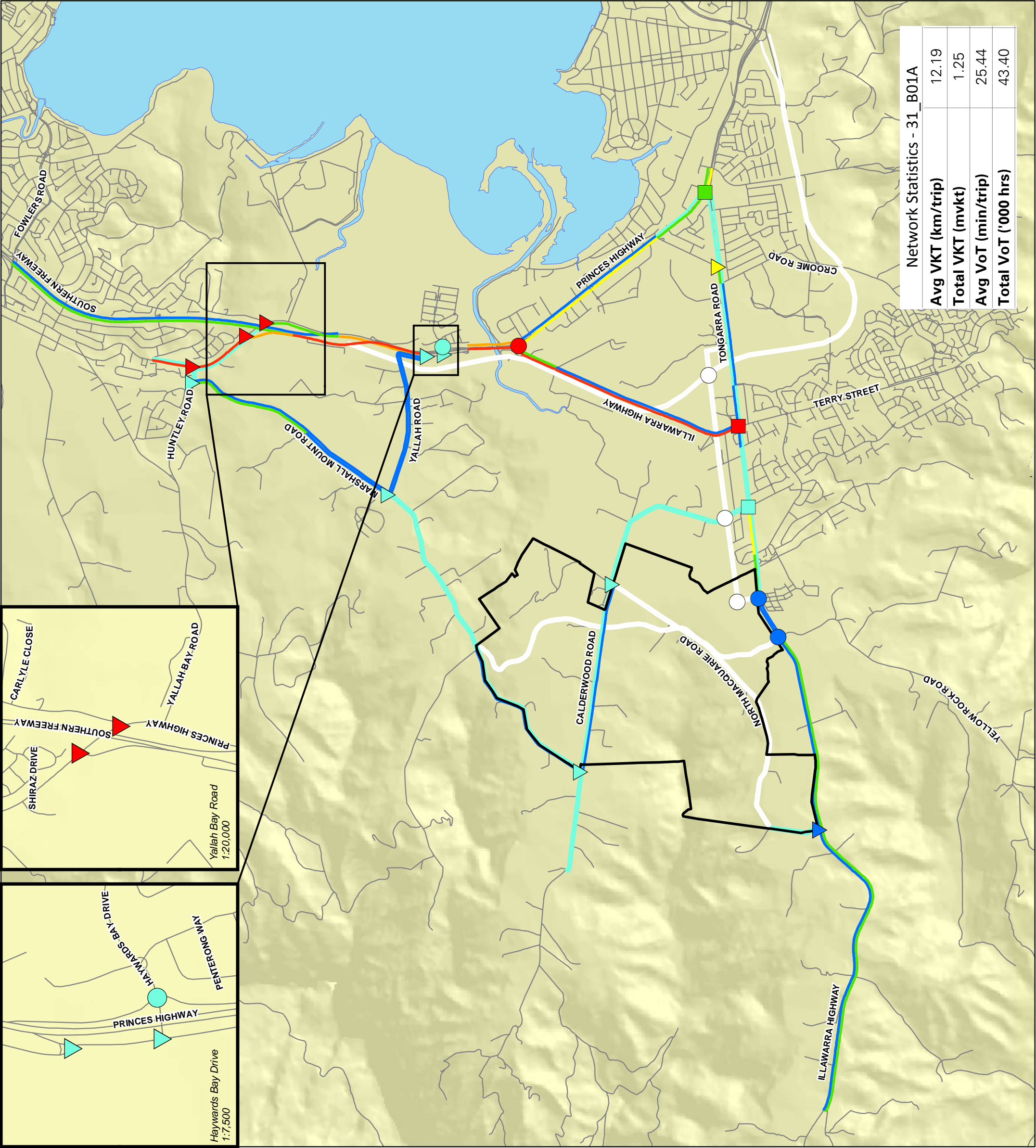


Figure 7.1

Road Network Performance
AM Peak 2031 Base
'Do Nothing' BAU

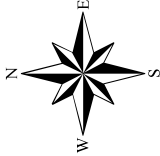
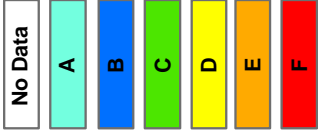
CALDERWOOD
URBAN DEVELOPMENT PROJECT

Legend

Model Ref No.: 31_B01

- Site Boundary
- Lake Illawarra (LPMA)
- Local Roads (LPMA)
- Mid-Block Road Sections
- Priority Control
- Roundabout
- Traffic Signals

Level of Service (LoS)



Scale 1:40 000 (at A3)

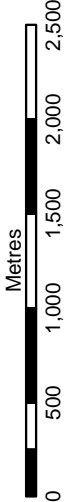


Figure 7.2

Road Network Performance PM Peak 2031 Base 'Do Nothing' BAU

CALDERWOOD
URBAN DEVELOPMENT PROJECT

Legend

Site Boundary

Lake Illawarra (LPMA)

Local Roads (LPMA)

Mid-Block Road Sections

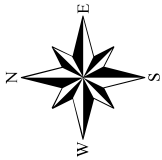
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Priority Control

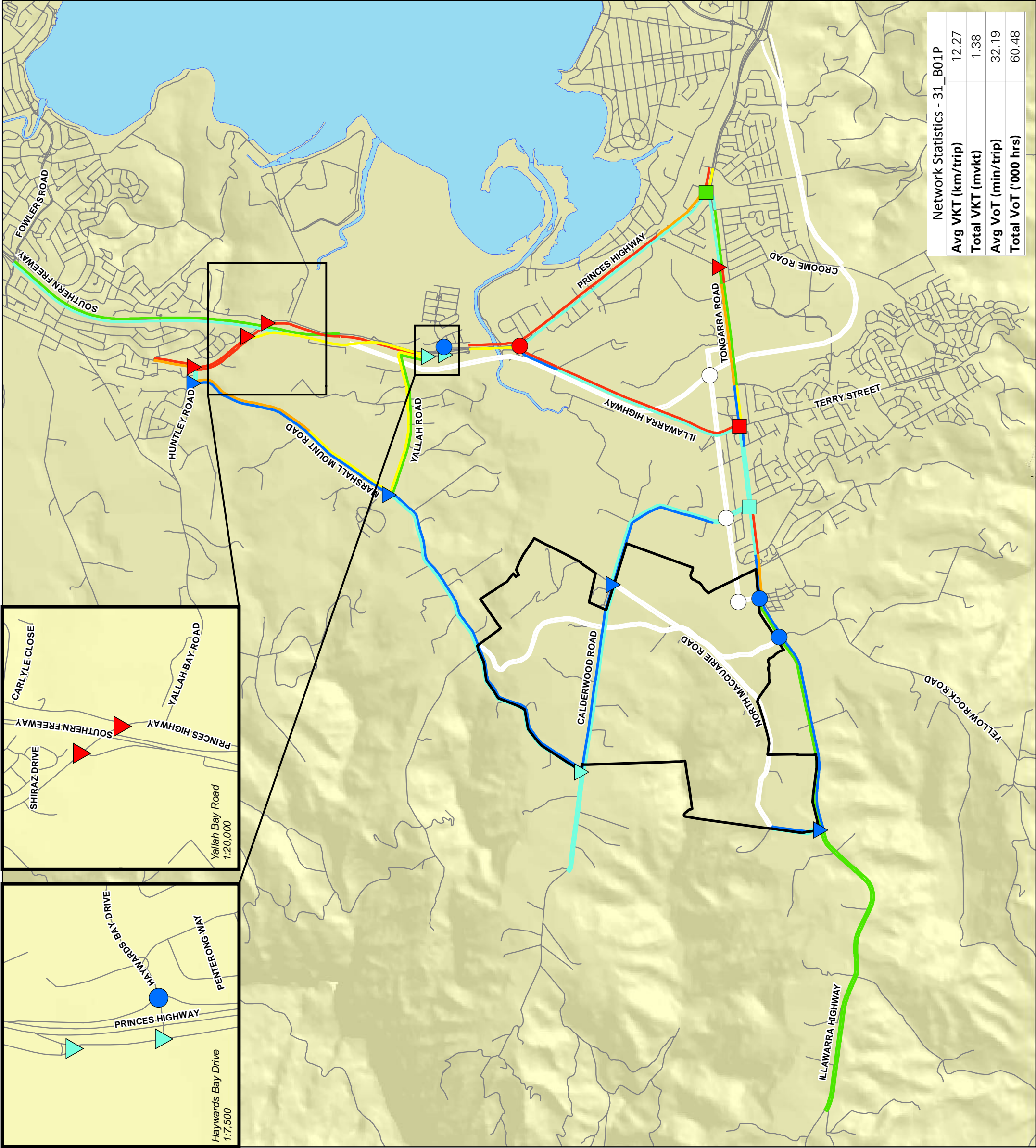
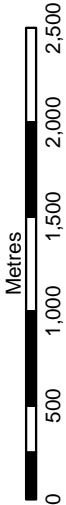
Roundabout

Traffic Signals

Level of Service (LoS)



Scale 1:40 000 (at A3)



Network Statistics - 31_B01P	
Avg VKT (km/trip)	12.27
Total VKT (mvkt)	1.38
Avg VoT (min/trip)	32.19
Total VoT ('000 hrs)	60.48


Figure 7.3


Road Network Performance AM Peak 2031 Base 'Do Minimum' BAU


CALDERWOOD
URBAN DEVELOPMENT PROJECT


Legend


- Model Ref No.: 31_B02

 Site Boundary

 Lake Illawarra (LPMA)

 Local Roads (LPMA)

 Mid-Block Road Sections

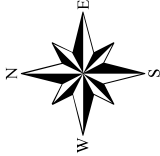
 Priority Control

 Roundabout

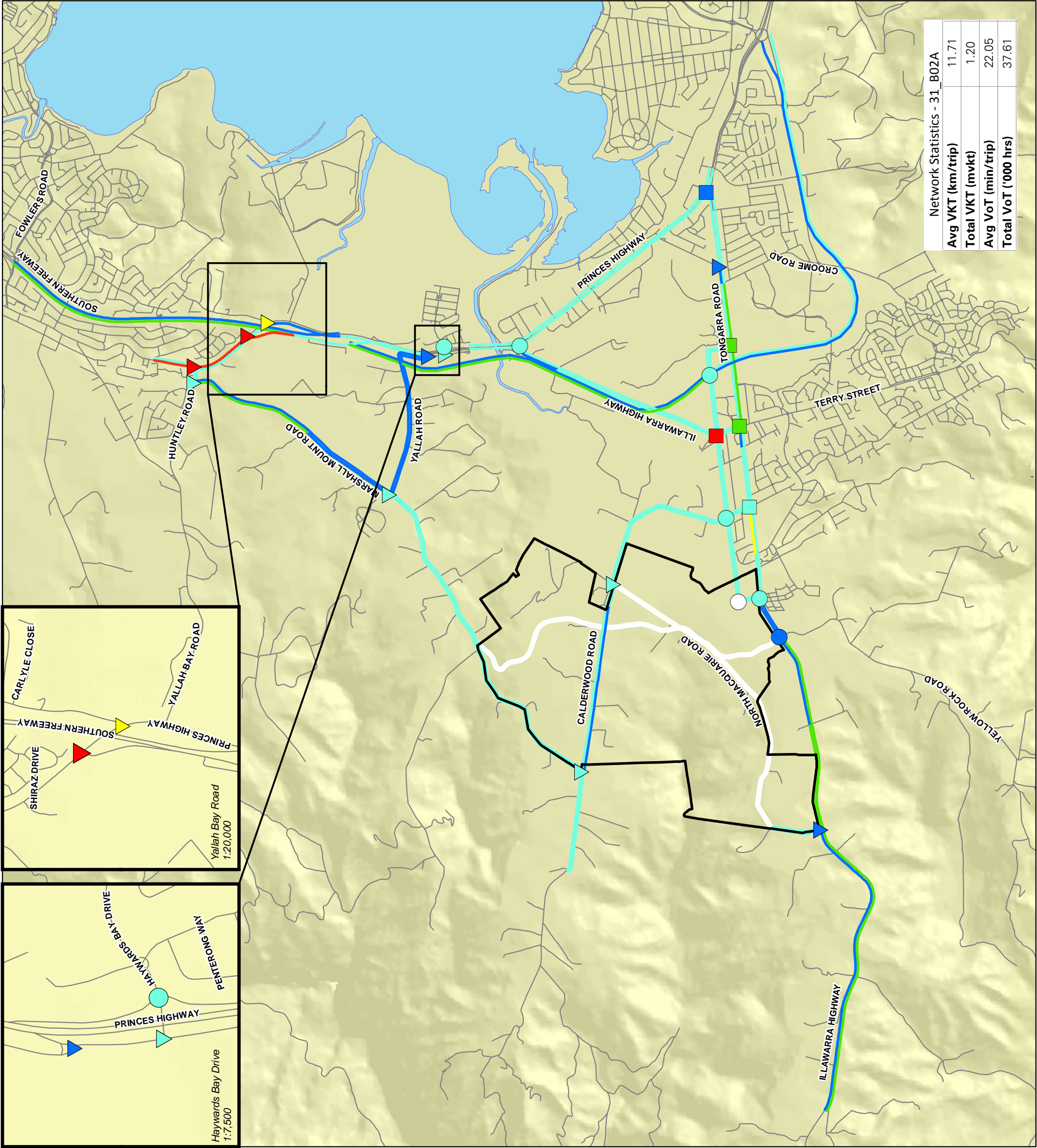
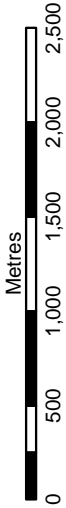
 Traffic Signals

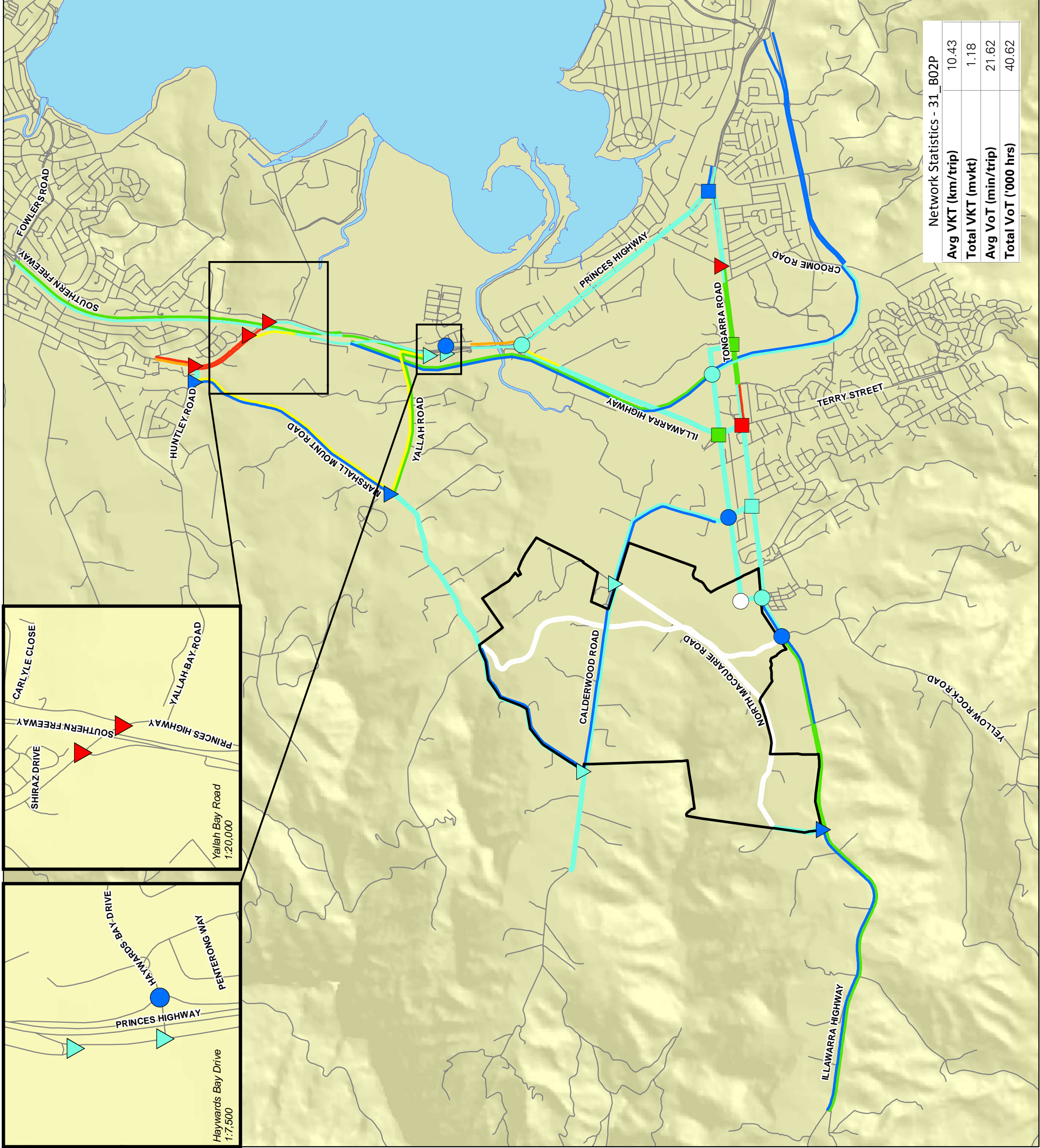
Level of Service (LoS)

- No Data
- A
- B
- C
- D
- E
- F




Scale 1:40 000 (at A3)



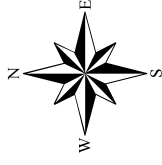
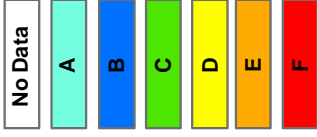


CALDERWOOD
URBAN DEVELOPMENT PROJECT

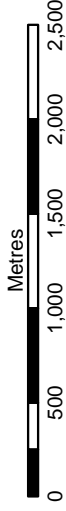
Model Ref No.: 31_B02

-  Site Boundary
 Lake Illawarra (LPMA)
 Local Roads (LPMA)
 Mid-Block Road Sections
 Priority Control
 Roundabout
 Traffic Signals

Level of Service (LoS)



Scale 1:40 000 (at A3)



Network Statistics - 31_B02P	
Avg VKT (km/trip)	10.43
Total VKT (mvkt)	1.18
Avg VoT (min/trip)	21.62
Total VoT ('000 hrs)	40.62

Map Produced by Cardno Wollongong
Date: 20 January 2010
Coordinate System: Zone 56 MGA/GDA 94
GIS MAP REF: 110026-01_58017_KeyRoutes_LevelOfService_31_B02P.mxd 04

Figure 7.5

Road Network Performance AM Peak 2031 Base 'Do Minimum' Mode Shift

CALDERWOOD
URBAN DEVELOPMENT PROJECT

Legend

- Model Ref No.: 31_B03

 Site Boundary

 Lake Illawarra (LPMA)

 Local Roads (LPMA)

 Mid-Block Road Sections

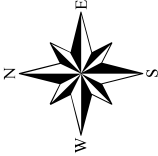
 Priority Control

 Roundabout

 Traffic Signals

Level of Service (LoS)

- No Data
- A
- B
- C
- D
- E
- F



Scale 1:40 000 (at A3)

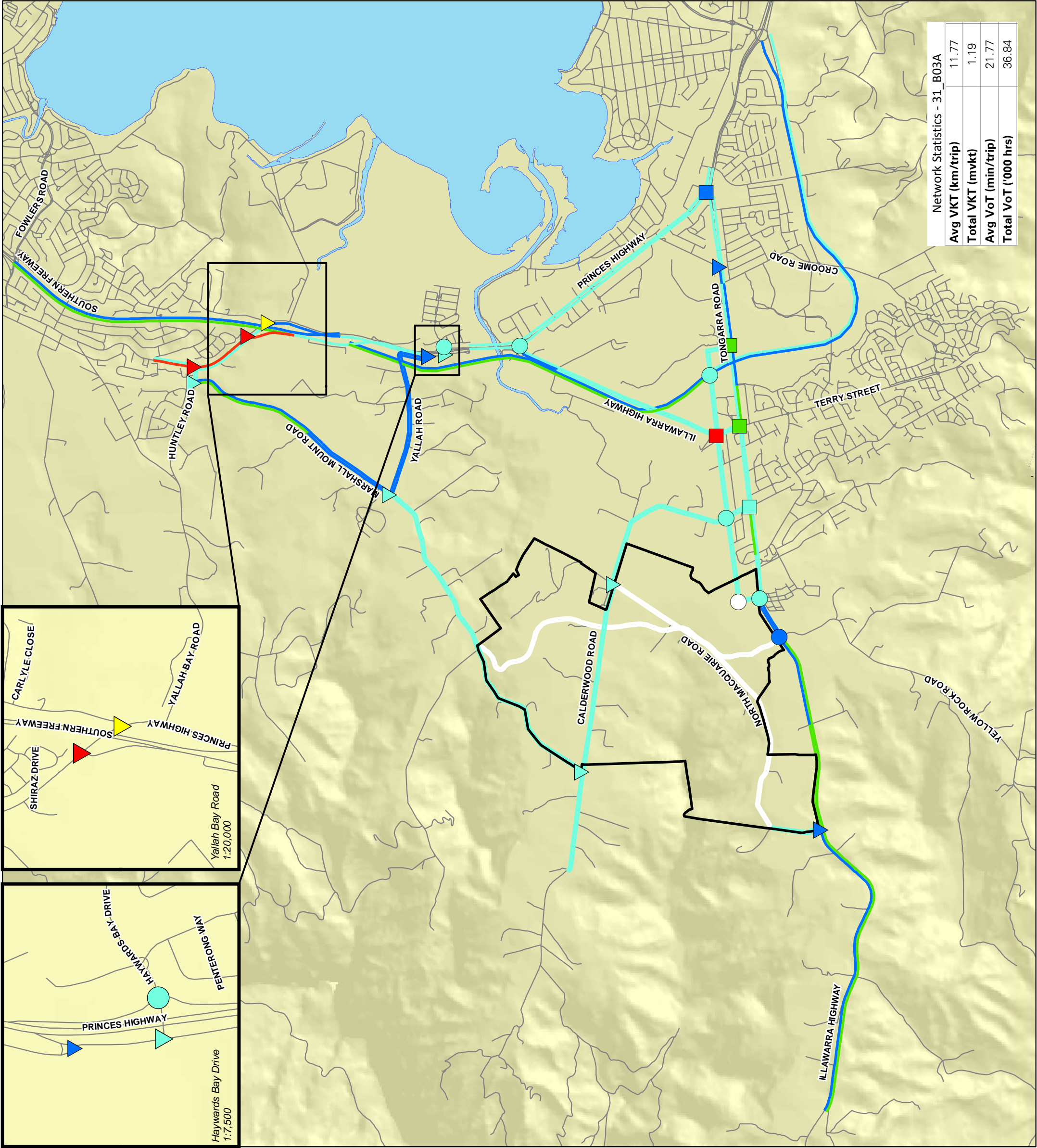
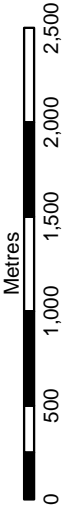


Figure 7.6

Road Network Performance PM Peak 2031 Base 'Do Minimum' Mode Shift

CALDERWOOD
URBAN DEVELOPMENT PROJECT

Legend

Model Ref No.: 31_B03

Site Boundary

Lake Illawarra (LPMA)

Local Roads (LPMA)


Mid-Block Road Sections

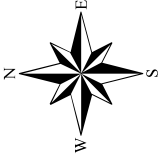
Priority Control

Roundabout

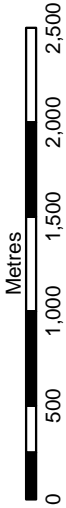
Traffic Signals


Level of Service (LoS)



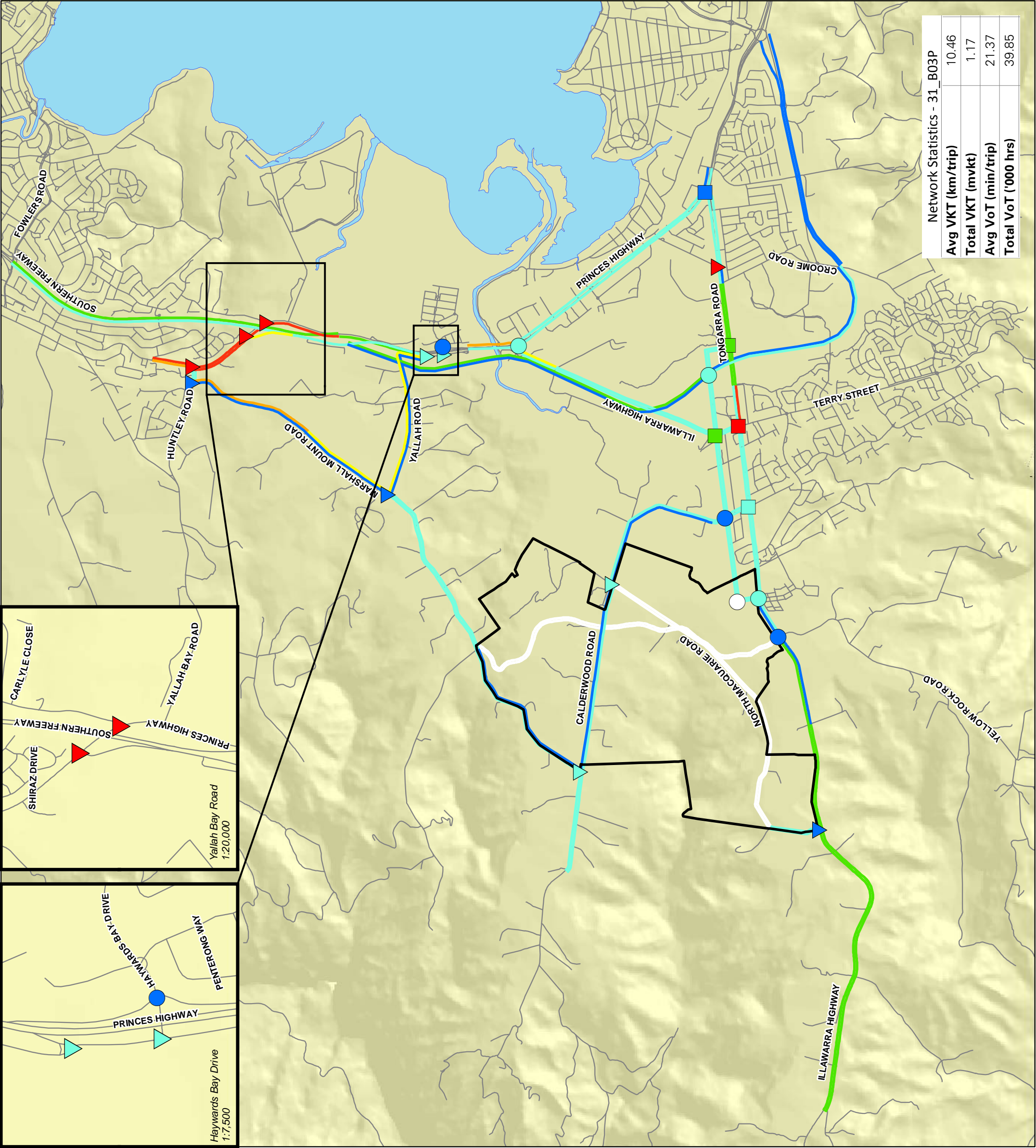


Scale 1:40 000 (at A3)





Map Produced by Cardno Wollongong
Date: 20 January 2010
Coordinate System: Zone 56 MGA/GDA 94
GIS MAP REF: 110026-01_38019_KeyRoutes_LevelOfService_31_B03P.mxd 04




Network Statistics - 31_B03P	
Avg VKT (km/trip)	10.46
Total VKT (mvtkt)	1.17
Avg VoT (min/trip)	21.37
Total VoT ('000 hrs)	39.85


Figure 7.7


Road Network Performance AM Peak 2031 Base 'Do Absolute Minimum' BAU


CALDERWOOD
URBAN DEVELOPMENT PROJECT


Legend


 Site Boundary


 Lake Illawarra (LPMA)

 Local Roads (LPMA)

 Mid-Block Road Sections

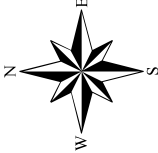
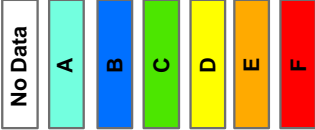
 Priority Control

 Roundabout

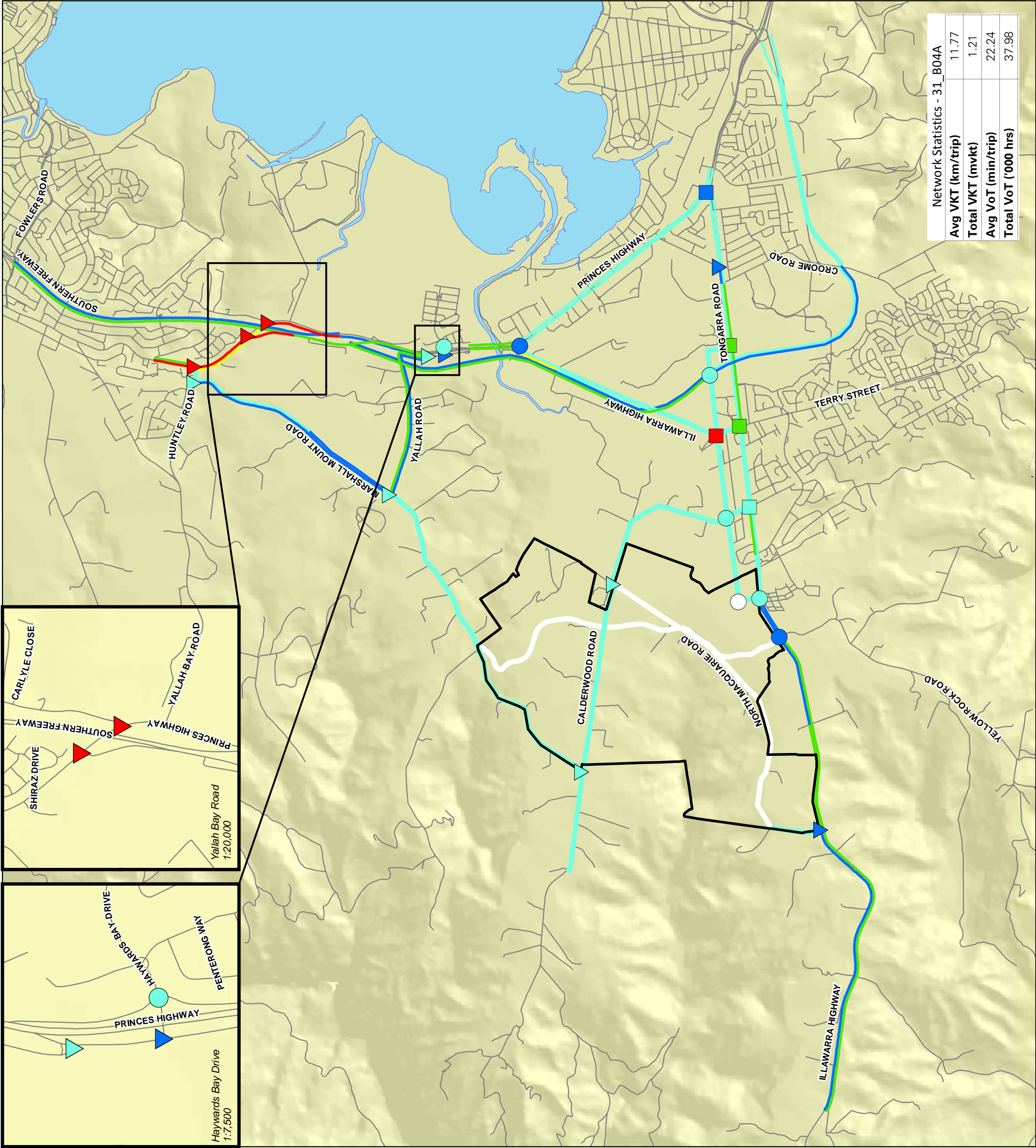
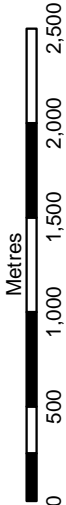
 Traffic Signals

Model Ref No.: 31_B04

Level of Service (LoS)



Scale 1:40 000 (at A3)



Network Statistics - 31_B04A	
Avg VKT (km/trip)	11.77
Total VKT (mvkt)	1.21
Avg VoT (min/trip)	22.24
Total VoT ('000 hrs)	37.98

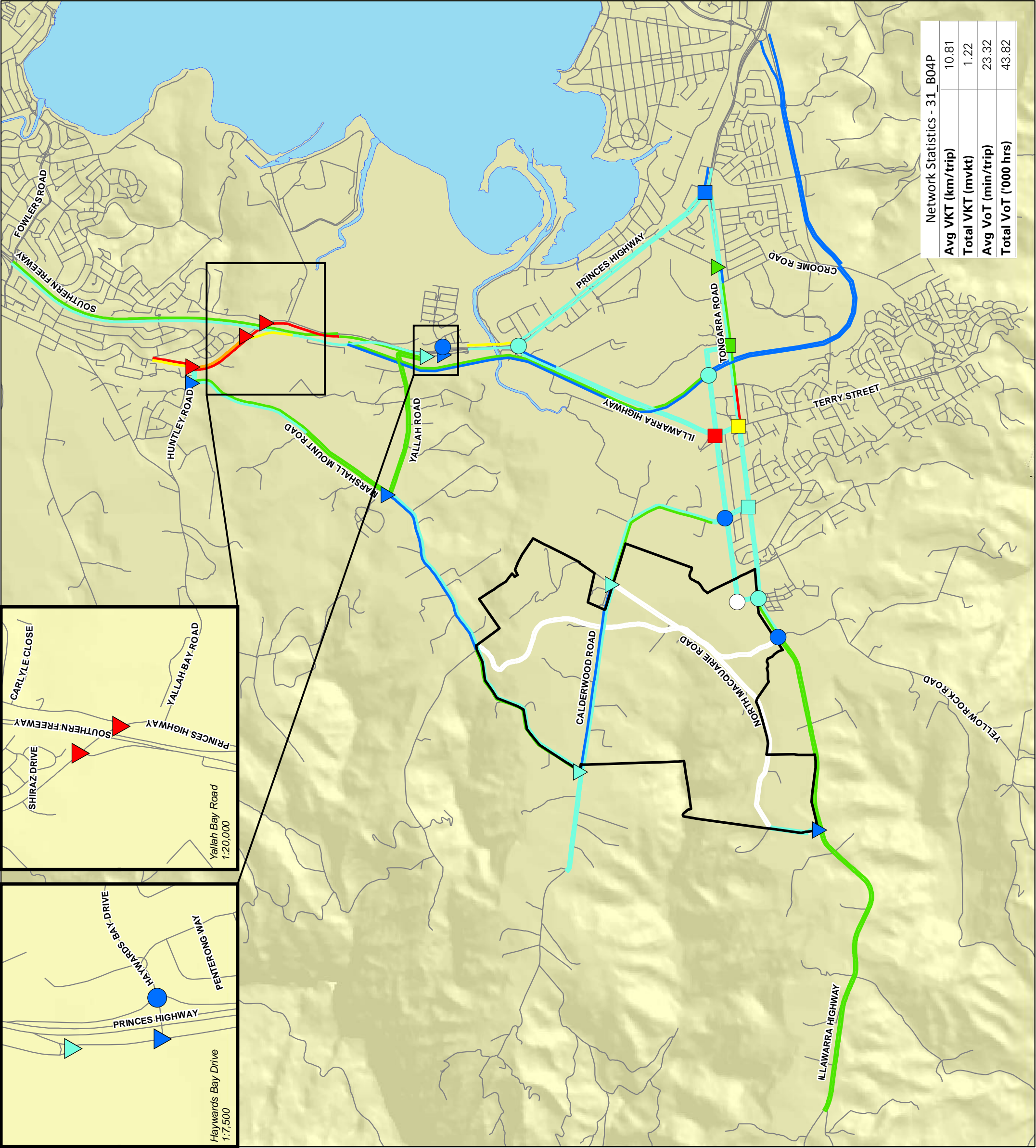


Figure 7.8

Road Network Performance PM Peak 2031 Base 'Do Absolute Minimum' BAU

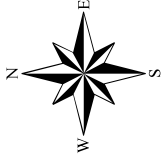
CALDERWOOD
URBAN DEVELOPMENT PROJECT

- Legend**
- Site Boundary
 - Lake Illawarra (LPMA)
 - Local Roads (LPMA)
 - Mid-Block Road Sections
 - Priority Control
 - Roundabout
 - Traffic Signals

Model Ref No.: 31_B04

Level of Service (LoS)

- No Data
- A
- B
- C
- D
- E
- F



Scale 1:40 000 (at A3)

