

Technical Paper 1

Construction

Traffic and

Transport

Management

Environmental Assessment No. 1

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1 Introduction

1.1 Project Overview

The North West Rail Link (NWRL) is a key priority railway transport infrastructure project. The project would provide eight new stations and services over a 23 kilometre addition to the CityRail network from Epping to Rouse Hill in North West Sydney. Stations are planned at Cherrybrook, Castle Hill, Hills Centre, Norwest, Bella Vista, Kellyville, Rouse Hill Town Centre and Cudgegong Road. Bus, pedestrian and cycling access facilities would be provided at all stations, with approximately 4,000 park and ride spaces in total proposed at Cherrybrook, Hills Centre and Kellyville Stations.

The new rail link would provide:

- Approximately 300,000 residents in North West Sydney with rail access to Epping, Macquarie Park, Chatswood, St Leonards, North Sydney and the Central Business District (CBD).
- New rail services to existing suburbs in the Hills District as well as future areas of growth planned for the north west.
- Improved travel time reliability compared with bus and private car.
- Travel time savings from many areas of the north west region to the CBD and Macquarie Park, and within the region, including to the Rouse Hill Town Centre.
- A major increase in services to Macquarie University and Macquarie Park.
- Reduced bus congestion in the CBD in the long term.

The NWRL project, including alignment and stations, was considered at concept level during 2006-2008, including consultation with relevant stakeholders. Given the passage of time, the broad design established in 2006-2008 has been optimised to ensure that it appropriately responds to the travel needs of Sydney commuters, improves value for money and produces a better project outcome for the community. This has resulted in some refinements to the project, which are being addressed through a modification to the 2008 Concept Approval (now referred to as a Staged Infrastructure Approval following recent amendments to the Environmental Planning & Assessment Act (EP&A Act)).

The rail alignment (see **Figure 1.1**) would extend from Epping to Rouse Hill via Castle Hill, through the Hornsby, The Hills, and Blacktown local government areas (LGAs). The majority of the rail line would be in the form of an underground rail tunnel from Epping Station to Bella Vista Station. The tunnel would traverse under the established residential suburbs of Cheltenham, Beecroft, West Pennant Hills, Cherrybrook and Castle Hill and the newly developed or developing residential and commercial areas of Bella Vista and Norwest Business Park.

It would traverse the new release areas of Balmoral Road (currently under development), Kellyville and Rouse Hill in an identified corridor. Parts of the alignment would be above ground, traversing the northern portion of the Balmoral Road Release Area, undeveloped land between the Balmoral Road Release Area and the Rouse Hill Town Centre, and the 'Area 20' precinct of the North West Growth Centre. Between Kellyville and the Tallawong stabling facility, there would be a combination of viaduct over flood prone land, embankment, at grade and cutting.

It would be a two track rail corridor comprising of the following main components:

- A direct underground connection into the existing Epping to Chatswood Rail Line (ECRL) at Epping.
- A service facility at Epping.
- A service facility at Cheltenham.
- Two tunnel stubs to safeguard the Parramatta to Epping Rail Line.
- Eight stations – Cherrybrook Station, Castle Hill Station, Hills Centre Station, Norwest Station, Bella Vista Station, Kellyville Station, Rouse Hill Station and Cudgegong Road Station.
- An underground section of route comprised of approximately 15.5km of two track railway in a twin tunnel configuration with cross passages at regular intervals between Epping and Kellyville.
- The remaining approximately 7.5km surface section of route from Kellyville to Tallawong stabling facility would be a combination of viaduct, embankment, at grade and cutting.
- A stabling facility at Tallawong Road for 16 eight-car trainsets with provision for later expansion to 24 eight-car trainsets.
- Other infrastructure and services to complement the transport product and to meet customer transport expectations.

Figure 1.1 NWRL Alignment & Station Locations



1.2 North West Rail Link Current Status

The North West Rail Link (NWRL) is a priority railway transport infrastructure project for the NSW Government.

In April 2011, a specialised project team was established within Transport for NSW (TfNSW) to fast track the NWRL. Since then, the project team has commenced work on the definition phase of delivering the project. Analysis has been undertaken with regard to possible alignment options, station locations, asset configuration, operational scenarios, land use as well as the integration of the NWRL with the existing public transport network. Extensive consultation has been undertaken with key stakeholders and the community to assess the NWRL customer outcomes.

The NWRL would provide eight new stations and services over a 23 kilometre addition to the CityRail network from Epping to beyond Rouse Hill in north west Sydney. The base scope of the project includes the construction of stations at Cherrybrook, Castle Hill, Hills Centre, Norwest, Bella Vista, Kellyville, Rouse Hill and Cudgegong Road. Bus, pedestrian, taxi and cycle access facilities would be provided at all stations, with approximately 4,000 park and ride facilities proposed at Cherrybrook, Hills Centre, Kellyville and Cudgegong Road Stations. The project scope also includes a train stabling facility at Tallawong Road beyond Rouse Hill.

1.3 Longer term Vision

The North West Rail Link will be part of an integrated transport network for Sydney. The development of that network in a strategic transport plan is currently underway in Transport for NSW. The plan is taking into account the North West Rail Link and the options for operating the rail network once the new rail line is in place. While there is no current plan to extend the North West Rail Link beyond Tallawong Road, further investigations into growth in the region and potential travel demand are also being undertaken by Transport for NSW. The outcomes of these studies will inform the development of the strategic transport plan for Sydney.

1.4 Construction Traffic and Transport Management

A key factor in the development of Construction Traffic Management Plans for the development of the NWRL is that there will be other developments occurring in the corridor and the surrounding areas that will also impact on the traffic operations. It is understood that developments within the Castle Hill and Rouse Hill Town Centres, together with ongoing residential development in the Kellyville and Rouse Hill areas would provide a cumulative impact on traffic flows during the construction phase of the NWRL. In addition, major road enhancements such as the widening of key roads including Showground Road, Norwest Boulevard, Schofields Road and Memorial Avenue would also need to be considered. These cumulative impacts will need to be carefully managed through ongoing liaison and co-ordination of authorities and stakeholders to ensure that suitable traffic management is provided.

The North West Rail Link Constructability Report and Concept Design Plans provide a general overview of the likely methods of construction that would be used to build the North West Rail Link. A significant portion of the work required would occur deep underground. This is the proposed method for the section of the NWRL between Bella Vista and the connection to the Epping-Chatswood Rail Link (ECRL) just to the north of the existing Epping Railway Station.

The preferred method for tunnels and stations is largely driven by the geology and ground conditions encountered during construction.

The section of the NWRL from the tunnel portal at Bella Vista Station to just north of Balmoral Road will be in cut with an overbridge to carry Balmoral Road over the rail line.

The section of the NWRL corridor from Memorial Avenue to the north of the proposed Rouse Hill Station would be on an elevated viaduct with stations at Samantha Riley Drive (Kellyville Station) and Rouse Hill.

Tunnelling work, including tunnelling construction sites, would be expected to operate 24 hours a day. Surface works and viaduct works would, in general, be carried out between 7am and 6pm Monday to Friday and from 8am to 1pm Saturdays. However, at times, works would be required out of hours, including at nights and on weekends. Local residents would be consulted before any out of hours work commences.

At the present time it is anticipated that for the purposes of definition of the current construction program for major civil works that EIS1 (Major Civil Works) is to exhibited in the first half of 2012 with a second EIS regarding station and other commissioning works to be placed on exhibition in Quarter 3 of 2012. The proposed timeframes include having Tunnel Boring Machines (TBMs) in ground by 2014 and for construction to take 5-6 years from the launch of the TBMs, although the construction completion date is not yet confirmed.

This Technical Paper has been informed through discussion of likely construction methods with TfNSW officers and service providers including the Delivery Team. The following sections outline:

- Assessment Approach and Key Assumptions
- Mitigation and Management
- Construction Traffic Impacts

2 Assessment Approach and Key Assumptions

One of the key factors is the assessment of the impact of the additional traffic generated by the construction of the NWRL on the surrounding road network, in particular, during the AM and PM peak periods. In this regard, a range of traffic count information was collected for key intersections in the vicinity of the proposed construction sites during the peak periods. These were supplemented with seven day counts along selected roads in the area. The results of these traffic counts were then utilised to undertake intersection modelling using the SIDRA Intersection modelling program. This section provides an assessment of these anticipated truck volumes for both spoil removal and deliveries to the sites.

The proposed construction sites and a summary of key construction activities are listed in Table 2.1.

Table 2.1 Proposed Construction Sites

Construction site	Construction Activity
Epping Services Facility	Demolition, earthworks, shaft excavation, mined tunnel works and spoil removal and TBM head removal.
Epping Decline	Tunnel access construction, spoil removal.
Cheltenham Services Facility	Tree removal, road works, shaft excavation, and spoil removal.
Cherrybrook Station	Tree removal, road works, open cut station box excavation, TBM launch / support and spoil removal.
Castle Hill Station	Tree removals, road works, shaft excavation, cut and cover station excavation, mined crossover cavern works and spoil removal.
Hills Centre Station	Demolition, tree removal, road works, cut and cover station box excavation, TBM support and spoil removal.
Norwest Station	Demolition, road works, cut and cover station excavation works and spoil removal.
Bella Vista TBM Portal	General civil works, TBM Launch / support and spoil removal.
Bella Vista Station	Road works, open cut station excavation works and spoil removal.
Balmoral Road and Memorial Avenue Pre-cast sites	Concrete pre-cast for tunnel works and viaduct. General earthworks and viaduct support sites
Kellyville Station	Car park, viaduct launch/support, general civil works, station construction.
Windsor Road site	Demolition and viaduct support works
Rouse Hill Station	Demolition, road works, station construction, general civil works.
Windsor Road Viaduct	Viaduct launch and support over Windsor Road, roadworks.

Construction site	Construction Activity
Windsor Road Viaduct to Cudgegong Road	Earthworks, support site, spoil removal, bridge construction.
Cudgegong Road Station and Tallawong Stabling Facility	Earthworks, station construction, track laying and track systems supply and support.

2.1 Duration of Construction Site Works

On a project as large and significant as NWRL there will be various construction activities occurring across a number of sites. Initial investigations have identified the duration of works for activities at each of the sites. These estimates relate to the station excavation, tunnelling and viaduct construction elements of the project. Station fit out and track laying activities are not included. Not all of these activities will occur at the same time, although there may be opportunity for some overlap of activities at some sites such that the duration of excavation/construction works would not be consecutive periods. Estimated time periods are outlined in **Table 2.2** below.

Table 2.2 Excavation / Viaduct Construction Timeframe Estimates

Construction site	Station/shaft excavation program (months)	Tunnel Excavation program (months)	Surface/viaduct activities (months)
Epping Services & Decline Facilities	12	-	-
Cheltenham Services Facility	12	-	-
Cherrybrook Station	10	12	-
Castle Hill Station	19	5	-
Hills Centre Station	14	12	-
Norwest Station	14	-	-
Bella Vista Station / Tunnel Portal	10	12	-
Bella Vista Viaduct Site	-	-	10
Memorial Avenue North	-	-	25
Kellyville Station	-	-	3
Old Windsor Road 1	-	-	2
Old Windsor Road 2	-	-	2.5
Windsor Road Intersection	-	-	2.5
Sanctuary Drive South	-	-	2
Sanctuary Drive / Bellcast Road	-	-	0.5
White Hart Drive South	-	-	1.5
Rouse Hill Station	-	-	3.5
Rouse Hill West	-	-	2
Cudgegong	-	-	7
Tallawong Stabling Facility	-	-	13

Source: NWRL Delivery Team 2012

2.2 Heavy Vehicle Forecasts

The heavy vehicle forecasts provided below have been developed from information provided to date¹. These will need to be reviewed as the project develops.

Construction of the NWRL would require a range of vehicle movements involving, cars, light vehicles, heavy vehicles and specialised vehicles. In conjunction with the removal of spoil from each of the construction sites, there would also be the potential truck movements for the delivery of materials to most sites for the construction of infrastructure.

The site truck movements would normally be uniformly distributed between approximately 7am to 6pm on most weekdays. On certain days, such as large concrete pours, there may however be spikes in the frequency of arrivals and departures. The time profile for construction traffic movements will be subject to change as construction planning proceeds. The construction program and subsequent management plans will include measures to manage activities to minimise traffic impacts, particularly during the surrounding road network peak periods and other sensitive times.

Spoil removal activities at the TBM sites (Cherrybrook, Hills Centre, Bella Vista) would require 24 hour operation as TBM operation would be 24/7 with limited site area for spoil stockpiling.

One of the main generators of traffic would be trucks removing spoil from the construction sites. The tunnelling works may require in the order of 100,000 x 30 tonne truck loads. The station and intermediate excavation works may require a further 42,000 truck movements. The construction sites expected to have the highest number of truck movements are Cherrybrook, Hills Centre, Bella Vista and Tallawong Stabling Facility.

The delivery of materials to the construction sites would also occur, although potentially the volume of truck deliveries would be less than for the spoil removal operations. Materials to be delivered could range from raw materials for the pre-cast tunnel segments to steel deliveries and the delivery of tunnel segments to the launch sites. These truck movements may coincide with tunnelling truck movements.

At times there may be scope to schedule vehicle movements to avoid the busy on-road AM and PM weekday peak traffic.

Overall, the peak flow of heavy vehicles to and from each of the sites is dependent on the construction methods, rate of spoil generation, stockpiling opportunities and availability of trucks to move materials. There is the potential to turnaround approximately 12 trucks an hour at peak operation. The estimated truck volumes for the proposed sites, for the purposes of this traffic assessment, have been determined on averaging the total daily truck volumes across the forecast weekday operating hours. Having regard for the above there is the potential for a variance of truck flows depending on construction program and other factors at individual sites. As the construction program develops these volumes would be assessed by others in the development of the final construction stage traffic management plans. The table at **Appendix B** provides an estimate of heavy and light vehicle traffic generation for each of the sites during the surrounding road network peak periods.

Tables 2.3 to 2.5 provide a summary of the expected heavy vehicle volumes generated for the removal of spoil and delivery of materials. For those sites that include tunnelling spoil removal as well as station excavation spoil removal, these activities will be occurring at different stages through the construction program and therefore heavy vehicle volumes and therefore will not occur at the same time.

¹ Constructability Report – Jan 2012 (TfNSW)

2.2.1 Cumulative Construction Traffic Impacts

There are a number of possible major developments by others with the potential to coincide with NWRL construction. The further expansion of Castle Towers, development of the Northern Freight Corridor, expansion of the Rouse Hill Town Centre, Balmoral Road and North Kellyville Release Areas may occur at the same time as construction activities on the NWRL. Most of these are at early stages of planning and little information is available on timing or scope of construction activities at the time of the preparation of this report. Initial consultation has begun with relevant stakeholders and is expected to be ongoing.

Identification and management of the cumulative impacts will be an important aspect of subsequent TMPs as the NWRL construction program develops.

2.2.2 Intersection Modelling

Key intersections surrounding the proposed construction sites have been analysed using the SIDRA intersection modelling program. SIDRA Intersection is an advanced micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive-cycle models coupled with an iterative approximation method to provide estimates of capacity and performance statistics (delay, queue length, level of service, etc).

Degree of Saturation

The degree of saturation value indicates the ratio of arrival volumes to capacity. Values above 1.0 represent oversaturated conditions (arrival volumes exceed capacity) whereas degrees of saturation below 1.0 represent undersaturated conditions (arrival volumes are below capacity).

Average Delay

The average delay is the amount of seconds that each vehicle incurs in waiting to pass through the intersection that arrives during the peak period.

Level of Service

Level of service is an overall indication of the operational performance of traffic on any given intersection, traffic lane or roadway. The Level of Service (LOS) parameter gives a good indication of how well a junction operates. The *Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis* and furthermore the previous *RTA Guide to Traffic Generating Developments, October 2002* provides the criteria used to determine the Level of Service for intersections.

Table 2.3 provides the LOS criteria. Note that the LOS is determined by delay at an intersection, rather than the degree of saturation.

Table 2.3 Level of Service (LOS) criteria for intersections

LOS	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop signs
A	Less than 14	Good Operation	Good Operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study is required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays	At capacity, requires other control mode
F	> 70	Over capacity, unstable operation	Over capacity, unstable operation

Source: Austroads, 2005

The best indicator of LOS at a signalised intersection is the average delay in seconds experienced by vehicles over all movements whereas for a priority control intersections and roundabouts, the best LOS indicator is the maximum delay for the corresponding movement.

Design Construction vehicle

To minimize the number of truck movements on the road network, the largest vehicles possible would be used having regard to access constraints and safety considerations. The standard vehicle would be a truck-and-dog or semi-trailer tipper able to carry 12.5m³.

Table 2.4 Station and Shaft Excavation Spoil Quantities

Station	Spoil Quantities ² (m ³)	Approx. Number of Trucks	Estimate of Daily Spoil/delivery Truck Movements ³ (One Way)
Epping Services Facilities	12,500	Total truck volume included in tunnelling forecasts in Table 2.5	80
Cheltenham Services Facility	12,000	960 ⁴	34
Cherrybrook	60,000	4,800	50 ⁵
Castle Hill	135,000	10,800	60
Hills Centre	85,000	6,800	505
Norwest	65,000	5,200	45
Bella Vista	65,000	5,200	55

Table 2.5 Tunnelling Heavy Vehicle Movement Forecasts

Site	Spoil Quantities ² (m ³)	Approx. Number of Trucks	Estimate of Daily Spoil Truck / Delivery Movements ³ (One Way)
Epping Services and Decline Facilities	100,000	8,000	80 ⁶
Cherrybrook Station	370,000	29,600	275 ⁷
Castle Hill Station	30,000	2,400	60 ⁸
Hills Centre Station	390,000	31,200	2757

² Spoil volumes in the table above are based on preliminary concept design drawings dated 16 December 2011, and are indicative and subject to change

³ Spoil truck volumes extracted from Constructability Report, additional volumes incorporating material deliveries as indicated.

⁴ Excavation works for the services shaft will not occur for the whole construction period.

⁵ Delivery vehicle volumes incorporated in tunnelling truck movements

⁶ Volume includes delivery truck volume of 10 movements split between the two Epping services sites.

⁷ Includes delivery of pre-cast tunnel segments and other deliveries to the major tunnelling sites at Cherrybrook and Hills Centre.

⁸ Includes removal of spoil and delivery of materials for cross-over cavern

Site	Spoil Quantities ² (m ³)	Approx. Number of Trucks	Estimate of Daily Spoil Truck / Delivery Movements ³ (One Way)
Bella Vista Station/Tunnel Portal	365,000	29,200	225 ⁹

Table 2.6 Civil Works Spoil & Heavy Vehicle Movements (incl. deliveries)

Site	Volume ²	Approx. Number of Trucks (incl. deliveries)	Estimate of Daily Truck Movements ³ (One Way)
Bella Vista (Viaduct Site)	2,900	15,000	50
Memorial Avenue North	5,000	2,400	25
Kellyville Station Site	2,200	2,500	25
Old Windsor Road 1	2,900	1,400	25
Old Windsor Road 2	3,500	1,700	25
Windsor Intersection	3,500	1,700	25
Sanctuary Drive South	2,900	1,400	25
Sanctuary Drive / Bellcast Road	700	340	25
White Hart Drive South	2,200	1,000	25
Rouse Hill Site	2,900	2,900	25
Rouse Hill West	2,900	1,400	25
Cudgegong	120,000	22,000	110
Tallawong Stabling Facility	560,000	95,000	240

⁹ Includes delivery of tunnelling materials but not pre-cast tunnel segments. These will be delivered via internal roads from the casting yard.

2.3 Hours of Construction

Tunnelling works, spoil removal and tunnelling support activities are expected to occur continuously on a 24 hour a day, 7 day a week basis.

Standard working hours for other construction activities are proposed to be:

- Monday to Friday: 7am – 6pm
- Saturday: 8am – 1pm

In some cases, works may have to be carried out at night or on weekends if the impacts on traffic flow by daytime activities are considered unacceptable.

Spoil from road header and TBM operations is typically transferred from the work face and stockpiled underground or on the surface. Depending of the stockpiling capacities at each construction site, spoil removal by trucks is likely to be required 24 hours per day.

2.4 Construction Workforce Parking

Limited workforce parking would be available at some of the construction sites. It is proposed that dedicated parking for construction staff could be identified at off-site locations and shuttle buses provided to transfer staff to the construction sites. While it is expected that some construction staff parking is likely to occur on streets surrounding the construction sites, particularly those with limited on-site parking, the impacts of this will need to be managed and minimised.

There is also the opportunity for some of the workforce to use public transport to commute to and from the construction sites. Where feasible, this should be encouraged. Shuttle buses used from the employee car parks could also be used to ferry staff to construction sites from nearby public transport nodes, if required.

2.5 Heavy Vehicle Routes

Heavy vehicle routes identified for access to and egress from construction sites were developed in the context of minimising impacts on local streets and maximising use of arterial roads. The suggested heavy vehicle routes, as illustrated in **Appendix A**, are indicative only and subject to further refinement.

The proposed construction site access points are summarised in

Table 2.7. Access arrangements are discussed in detail in Section 4. This table represents the identified access points at this time. Further discussion would be required with responsible authorities prior to finalisation.

Table 2.7 Construction Sites, with Proposed Access

Construction site	Proposed Site Access	Proposed Local Traffic Routes to Arterial Road Network (if applicable)
Epping Services Facility	Beecroft Road (left in / left out)	Nil
Epping Decline Facility	Beecroft Road (left in / left out)	Nil
Cheltenham Services Facility	Kirkham Street (left in / right out)	Kirkham Street to Beecroft Rd
	M2 (left in / left out)	Nil
	Castle Howard Road	Light vehicles only – Castle Howard Road, Oaklands Avenue, Boronia Avenue, Kirkham Street to Beecroft Road
Cherrybrook Station	Castle Hill Road at Glenhope Road (all movements)	Nil
	Franklin Rd (left in / left out / right out)	Nil
	Robert Road (left in / left out)	Light vehicles only
Castle Hill Station	Old Northern Road / Terminus Street (all movements)	Nil
	McMullen Avenue (left in / left out)	Nil
	Crane Road (left out only)	Crane Road to Terminus Street
Hills Centre Station	Showground Road (new access, all movements)	Nil
	Carrington Road (all movements)	Carrington Road to Showground Road
Norwest Station	Norwest Boulevard (East)	Nil

Construction site	Proposed Site Access	Proposed Local Traffic Routes to Arterial Road Network (if applicable)
	Brookhollow Avenue	Brookhollow Ave (west) to Norwest Bvd
Bella Vista TBM Portal and Bella Vista Station	Celebration Drive (all movements) Refer to Appendix A	Celebration Drive to Old Windsor Road
	Balmoral Road (right in/left out)	Balmoral Road to Old Windsor Road
Balmoral Road and Memorial Avenue Pre-cast sites	Balmoral Road (left in / right out)	Balmoral Road to Old Windsor Road
	Memorial Avenue (all movements)	Nil
Kellyville Station	Samantha Riley Drive (all movements)	Samantha Riley Drive to Old Windsor Road or Windsor Road
Windsor Road	Samantha Riley Drive (left in/left out)	Samantha Riley Drive from Old Windsor Road and to Windsor Road or Old Windsor Road via roundabout
	Windsor Road (left in / left out)	Nil
	Sanctuary Drive South (right in/left out)	Sanctuary Drive to Windsor Road
	Sanctuary Drive North (left in / right out)	Sanctuary Drive to Windsor Road
Rouse Hill Station	White Hart Drive (left in)	White Hart Drive
	Rouse Hill Drive (right out)	Rouse Hill Drive to Windsor Road
Windsor Road Viaduct site	Rouse Hill Drive (left in / right out)	Rouse Hill Drive to Windsor Road
Schofields Road site	Schofield Road (all movements)	Nil
Cudgegong Station	Cudgegong Road (all movements)	Cudgegong Road to Schofields Road
Tallawong Stabling Facility	Tallawong Road (all movements)	Tallawong Road to Schofields Road
	Schofields Road (all movements)	Nil

3 Mitigation and Management Approach

The overarching construction traffic management approach is described in the following sections of this report. This section describes the general traffic management measures which reflect the proposed approach to matters of traffic management that are applicable to either all or, a number of the proposed construction sites. Site specific issues and potential mitigation measures are identified in each of the respective sections detailing the proposed construction activities.

The respective contractors for each of the packages of work would be responsible for the management of traffic around each of the construction sites would be required to manage the construction traffic impacts through the development of traffic management and traffic control plans. The framework of procedures and techniques identified would be applied across all stages of construction with the following objectives:

- Adopt appropriate measures to protect pedestrians and cyclists and to maintain public transport networks
- Manage traffic flows within, and surrounding, each construction site and associated construction materials and spoil haulage routes to minimise potential impacts on the local and regional road network
- Identify opportunities to improve the efficiency and safety of traffic conditions
- Minimise potential construction impacts on local residents, businesses and the local community while maximising worker and public safety

The types of traffic management documentation and purposes are summarised in **Table 3.1**.

Table 3.1 Traffic Management Documentation and Purpose

Document	Purpose
Framework Traffic Management Plan	• Overarching plan/framework document • Identifies overarching procedures and techniques to ensure effective management and delivery of the construction of the NWRL.
Construction Traffic Management Plans	• Produced for each major stage of construction at each construction site and would: - o Provide for any associated road occupancy licence applications and speed zone authorisations requiring RMS, Transport Management Centre (TMC) or local council approval - o Be produced in accordance with relevant Australian Standards and RMS guidelines

Document	Purpose
Site Specific Traffic Management Plans	• Would be developed for each station construction site and rail corridor construction site • Includes site specific detail, which may include: - o Existing site conditions (i.e. pedestrian movements/volumes, bus routes and stops, taxi ranks, on-road and off-road cycle routes, parking, traffic volumes and turning movements at key intersections) - o Site layouts, truck access and egress points, construction methods and staging, site access limitations (e.g. truck movement times) - o Incidents and events management requirements (such as emergency vehicle access).
Construction Traffic Control Plans	• Produced for each traffic or road occupancy change at each construction site and would include: - o Specific details of the proposed traffic control arrangements and extent of road occupancy (as required) - o Graphical depiction of each traffic control plan proposed.

Key traffic management measures would include:

- Directional signage and line-marking to direct and guide drivers and pedestrians past construction sites and on the surrounding network. This would be supplemented by permanent and portable Variable Message Signs (VMS), where possible, to advise drivers of any potential delays, traffic diversions, speed restrictions, or alternative routes
- Public notification of proposed traffic changes by newspaper, radio, web site and community liaison
- Co-ordination with Transport Management Centre's (TMC) in the event of incidents or undue congestion
- Management of pedestrian and vehicular access to and past construction sites to ensure safe entry and exit procedures. Depending on the location, this may require manual supervision, physical barriers, temporary traffic signals, modification to existing signals or, on occasions, police presence
- Maintenance of access to existing properties and buildings, which may require temporary kerb and footpath crossings.

3.1.1 Agency and Community Liaison

It is critical that the NWRL construction works are coordinated with other developments and that stakeholders that would be most affected by the project are aware of the scheduling of works and related transport and road network implications. In this regard, the establishment of a Traffic and Transport Liaison Group for each Local Government Authority (LGA) and a strategic level Central

Project Coordination Committee would assist in the effective and coordinated delivery of the NWRL. **Table 3.2** identifies the role of each proposed liaison group.

Table 3.2 Liaison Groups

Liaison Group	Role
Traffic and Transport Liaison Group	• LGA specific group with participants varying depending on site and potential issues/areas affected • Likely core group to include NWRL, NSW Roads and Maritime Services (RMS), Transport Management Centre (TMC), Transport for NSW, Police, bus operators, NWRL Contractor • Other participants to attend depending on potential issues and areas affected or, project elements being discussed • Review Road Occupancy Licence (ROL) applications submitted to council and TMC/RMS to monitor potential for cumulative travel time impacts as a result of multiple ROLs operating concurrently in an area or region.
Central Project Coordination Committee	• Seek to coordinate NWRL works with other major developments and public works and contribute to the management of cumulative impacts. • Strategic approach to longer term management of traffic and transport issues (prior to, during and post construction) and review of proposed 'operational' traffic and transport arrangements, including network integration with NWRL facilities.

Consultation activities would include provision of information relating to traffic and transport changes sufficiently in advance of the changes occurring. The Construction Stakeholder and Community Involvement Plan to be prepared by the Central Project Coordination Committee would identify the various communication needs, including the requirement for notification associated with traffic and transport changes, and how they would be implemented.

3.1.2 General Mitigation Measures

Minimise impacts of truck movements

Heavy vehicle routes identified for access to and egress from construction sites would be developed in the context of minimising impacts on local streets and maximising use of arterial roads.

Traffic controllers would be available to manage heavy vehicle movements at construction sites, and to monitor the need for pedestrian control. All trucks would enter the construction sites, load spoil (or other materials), or make deliveries of materials and exit in a forward direction.

Further consideration of the alternative night-time routes identified for the main tunnel spoil sites at Bella Vista, Hills Centre and Cherrybrook sites would be undertaken during the detailed design phase and would include review of heavy vehicle turning paths. Where possible, spoil could be stockpiled on the construction sites in order to reduce the out of hour's truck movements and operations during peak periods on the surrounding road network. It should also be noted that the majority of the construction sites are located within highly developed urban areas and the available land for stockpiling of spoil and other materials is restricted.

Minimise impacts on pedestrians and cyclists movements

Advance directional signage to direct pedestrians to alternative pedestrian routes would be implemented at construction sites where high pedestrian volumes are anticipated.

Traffic controllers would be available at various locations including construction site access and egress points, to monitor and regulate pedestrian movements, provide guidance and, where necessary, deter pedestrians from using the roadways. This would be implemented, as necessary, at peak pedestrian times in the morning, lunchtime and afternoon peak periods to reduce potential conflicts between pedestrians and construction vehicles.

The review of traffic controls would be ongoing during the construction period and would focus on the appropriate management of traffic, pedestrian and cycle movements. The reviews would consider whether additional traffic control is needed for particular days or times.

Buses

The management of buses at key transport interchanges such as Castle Hill and Rouse Hill would be reviewed during the development of the detailed construction staging plans and associated traffic management documentation to minimise impacts on existing services. Special event services for Sydney Olympic Park (Royal Easter Show, and Major Sporting and Entertainment Events) would also need to be managed, in particular, in Carrington Road at the Hills Centre Station site.

The North West Transitway (T-way) operations are to be maintained at all times during the construction of the NWRL. The Memorial Avenue station (Burns station), Riley station and Rouse Hill will require some alteration to operations or car parking however, this will be carried out to ensure that bus operations are not hindered and that passengers are provided safe conditions at all times.

Workforce Management

As part of the development of detailed construction traffic management documentation, the need for, and provision of, alternative remote parking locations and shuttle bus transfers for daytime and night-time construction staff would be considered for all construction sites.

Event Management

The Traffic and Transport Liaison Group (TTLG) established for the NWRL would consider individual events and any other special event needs and, as necessary, make appropriate short-term adjustment to the construction phase activities and/or review and update detailed Traffic Management Plans.

4 Construction Traffic Impacts

4.1 Epping Services Facility / Epping Decline Facility

4.1.1 Site Context

The Epping Services facility and Epping Decline facility provide access for the construction of the shafts from the surface down to the tunnels for the future service facility, connection of the NWRL to the ECRL, a cross over cavern and the stubs for the Parramatta Epping Rail Link (PERL). This work is to be carried out with road headers. The site would also be used to dismantle the TBMs that have tunnelled eastward from the Cherrybrook site. The operations for the NWRL construction would take place across two sites located on Beecroft Road, one on the western side and one on the eastern side of the road. The Epping Services site is proposed to be located on the western side of the road with the Epping Decline construction site located on the eastern side of the road.

Road Network

The (western) Epping Services facility construction site would be located on the western side of Beecroft Road about 100m north of the intersection with Carlingford Road. The site proposed for the Epping Services Facility currently is provided with a short deceleration lane to the entry located on the northern end of the site. Epping Decline (eastern) construction site would be located on the eastern side of Beecroft Road opposite the Kandy Avenue intersection. This site has a short merging lane provided to the south in Beecroft Road. This merge lane may need to be reviewed for adequacy to allow the merging of heavy vehicles leaving the construction site to travel south on Beecroft Road.

Beecroft Road is a busy, 60 km/h divided (with narrow median) four lane arterial carrying approximately 32,000 vehicles per day (vpd). It has a southbound clearway in the AM peak (6-10am) and a northbound clearway in the PM peak (3-7pm).

Photo 4.1 Beecroft Road, looking south opposite Epping Decline Site

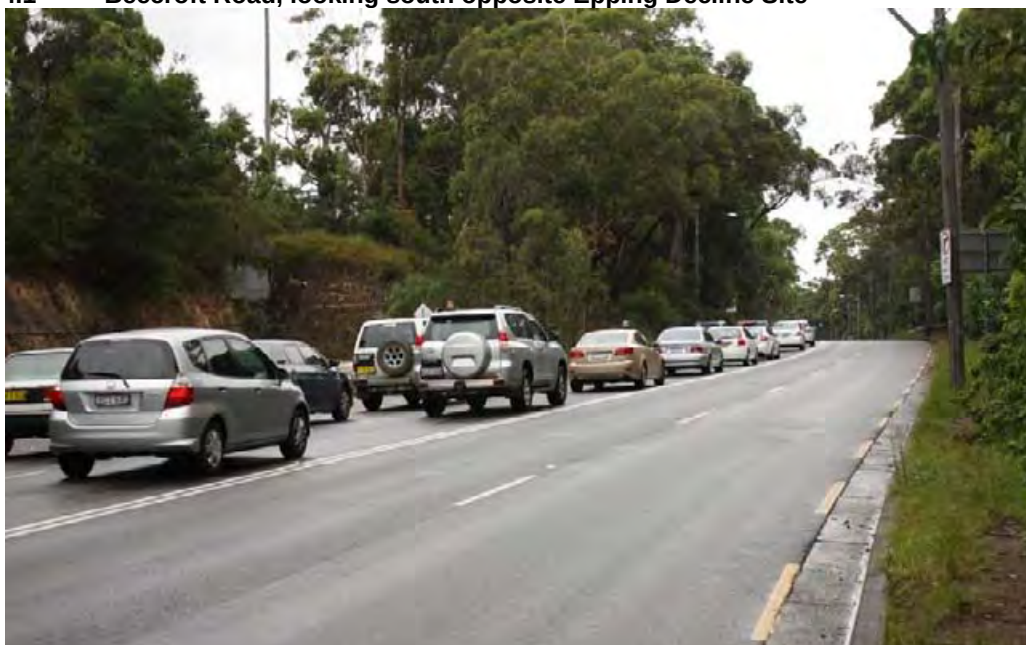


Table 4.1 Epping Services Facilities – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Beecroft Road	RMS	4	31,680	Northbound	AM 747 (8-9am) PM 1,434 (5-6pm)
				Southbound	AM 1,266 (7-8am) PM 912 (6-7pm)
M2 Motorway (On & Off Ramps)	RMS	4	70,750	Eastbound	AM 715 (7.45-8.45am) PM 259 (4.45-5.45pm)
				Westbound	AM 152 (7.30-8.30am) PM 430 (4.30-5.30pm)
Carlingford Road	RMS	4	27,013	Eastbound	AM 1,612 (7.15-8.15am) PM 776 (5-6pm)
				Westbound	AM 723 (7.15-8.15am) PM 1,248 (5-6pm)

Planned Road Improvements

The M2 is currently being upgraded to provide three lanes in each direction and a proposed 100 km/h speed limit between Windsor Road and Delhi Road overpasses. These works are expected to be completed in the first half of 2013.

4.1.2 Construction Site Detail

Access to the Epping construction sites on either side of Beecroft Road are proposed as left in/left out arrangements on Beecroft Road between Carlingford Road and the M2 interchange.

The proposed access arrangements would be managed by traffic controllers. For the western site all site traffic would approach from the south and depart to the north. The converse would apply for the eastern site where all site traffic would approach from the north and depart to the south. Approach and departure routes are well-served by nearby arterial roads: Beecroft Road, Carlingford Road and Pennant Hills Road. Use of the M2 is unlikely due to a lack of west-facing ramps at Beecroft Road.

As the current entrance to the commercial development on this site is shared with adjoining developments to the south an alternative access would need to be provided to ensure access is maintained and separate to the site access.

The extension of the existing deceleration lane to the south, toward the Carlingford Road intersection, would enable its use for the proposed new entrance to the adjacent commercial properties. This entry could also provide access to the construction site to avoid potential traffic conflicts with having separate accesses within close proximity to each other. The potential traffic volumes for the construction site are relatively low and a combined access would be able to accommodate both accesses.

The Beecroft Road/Carlingford Road intersection is not expected to be impacted by the site operations and the operation of the traffic signals will provide breaks in the traffic flows to enable vehicles to exit the site.

Site traffic should be managed wherever possible to avoid significant movements in the AM peak in the critical southbound direction and in the PM peak in the critical northbound direction.

It is not anticipated that there will be any traffic lane closures required on the surrounding network during the construction operations. Some changes to the existing deceleration and acceleration lanes at the two sites are proposed to assist in minimising impacts on passing traffic.

4.1.3 Heavy Vehicle (HV) Routes

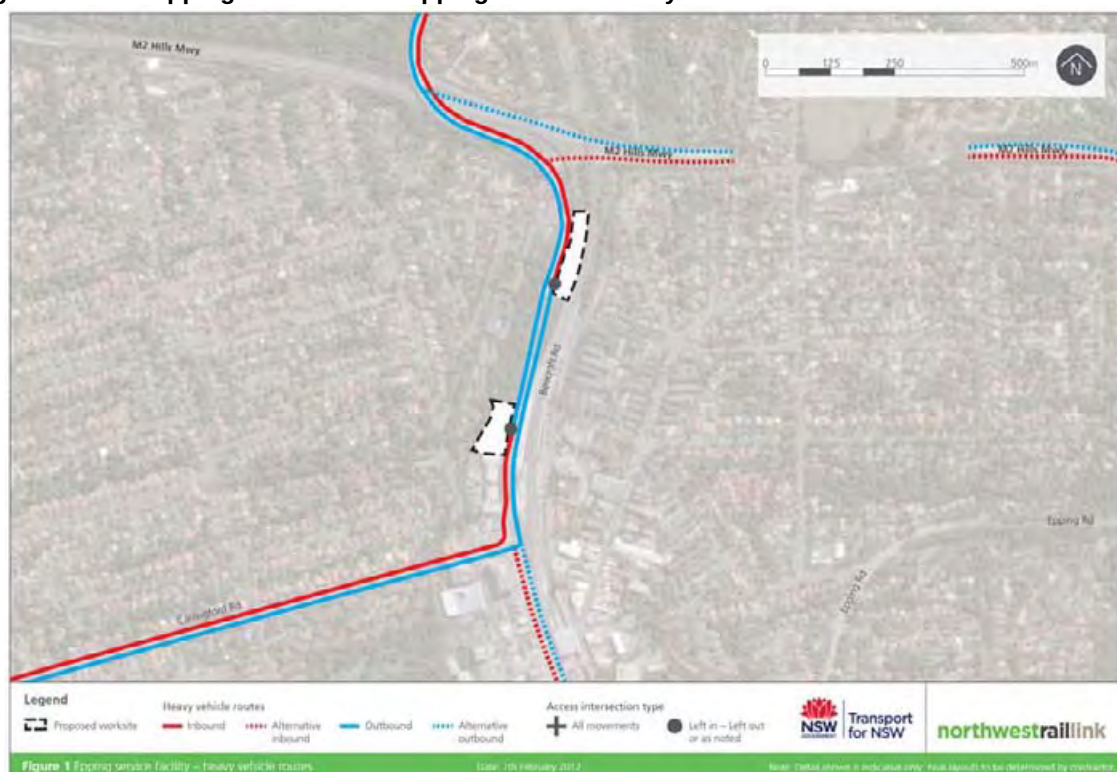
The approach route for the western site would be via Carlingford Road and Beecroft Road when approaching from the west and Epping Road and Beecroft Road when approaching from the east. The departure route would be via Beecroft Road to either the M2 (for eastbound travel) or Pennant Hills Road for westbound/northbound travel.

The Epping Decline site would be the reverse of this with approaches southbound on Beecroft Road from either the M2 or Pennant Hills Road and departures along Beecroft Road to Carlingford Road or Epping Road.

It is estimated that the two sites would generate approximately 80 truck trips in each direction per day during the construction phase.

A diagram of the proposed HV routes is shown in Figure 4.1 with larger scale diagrams provided in Appendix A.

Figure 4.1 Epping Services and Epping Decline Facility HV Routes



4.1.4 Road Network Operation and Intersection Performance

- Carlingford Road / Beecroft Road (traffic signals) – This is a major intersection with major traffic flows occurring along Beecroft Road and Carlingford Road toward the City in the AM peak and the

reverse movement in the PM peak. Beecroft Road provides two through lanes and a right turn bay on the northern approach to the intersection and two through lanes and two left turn lanes on the southern approach. Carlingford Road provides two lanes on the approach to the intersection with the kerb lane being a shared left/right lane with a left turn slip lane at the intersection and a right turn lane.

- M2 Ramps / Beecroft Road (traffic signals) – The on and off ramps for the M2 are separated by approximately 300 metres and provide only for approach and departure to the east on the M2. Beecroft Road is provided with two through lanes in each direction at both intersections with the on-ramp (northern intersection having a right turn lane and left turn slip lane to the M2. The M2 off-ramp is provided with two right turn lanes and a left turn slip lane onto Beecroft Road.

Construction traffic on Beecroft Road from the two sites is estimated to be in the order of 50 vph in the surrounding road network peak periods with the majority of these light vehicles.

As can be seen in Table 4.2 this additional traffic would result in:

- No change to the degree of saturation or level of service at the existing Carlingford Road / Beecroft Road and M2 Ramps / Beecroft Road intersections.

Table 4.2 Intersection Performance – Epping Sites

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Carlingford Rd/ Beecroft Rd	E	1.00	D	1.00	E	1.00	E	1.00
M2 Ramp Off-ramp/ Beecroft Rd	A	0.55	A	0.70	A	0.56	A	0.71
M2 Ramp On-ramp/ Beecroft Rd	A	0.66	A	0.70	A	0.66	A	0.71

(LOS = Level of Service, DoS = Degree of Saturation at intersection)

4.1.5 Buses

There are no scheduled route bus services that operate along this section of Beecroft Road and therefore the impact on bus operations would be minimal.

4.1.6 Pedestrians and Cyclists

There is a footpath provided on the western side of the road with a formal concrete path provided from Carlingford Road to the proposed site entrance. North of the site entrance it is a formed footpath only. Pedestrian volumes are relatively low.

There is no footpath provided on the eastern side of this section of Beecroft Road. The cycleway tunnel under the Main Northern Line that connects Cambridge Street with Beecroft Road would be maintained during construction. This tunnel connects to a cycleway located on the eastern side of Beecroft Road to the north. There are no marked cycle facilities on the remaining sections of Beecroft Road and cyclist volumes are also low.

4.1.7 Parking, Taxis and Kiss-and-Ride

There is no on-street parking in this section of Beecroft Road and therefore the impact on parking would be minimal. The existing deceleration lane into the existing commercial development currently has a 'No Parking' restriction which would enable taxis to pick up and set down passengers and for kiss and ride. Any similar restriction to the relocated deceleration lane may need to be changed to 'No Stopping' for the duration of the works which would remove this opportunity. There is still the opportunity for pick up and set down along the remainder of Beecroft Road.

4.2 Cheltenham Services Facility

4.2.1 Site Context

The Cheltenham Services Facility is to provide a service shaft access to the tunnels during construction and also during operation. It is proposed to be located within the Cheltenham Oval precinct, although it is not proposed to excavate the oval itself. Access to the site is proposed to be via a new access road off Kirkham Street, to the north of the bridge over the M2. Alternatively, direct heavy vehicle access to/from the M2 may also be required for certain vehicle types at different times throughout the construction period. An alternative, light vehicle only, access is also proposed off Castle Howard Road, at the end of Murray Road, into the site.

Road Network

The Cheltenham Services Facility construction site is located between the M2 to the south, Cheltenham Oval to the east, Kirkham Street to the west and Castle Howard Road to the north. The latter is a low-volume local road whilst the M2 is an urban motorway. Kirkham Street is a local collector road providing access across the M2 between Beecroft and Carlingford.

Photo 4.2 Kirkham Street, looking north from approximate site entrance



Table 4.3 Cheltenham Services Facility – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Beecroft Road	RMS	4	31,680	Northbound	AM 747 (8-9am) PM 1,434 (5-6pm)
				Southbound	AM 1,266 (7-8am) PM 912 (6-7pm)
Kirkham Street	Hornsby Shire Council	2	5,374	Northbound	AM 231 (9-10am) PM 259 (5-6pm)
				Southbound	AM 446 (8-9am) PM 283 (5-6pm)
Castle Howard Road	Hornsby Shire Council	2	366	Northbound	AM 23 (8-9am) PM 28 (2-3pm)
				Southbound	AM 27 (8-9am) PM 31 (12-1pm)

Planned Road Improvements

The M2 is currently being upgraded to provide three lanes in each direction and a continuous 100 km/h speed limit. The works include lengthening the Kirkham Street bridge over the M2. These works are expected to be completed in the first half of 2013.

4.2.2 Construction Site Detail

Three potential access points to the site have been identified. The primary access to the Cheltenham Services Facility construction site is proposed on Kirkham Street immediately north of the bridge over the M2. This would require the construction of a new construction access road on the edge of the bushland area adjacent to the M2 corridor. The access would include temporary signals to permit a right turn out of the site. Kirkham Street currently has a 3 tonne load limit in force. All traffic would use Kirkham Street to and from the north. Road transport regulations provide that a vehicle of a greater mass is not prohibited from using the road if it has a destination in the road and there is no alternative route.

An alternative access could be implemented as a left in/left out arrangement on the M2 between the Pennant Hills Road and Beecroft Road interchanges. Vehicles would need to enter the M2 at Pennant Hills Road or further west, and the first available exits would be Christie Road or Lane Cove Road to the east.

The M2 access would need to be appropriately designed with sufficient deceleration and acceleration lanes to allow for the major speed differential between motorway traffic and construction site traffic. Any access would require major civil works because the M2 in this location is constructed along a creek corridor. Alternatively the access could be provided similar to the bus stops located on the M2 west of Windsor Road (at Cropley Drive and Gooden Reserve) with the shoulder used for the deceleration and acceleration lanes and a reduced speed limit in the vicinity of the access.

A light vehicle only access could be provided from the site to Castle Howard Road opposite Murray Road so as to reduce any potential conflicts with heavy vehicles using the main access point.

4.2.3 Heavy Vehicle Routes

All heavy vehicles would approach the site via Kirkham Street, to and from the north, to Beecroft Road. Beecroft Road then provides access to Pennant Hills Road for northbound or the M2, Carlingford Road and Epping Road for southbound/eastbound. The Beecroft Road / Kirkham Street intersection is priority controlled making right turns out difficult, particularly during peak periods. All construction traffic would be directed to treat this as a left in/left out intersection and therefore approach from the south and depart to the north.

A diagram of the proposed Heavy Vehicle routes is shown in **Figure 4.2**, with larger scale diagrams provided in **Appendix A**.

Figure 4.2 Cheltenham Services Facility Heavy Vehicle Routes



4.2.4 Road Network Operation and Intersection Performance

Key Intersections

- Beecroft Road / Kirkham Street (priority controlled) - This intersection is a four way intersection with The Crescent providing the fourth leg on the other side of Beecroft Road. Kirkham Street and The Crescent are provided with 'Stop' signs on the approach to the intersection.
- Beecroft Road is a four lane undivided road at this location, with Kirkham Street and The Crescent having a single lane approach and single lane departure. It is proposed that trucks approaching and departing the Cheltenham construction site utilise only left turns into and out of Kirkham Street at Beecroft Road.

Intersection modelling was not undertaken for the intersections of Beecroft Road/Kirkham Street and Kirkham Street/Site Entrance. For the Beecroft Road/Kirkham Street intersection it is proposed that all heavy vehicles would operate through this intersection as a left in/left out operation only, in order to

minimise any impacts on the intersection operation. Restricting truck movements to left in / left out is the best means of mitigating traffic impacts at this intersection. During the road network peak hour truck movements are not expected to exceed 6 trucks per hour and as such detailed intersection modelling was not considered warranted.

The Kirkham Street/Site Entrance would most likely operate with traffic signals to provide for the right turn movements out of the site. Given the forecast truck movements out of the site per day these signals would only be activated approximately 6 times during the peak. The forecast traffic exits are such that interruption to traffic flow will be minimal and unlikely to cause added congestion. Left turn movements into the site would be operated without the need to trigger traffic signals.

At a forecast volume of 68 trucks entering and exiting the site per day, this means approximately six trucks per hour entering or exiting the site, or one every 10 minutes in each direction. This is considered to be minimal impact on the level of service of the street.

The abovementioned measures are proposed to minimise the impact on Kirkham Street traffic and to aid in the safe egress of trucks from the site.

4.2.5 Buses

There is currently one scheduled bus service along Kirkham Street, route 553 operated by Sydney Buses. This is a limited service with approximately nine services a day, in each direction, along Kirkham Street in the vicinity of the proposed site entrance.

There are a significant number of bus services that operate along the M2 past the site. A 'Bus Only' lane is provided adjacent to the median on the M2 however this ends in the vicinity of the proposed site, with buses merging back into the general traffic lanes. Any works on the shoulders of the M2 would not impact on bus operations.

4.2.6 Pedestrians and Cyclists

Pedestrian and cyclist activity in the vicinity of the construction site is low. The footpath on the western side of Kirkham Street would be maintained.

Cycling is permitted on the M2 shoulders. An additional intersection (left in/left out) would make cycling more hazardous in the eastbound direction. Appropriate signage would be used to manage the conflict. Sufficient sight distance would need to be provided to ensure that heavy vehicles exiting the site onto the M2 have good visibility to approaching traffic and cyclists.

4.2.7 Parking, Taxis and Kiss-and-Ride

There is little demand for on-street parking as on-street parking is not permitted on Kirkham Street in the vicinity of the proposed site access due to the narrow width of the road and therefore, the impact on parking would be negligible.

4.3 Cherrybrook Station Construction Site

4.3.1 Site Context

The Cherrybrook Station site is located adjacent to, and to the north of, Castle Hill Road between Robert Road and Franklin Road. The excavation for the station box will be carried out initially to provide for the future station and for the assembly of the TBMs. The site would be used to launch the

TBMs for the excavation of the tunnels towards Epping and associated spoil removal. The site would also be used to dismantle and retrieve the TBMs which have tunnelled from Bella Vista. The site would operate on a 24 hour, seven day a week basis during the tunnelling phases, including spoil removal from the site, of the project.

The surrounding area is mainly low density residential with two schools located on the eastern side of Franklin Road.

Road Network

Castle Hill Road is a busy, 60 km/h undivided four lane arterial road. It carries approximately 43,000 vpd and does not exhibit a clear peak direction of traffic flow. Clearways operate during peak periods. It provides an important link to Pennant Hills Road (Cumberland Highway) from the Hills district. Signalised intersections on Castle Hill Road near the site are located at Edward Bennett Drive/Coonara Avenue, to the east, and County Drive/Highs Road to the west.

Franklin Road, Robert Road and Glenhope Road are all local roads with priority junctions at Castle Hill Road. Adjacent to the site Franklin Road and Robert Road are narrow two lane pavements. Robert Road is a narrow road of approximately 8.5 metres which provides only a single traffic lane if vehicles are parked on both sides of the road. Franklin Road provides kerb and gutter on the western side of the road with a narrow two lane pavement (approximately 7.5 metres wide) and very narrow unsealed shoulder on the eastern side of the street. Glenhope Road provides two traffic lanes and parking lanes adjacent to the kerb although no edge marking is provided.

Photo 4.3 Castle Hill Road, looking west toward Glenhope Road



Table 4.4 Cherrybrook Station – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Castle Hill Road	RMS	4	43,331	Eastbound	AM 1,309 (6-7am) PM 852 (5-6pm)
				Westbound	AM 855 (8-9am) PM 1,365 (5-6pm)
Franklin Road	Hornsby Shire Council	2	Not recorded	Northbound	0*
				Southbound	AM 41 (7.45-8.45am) PM 24 (4-5pm)
Glenhope Road	Hills Shire Council	2	Not recorded	Northbound	AM 136 (8-9am) PM 77 (4.45-5.45pm)
				Southbound	AM 63 (7.15-8.15am) PM 94 (5-6pm)
Robert Road	Hornsby Shire Council	2	Not recorded	Northbound	0*
				Southbound	AM 54 (7-8am) PM 27 (4-5pm)

Note:* No vehicles were recorded travelling north on Franklin Road or Robert Road on the day of the intersection surveys. Franklin Road traffic restrictions prevent turning movements off Castle Hill Road into the street.

Planned Road Improvements

At the present time there are no proposed road improvements in the area. A proposed subdivision and residential development has been approved on the eastern side of Robert Road adjacent to the site.

4.3.2 Construction Site Detail

The Cherrybrook site would be one of the main generators of traffic on the project, particularly trucks removing spoil. Therefore, the ability for trucks to enter and exit the site from both directions along Castle Hill Road safely is required, desirably directly to Castle Hill Road.

The primary access to the Cherrybrook construction site is proposed as a new signalised intersection on Castle Hill Road at Glenhope Road. This would involve converting the existing Castle Hill Road / Glenhope Road T-intersection into a four-way intersection with a new leg to the north. Provision of a new signalised intersection at this location is appropriate in the context of the wider road network having regard to the spacing of signalised intersections along Castle Hill Road. This will need to be subject to a road safety audit and design audit prior to the commencement of works.

A supplementary access to Castle Hill Road at Franklin Road would be required to accommodate mainly light vehicles and some daytime spoil truck movements at peak production times. This intersection is currently left out only from Franklin Road, i.e. no left or right turn into Franklin Road from Castle Hill Road. A left in/left out arrangement at Castle Hill Road / Franklin Road is possible with some vegetation clearing on Castle Hill Road to provide adequate sight distance. The provision of a right out movement at this intersection is considered to be a priority in the facilitation of the spoil removal process. This would best be achieved with the provision of traffic signals at the intersection. These traffic signals would also be of benefit during the operational phase to provide access from the station precinct onto Castle Hill Road and reducing the likelihood for vehicles to travel via the local

road system in Cherrybrook. Light vehicle access to and from the construction site would also be possible via Robert Road.

4.3.3 Heavy Vehicle Routes

All heavy vehicle trips for the site would operate along Castle Hill Road, to and from the site. The main access would be via the access located opposite Glenhope Road with the secondary access via Franklin Road. Light vehicles would also be able to access the site via Robert Road. The Castle Hill Road access would provide for heavy vehicles to approach from both the east and the west and enable departures in both directions as well. Heavy vehicles using the Franklin Road departure would only be permitted to travel south to Castle Hill Road and then east towards Pennant Hills Road. Should it be necessary for heavy vehicles to access the site from Franklin Road, this would be available only by a managed left turn from Castle Hill Road and that section of Franklin Road to the site access.

The peak heavy vehicle movement for the site would occur during tunnelling activities with 24 hour operation. This would generate approximately 275 truck trips to and from the site per day removing spoil, delivery of tunnel segments and other materials.

A diagram of the proposed Heavy Vehicle routes is shown in **Figure 4.3** with larger scale diagrams provided in **Appendix A**.

Figure 4.3 Cherrybrook Station Heavy Vehicle Routes



4.3.4 Road Network Operation and Intersection Performance

Key Intersections

- Castle Hill Rd / County Dr / Highs Rd (traffic signals) – This intersection is a four way intersection with County Drive providing double right turn lanes, through traffic lane and left turn lane. Highs

Road provides a left turn lane and shared right/through lane. Right turn bays are provided on Castle Hill Road with a left turn lane into County Drive. Medians are provided on Castle Hill Road and County Drive on the approaches to the intersection.

- Castle Hill Rd / Robert Rd (priority controlled) – Robert Road is a local street providing access from the adjoining residential area to Castle Hill Road. It is restricted to left in/left out at Castle Hill Road with the provision of a median to control traffic movements.
- Castle Hill Rd / Glenhope Rd (priority controlled) – Glenhope Road is a local street to the south of Castle Hill Road. It provides one traffic lane in each direction. All movements are permitted at the intersection although no turn bays are provided on Castle Hill Road.
- Castle Hill Rd / Franklin Rd (priority controlled) – Franklin Road is a local road and is restricted to a left out movement only at Castle Hill Road. Left turns in, right turns out and right turns in from Castle Hill Road are not permitted at this intersection. Sight distance is restricted for vehicles turning left out of Franklin Road due to the presence of vegetation and property fences to the west of the intersection on Castle Hill Road.
- Castle Hill Rd / Coonara Ave / Edward Bennett Dr (traffic signals) – This intersection is a four way intersection with Castle Hill Road providing two through lanes in each direction and short right turn bays. Edward Bennett Drive is provided with a left run lane and shared right/through lane at the intersection. Coonara Avenue is provided with a right turn lane and shared left/through/right turn lane providing for a double right turn out of the street eastbound on Castle Hill Road.

Construction traffic on Castle Hill Road from the two sites is estimated to be in the order of 90 vph in the peak periods with the majority of these light vehicles. No changes to key signalised intersections are proposed.

As can be seen in **Table 4.5** this additional traffic would result in:

- Very minor increase in the degree of saturation, but no change to the level of service at the existing Castle Hill Road / Coonara Avenue / Edward Bennett Drive and Castle Hill Road / County Drive / Highs Road intersections in the peak periods.

Table 4.5 Cherrybrook Station – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Castle Hill Road / Coonara Avenue / Edward Bennett Drive	D	0.75	C	0.85	D	0.76	C	0.85
Castle Hill Road / County Drive / Highs Road	E	1.01	E	1.01	E	1.01	E	1.01
Castle Hill Road / Glenhope Road	NA	1.00	NA	1.00	B	0.78	C	0.89

Note: For priority intersections, LOS=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.

4.3.5 Buses

Bus routes in the immediate vicinity of the construction site are confined to Castle Hill Road and Franklin Road (school services). None of these services would be required to be re-routed during the construction period.

4.3.6 Pedestrians and Cyclists

The northern footpath on Castle Hill Road adjacent to the construction site would need to be maintained during construction, together with the crossing of the access road opposite Glenhope Road. Traffic controllers would be available to manage potential conflicts with heavy vehicle access, especially at times of peak spoil production.

Two schools are located on the eastern side of Franklin Road opposite the construction site, accessed via driveways off Franklin Road. A marked pedestrian path past the site on the western side of Franklin Road would be provided to maintain efficient and safe pedestrian access.

There are currently no dedicated pedestrian crossing facilities across Castle Hill Road between Edward Bennett Drive and County Drive. The new signalised pedestrian crossings to be provided with the Castle Hill Road / Glenhope Road signalised intersection would benefit pedestrians and improve safety when crossing Castle Hill Road.

Cycle routes in the area would be unaffected during the construction period. The additional truck movements may conflict with the small number of cyclists along Castle Hill Road. This would be managed through appropriate signage of the changed traffic conditions in the area.

4.3.7 Parking, Taxis and Kiss-and-Ride

There is no on-street parking in this section of Castle Hill Road and therefore the impact on parking would be minimal. On-street parking on Robert Road would be retained during the construction phase. In Franklin Road it would be necessary to restrict parking between Castle Hill Road and the northern boundary of the access to the site.

While it is being considered that on-site parking at the Cherrybrook Station site will be minimal and parking will be provided off-site with shuttle buses transferring workers to and from the site, there will still be some requirement for staff to park near the site. This will most likely occur on Robert Road, Franklin Road or Glenhope Road.

As these roads do not have parking restrictions generally it will be difficult to prevent it from occurring. It will be necessary for measures to be in place to ensure that local residents are not inconvenienced through this additional parking on the street through the provision of guidelines and close liaison with the local council and residents.

4.4 Castle Hill Station Construction Site

4.4.1 Site Context

The Castle Hill Station construction site includes the excavation and construction of the station box as a cut and cover operation and for the construction of cross over passages on the city side of the station. The site is located under the existing Arthur Whitling Park and Castle Hill bus interchange along a section of Old Northern Road. The site is bounded by Old Castle Hill Road, McMullen Avenue, Old Northern Road and Crane Road. This site would be expected to operate 24 hours per day, 7 days per week for spoil removal during the crossover cavern construction phase.

Road Network

The Castle Hill construction site is located in the middle of a busy town centre. Through traffic has been largely removed from the town centre via reassignment to a ring road system including Terminus Street and Pennant Street/McMullen Avenue. Traffic arrangements were reconfigured as part of the ring road development so that Old Northern Road between Crane Road and Terminus Street is a bus only road. It is used as a bus stop and as a layover facility. Old Castle Hill Road is also part of the bus interchange, catering for northbound services on the western side of the street and bus layover on the eastern side of the street.

The Castle Hill road network, characterised by a number of closely spaced intersections, is often congested in both peak and off-peak periods.

It is proposed to relocate the bus interchange as part of the construction phase of the NWRL to Old Castle Hill Road. This will involve changes to traffic operations in Old Castle Hill Road to provide for two way bus traffic whilst maintaining the existing one way northbound flows for general traffic. It will also incorporate changes to the traffic signals at Old Northern Road/Old Castle Hill Road/Castle Street/Crane Road to facilitate buses travelling south on Old Castle Hill Road.

Photo 4.4 Old Northern Road, looking north from intersection with Terminus Street



Table 4.6 Castle Hill Station – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Old Northern Road	RMS	4	44,947	Northbound	AM 1,604 (7-8am) PM 1,801 (5-6pm)
				Southbound	AM 1,861 (8-9am) PM 1,946 (6-7pm)
Terminus Street	RMS	4	27,694	Northbound	AM 911 (8-9am) PM 942 (5-6pm)
				Southbound	AM 1,295 (8-9am) PM 1,333 (4-5pm)
Old Castle Hill Road	Hills Shire Council	2	8,042	Northbound	AM 751 (10-11am) PM 771 (6-7pm)

Planned Road Improvements

It is proposed, separate from the NWRL project, to upgrade Showground Road from Pennant Street to Carrington Road from its current configuration of one traffic lane in each direction to provide two lanes in each direction, as part of the Castle Towers development works. This work would also provide signalisation of the Showground Road/Kentwell Avenue and Showground Road/Rowallan Avenue intersections.

4.4.2 Construction Site Detail

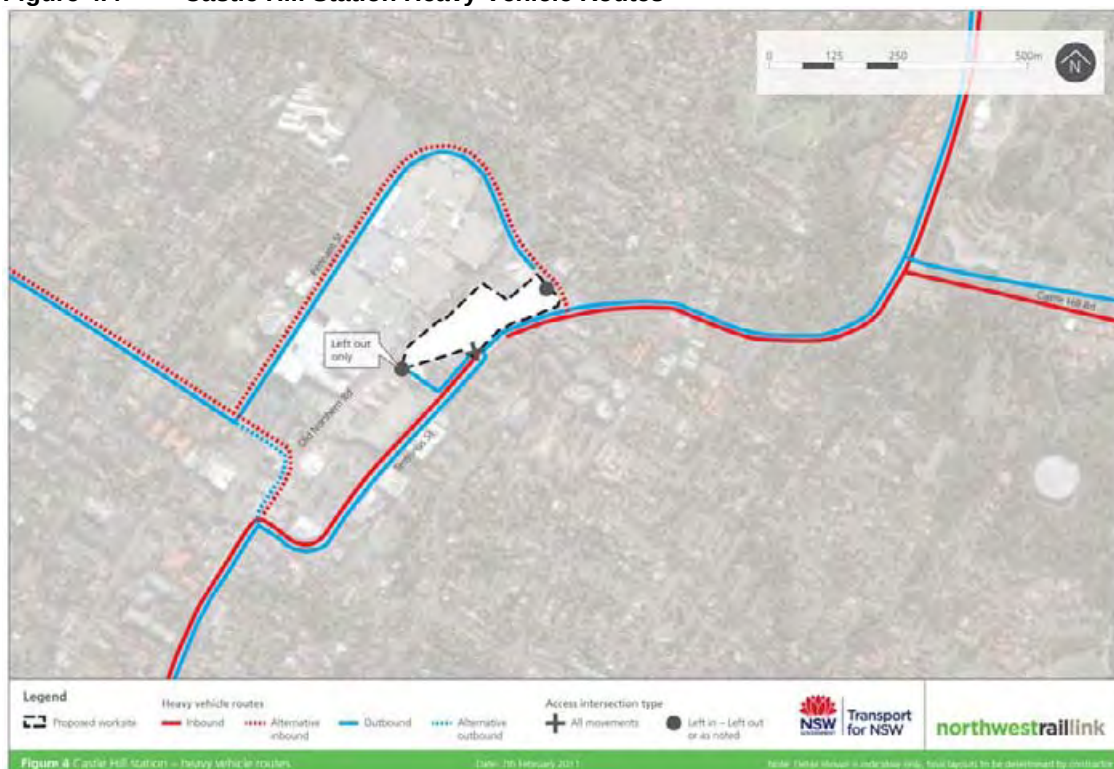
Access to the Castle Hill construction site is proposed at the intersection of Old Northern Road / Terminus Street. Access to the construction site at this intersection would provide a full access intersection to allow all movements. The narrowness of the site will require trucks removing spoil or making deliveries will need to travel in a one way direction through the site from the terminus street/Old Northern Road entry to exit the site at the intersection of Old Northern Road/Crane Road/Castle Street, exiting via a left turn into Crane Road and then into Terminus Street. A secondary left in/left out access is proposed from McMullen Avenue.

4.4.3 Heavy Vehicle Routes

As mentioned above the main site access would be from the Old Northern Road/Terminus Street intersection. Heavy vehicle approach and departure routes for the site would occur via Castle Hill Road and Old Northern Road to the north, Showground Road, Pennant Street, McMullen Avenue, Old Northern Road to the west and Old Northern Road, Cecil Avenue/Terminus Street to the south.

At peak operation, during the station excavation phase, it is forecast that a maximum heavy vehicle generation of approximately 60 trucks would enter and leave the site per day.

A diagram of the proposed Heavy Vehicle routes is shown in **Figure 4.4**, with larger scale diagrams provided in **Appendix A**.

Figure 4.4 Castle Hill Station Heavy Vehicle Routes

4.4.4 Road Network Operation and Intersection Performance

Key Intersections

- Old Northern Rd / McMullen Rd (traffic signals) – This intersection is a T-junction which is the convergence of the eastern and western ring roads around the Castle Hill Town Centre. Medians are provided on all approaches to the intersection.

Old Northern Road is provided with two through lanes and two right turn lanes on the northern approach and two through lanes and a left turn slip lane on the southern approach. Brisbane Road intersects with Old Northern road approximately 30 metres south of the McMullen Avenue intersection. A median opening and short right turn bay is provided for vehicles turning from Old Northern Road into Brisbane Road. McMullen Avenue is provided with two right turn lanes and two left turn lanes at the intersection.

- Old Northern Rd / Crane Rd / Castle Street / Old Castle Hill Road (traffic signals) – There are five legs to this intersection. The southern approach of Old Northern Road provides a single through right lane and a short left turn lane. Old Castle Hill Road is one way northbound at the intersection. Crane Road is provided with two lanes on approach with a shared left/through lane and shared right/through lane. Castle Street has two lanes on approach with a shared left/through lane and shared right/through lane. The northern leg of Old Northern Road is a Bus Only road with a single lane approach to the intersection.
- Crane Rd / Terminus St (traffic signals) – This is a four way intersection with Terminus Street having a divided four lane configuration providing a shared left/through lane, through lane and right turn bay on each approach. Crane Road is provided with two traffic lanes on each approach with the western approach having an exclusive left turn lane and shared right/through lane and the eastern approach having a shared left/through lane and shared right/through lane.

Construction stage traffic impacts at Castle Hill will be as a result of construction traffic and also re-routing of bus services.

As can be seen in **Table 4.7** this would result in:

- No significant change to the degree of saturation or level of service at the existing Old Northern Road / McMullen Avenue and Terminus Street / Crane Road intersections.
- A small increase in the degree of saturation but no change to the level of service at the modified Old Northern Road / Crane Road / Castle Street intersection. Buses from Old Northern Road adjacent to the park would be re-routed along Old Castle Hill Road which will carry buses in both directions.

Table 4.7 Castle Hill Station – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Old Northern Road / McMullen Avenue	C	0.89	C	0.74	C	0.90	C	0.74
Old Northern Road / Crane Road / Castle Street	B	0.44	B	0.46	B	0.50	B	0.47
Terminus Street / Crane Road	D	0.88	C	0.68	C	0.88	C	0.68

4.4.5 Buses

The proposed construction site location within the Arthur Whitling Park and adjoining section of Old Northern Road would require the relocation of the existing bus stops from that section of Old Northern Road for the duration of the works. Alternative sites are currently under investigation however, it is expected that the bus stops would be relocated to Old Castle Hill Road, on the western side of the construction site and utilising both sides of the road. Buses would require two way access along the section of Old Castle Hill Road between Eric Felton Street and Castle Street/Crane Road intersection.

This would also require the identification of an alternative site for bus layover, given the number of buses that are required to layover at Castle Hill.

Some minor changes to bus routes would occur as a result of a move to Old Castle Hill Road, along with other traffic management measures to facilitate buses accessing the stops in both directions on Old Castle Hill Road.

There is currently provision for approximately four buses at the ranks located in Old Northern Road for buses travelling south. There is sufficient length of kerb available in Old Castle Hill Road to accommodate these buses. Some road widening is required at the southern end of the street to provide for the two way flow of buses as well as the bus ranks.

As for the existing traffic flows general traffic would be restricted to one way northbound in the section of Old Castle Hill Road between Castle Street and Eric Felton Street. Southbound general traffic approaching from the intersection of Old Castle Hill Road and McMullen Avenue will still be required to turn right into Eric Felton Street to the Castle Towers car parks. Further analysis and consultation with the Hills Shire Council, owners of Castle Towers and other key stakeholders is required to ensure that the changes proposed can be effectively mitigated. Further investigation of bus layover locations

and facilities will be carried out in the development of subsequent TMP's as planning for the bus layovers is still in the early stages.

Photo 4.5 Old Castle Hill Road, looking north from Castle Street intersection



4.4.6 Pedestrians and Cyclists

The Castle Towers shopping centre, along with other retail uses in the town centre precinct, attracts a significant amount of pedestrian activity around the construction site. It is therefore important that during construction appropriate alternative routes are provided to accommodate this high level of pedestrian movement.

During construction, the following temporary pedestrian and cyclist impacts would occur:

- The footpath on the northern side of Old Northern Road, between the Terminus Street/Old Northern Road intersection and Old Castle Hill Road, would be closed to pedestrian movement. The southern footpath along this section of road would remain open during the construction works. Alternatively, pedestrians can walk via Terminus Street and Crane Road to access the Old Castle Hill Road / Castle Street / Old Northern Road intersection.

The pedestrian routes through Arthur Whitling Park would be temporarily closed during the construction period. Pedestrians wishing to access Old Castle Hill Road from the Brisbane Road area would require a diversion via either the southern footway along Old Northern Road, Crane Road or McMullen Avenue.

4.4.7 Parking, Taxis and Kiss-and-Ride

The construction site is unlikely to affect any existing off-street parking. There would be a loss of approximately 10 kerbside car parking spaces on Old Castle Hill Road for a relocated bus interchange. This parking will be lost for the duration of the construction phase to provide for the two way travel and ranking of buses along this section of Old Castle Hill Road.

Taxi and kiss and ride users would be largely unaffected during construction. The small number of drop offs which currently occur on Old Northern Road between Terminus Street and Old Castle Hill

Road would be shifted to other streets within the town centre, such as Old Castle Hill Road, Crane Road or Castle Street.

4.5 Hills Centre Station Construction Site

4.5.1 Site Context

The Hills Centre site is located within the area currently occupied by the Hills Shire Council's works depot, car parking for the Hills Centre and part of the Castle Hill Showground. Access to the site is proposed from Carrington Road and a new access off Showground Road located to the west of the Gilbert Road intersection. The site works would include the excavation for the station, removal of tunnel spoil and servicing of the TBM's that have proceeded from the Bella Vista launch site. As the TBMs proceed from this site toward Cherrybrook it will become the main tunnelling support site for the drives and will operate 24 hours a day, 7 days a week, including spoil removal.

Road Network

Showground Road is a busy 60 km/h four lane arterial with a central median of variable width between Carrington Road and Windsor Road. It carries approximately 45,000 vpd. The road drops from Gilbert Road to a bridge over Cattai Creek before rising to Victoria Avenue. There is also a significant horizontal curve on this section of road.

Carrington Road is a major collector road serving the Hills Shire Council offices, Hills Centre, Council Works Depot and the Castle Hill industrial area. The western section of the road, between Victoria Avenue and the edge of the commercial/industrial development near Ashford Avenue, is a B-Double route.

It is expected that all existing traffic lanes on the surrounding road network will be maintained during the construction phase. The access to the Showground at Doran Drive will be closed to enable excavation of the station however, it is expected that further development of TMPs will identify alternative access.

Photo 4.6 Carrington Road, looking east toward Doran Drive



Photo 4.7 Showground Road, looking east from Kings Road**Table 4.8 Hills Centre Station – Roads Summary**

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Showground Rd	RMS	4	44,913	Eastbound	AM 1,825 (8-9am) PM 1,882 (6-7pm)
				Westbound	AM 1,631 (8-9am) PM 1,697 (3-4pm)
Gilbert Rd	Hills Shire Council	2	16,134	Northbound	AM 656 (7.45-8.45am) PM 1,077 (5-6pm)
				Southbound	AM 1,221 (8-9am) PM 785 (4-5pm)
Carrington Rd	Hills Shire Council	2	15,409	Eastbound	AM 741 (11-12am) PM 1,075 (5-6pm)
				Westbound	AM 802 (8-9am) PM 852 (3-4pm)
Victoria Ave	Hills Shire Council	4	25,710	Northbound	AM 1,263 (11-12am) PM 1,295 (4-5pm)
				Southbound	AM 1,242 (11-12am) PM 1,142 (12-1pm)

Planned Road Improvements

RMS is currently investigating the widening of the section of Showground Road between Carrington Road and Pennant Street from its current two lanes to a four lane roadway.

4.5.2 Construction Site Detail

Access to the Hills Centre Station construction site is proposed at two locations:

- Showground Road (all movements)
- Carrington Road (all movements)

The construction site would essentially be divided into two separate zones. The Showground Road access would serve the northern zone and would carry most heavy vehicle traffic. The Carrington Road access would carry significantly less traffic.

The proposed Showground Road access is located midway between Gilbert Road and Cattai Creek. It is proposed that this be provided as a full access signalised intersection with appropriate acceleration and deceleration lanes on Showground Road. The final location of this intersection will be determined as the construction program is further developed.

The Carrington Road access point could be in the form of an all movement intersection controlled by traffic controllers (i.e. the access intersection is not proposed to be signalised during construction). In the longer term this would become the main station access point and be controlled by traffic signals.

4.5.3 Heavy Vehicle Routes

It is proposed that heavy vehicle access for the removal of spoil from the tunnelling and station excavations would occur through the Showground Road access. This access would provide for all movements with the principle heavy vehicle movements being right in and left out of the site. Carrington Road and Victoria Avenue would provide a secondary access to the site should the Showground Road access be unavailable.

The peak heavy vehicle movement for the site would occur during tunnelling activities with 24 hour operation. This would generate approximately 275 truck trips to and from the site per day removing spoil, delivery of tunnel segments and other materials. Prior to the commencement of tunnelling activities the site will generate approximately 50 trucks per day entering and leaving the site during station excavation.

A diagram of the proposed Heavy Vehicle routes is shown in **Figure 4.5**, with larger scale diagrams provided in **Appendix A**.

Figure 4.5 Hills Centre Heavy Vehicle Routes

4.5.4 Road Network Operation and Intersection Performance

Key Intersections

- Showground Rd / Carrington Rd (traffic signals) – This intersection is a signalised T-junction with Showground Road being a divided carriageway providing two lanes in each direction with the western approach having a right turn bay. Carrington Road is provided with two lanes on approach with a shared left/right lane and a right turning lane.
- Showground Rd / Gilbert Rd (traffic signals) – This intersection is a signalised T-junction with Showground Road having a divided carriageway with two through lanes in each direction, a left turn slip lane on the western approach and a right turn bay on the eastern approach. Gilbert Road is provided with two right turn lanes on approach and a left turn lane.
- Victoria Ave / Carrington Rd (roundabout) – This intersection provides two lanes on each of the Victoria Avenue approaches and two lanes on the Carrington Road approach.

Heavy vehicle construction traffic will be concentrated on the new Showground Road access limiting the impact on Carrington Road.

As can be seen in **Table 4.9** the additional traffic would result in:

- An increase in the degree of saturation of 4% at the existing Showground Road / Carrington Road intersection in both the AM and PM peaks with no change in the level of service.
- An increase in the degree of saturation of up to 3% at the existing Victoria Avenue / Carrington Road roundabout.

The Showground Road / Site Access intersection, with provision for all turning movements, is forecast to operate at an acceptable degree of saturation and level of service.

Table 4.9 Hills Centre Station – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Showground Road / Carrington Road	C	0.75	D	0.92	C	0.79	D	0.96
Victoria Avenue / Carrington Road	A	0.42	A	0.57	A	0.45	A	0.59
Showground Road / Site Access	Not Applicable				B	0.83	B	0.81
Showground Road / Gilbert Road	C	0.80	B	0.66	C	0.82	B	0.67

4.5.5 Buses

Four bus routes operate along Showground Road, Carrington Road and Victoria Ave in the vicinity of the construction site. None of these services would be required to be re-routed during the construction period, with negligible impacts on bus travel times anticipated. Special Event buses for Sydney Olympic Park/Royal Easter Show (Route 5A) commence their journeys at this location with the car parking occurring in the Hills Centre car park and the adjoining Showground. An alternative location for car parking and the ranking of buses would need to be determined.

These existing bus stops on Carrington Road, 50m west of Middleton Ave, may be required to be relocated east of Middleton Ave to maintain access for through and construction traffic on Carrington Road.

4.5.6 Pedestrians and Cyclists

An existing pedestrian route from Carrington Road through the Castle Hill Showground to Showground Road would be closed during construction.

The existing cycle path which runs alongside Cattai Creek and under Showground Road into Fred Caterson Reserve would remain unaffected during construction.

The northern footpath of Carrington Road at the site access point, opposite Ashford Ave, is to be managed appropriately through the provision of a marked pedestrian path across the site entrance and traffic control as necessary during the construction period to allow the safe movement of pedestrians.

4.5.7 Parking, Taxis and Kiss-and-Ride

Approximately 200 off-street parking spaces contained in the Hills Centre car park would be lost during construction. Alternative parking could be provided within the Showground during the construction phase however, this will require liaison with the Hills Shire Council, lessee of the Hills Centre and Castle Hill Show Society regarding location and usage patterns. Potential Easter Show and Sydney

Olympic Park special events related car parking and bus arrangements in the vicinity of the Hills Centre construction site are being investigated and will be detailed further in subsequent TMPs.

On-street parking is unlikely to be affected, except where no stopping zones are extended at the new site access point on Carrington Road.

4.6 Norwest Station Construction Site

4.6.1 Site Context

The Norwest Station site is located under Norwest Boulevard immediately east of the intersection with Brookhollow Avenue/Century Circuit with service access being provided via the properties on the south eastern corner of the intersection, between Norwest Boulevard and Brookhollow Avenue. The site works involve the excavation for the station using a top down method in order to minimise any traffic impacts for the site. It would be necessary to provide for the temporary re-alignment of at least one of the carriageways of Norwest Boulevard to cater for the station construction. The current configuration provides that a temporary re-aligned westbound carriageway would be required. It is expected that westbound traffic would be diverted to this re-aligned carriageway for the initial station excavation and would be returned to original alignment as soon as practicable.

In order to facilitate safe pedestrian access across Norwest Boulevard and with the potential for reduced sight distance for vehicles entering the Brookhollow Avenue/Norwest Boulevard/Century Circuit intersection it is anticipated that the roundabout would be signalised or the intersection converted to full traffic signal operation for the construction works for the station.

The initial traffic management plans for this site have identified that the existing lane numbers will be maintained on Norwest Boulevard during the construction phase. There may be the loss of some parking (approximately 10-15 spaces) on Brookhollow Avenue during construction. This will be assessed further as the construction plans progress.

Road Network

- Norwest Boulevard is a busy, 60 km/h divided four lane arterial with a wide, landscaped central median. It is the only arterial access route for most of the Norwest area and is characterised by high commuter peak flows. Major intersections are controlled by two-lane roundabouts. There are limited alternative routes in the area and private vehicle traffic is the major travel mode.
- Brookhollow Avenue is local street providing access to a number of commercial properties. Parking is allowed on both sides of the road and incorporates some speed control devices in the form of a contrasting pavement and landscaped medians.
- Century Circuit is a local road which provides access from Norwest Boulevard to the Norwest Shopping Centre, indoor swimming centre and commercial properties adjacent to the shopping centre.

Photo 4.8 Norwest Blvd, looking east toward Windsor Road from proposed station location



Table 4.10 Norwest Station – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Norwest Blvd	RMS	4	26,417	Eastbound	AM 1,033 (9-10am) PM 1,244 (3-4pm)
				Westbound	AM 1,451 (8-9am) PM 1,159 (3-4pm)
Windsor Rd	RMS	4	34,782	Northbound	AM 1,544 (7.30-8.30am) PM 1,642 (4.45-5.45pm)
				Southbound	AM 2,653 (8-9am) PM 1,706 (4.45-5.45pm)
Brookhollow Ave	Hills Shire Council	2	2,726	Northbound	AM 205 (8-9am) PM 322 (5-6pm)
				Southbound	AM 171 (9-10am) PM 206 (4-5pm)

Planned Road Improvements

RMS is currently undertaking widening of Norwest Boulevard at the intersection with Windsor Road to provide three right turn lanes out of Norwest Boulevard and two left turn lanes in from Windsor Road.

RMS has also carried out some preliminary assessments for the future requirements of Norwest Boulevard and the intersections located along its length. This assessment has identified a number of

improvements including signalling of key intersections and the provision of additional traffic lanes and bus lanes in the future. It should be noted that these improvements are not currently scheduled and would be subject to further consideration and investigation.

4.6.2 Construction Site Detail

Access to the site would be provided at two locations. The Brookhollow Avenue access would provide for light vehicle access and heavy vehicles for removal of spoil during the early stage of the construction. Spoil removal is expected to occur via direct access onto Norwest Boulevard. This access is expected to occur at the eastern end of the Norwest Boulevard excavation with vehicles entering and exiting from the east.

4.6.3 Heavy Vehicle Routes

During the initial construction phase of the services area construction vehicle access would be via Brookhollow Avenue to the east and west for accessing Norwest Boulevard. During the station excavation stage heavy vehicle access would be via a site access located in the middle of Norwest Boulevard on the eastern end of the site. Some site deliveries would also occur via Brookhollow Avenue during this phase of the work.

A diagram of the proposed HV routes is shown in **Figure 4.6**, with larger scale diagrams provided in **Appendix A**.

Figure 4.6 Norwest Station Heavy Vehicle Routes



4.6.4 Road Network Operation and Intersection Performance

Key Intersections

- Norwest Blvd / Windsor Rd (traffic signals) – This signalised T-junction is currently subject to road works to provide for three lanes exiting Norwest Boulevard to the south on Windsor Road and two left turn lanes from Windsor Road. This work is expected to be completed in 2012. Windsor Road is currently a four lane divided carriageway with two through lanes in each direction, two right turn lanes into Norwest Boulevard for the northern approach, single left turn lane for the southern approach. A southbound 'Bus Only' queue jump lane is provided southbound at the intersection.

Norwest Boulevard is currently provided with two right turn lanes and two left turn lanes at the intersection.

- Norwest Blvd / Columbia Cct / Brookhollow Ave (East) (roundabout) – This intersection is provided with a two lane roundabout with Norwest Boulevard having two lanes on each approach and Columbia Circuit having a single lane approach and Brookhollow Avenue having two lanes marked for a short distance on approach to the intersection.
- Norwest Blvd / Solent Cct (East) (priority control) – this intersection is a channelised T-junction with Norwest Boulevard have priority. A right turn bay is provided for traffic turning from Norwest Boulevard into Solent Circuit. Right turns are not permitted out of Solent Circuit.
- Norwest Blvd / Brookhollow Ave(West) / Century Circuit (roundabout) – This intersection is provided with a two lane roundabout with both Norwest Boulevard approaches and the Century Circuit approach have two lanes. The Norwest Boulevard approaches are marked as a shared left/through and shared through/right with the Century circuit approach having an exclusive right turn lane and a shared left/through/right lane. Brookhollow Avenue is provided with a single lane approach to the intersection.
- Norwest Blvd / Reston Grange / Solent Cct (west) (roundabout) – This intersection is provided with a two lane roundabout with all approaches having two lanes. The Norwest Boulevard approaches are both marked with a shared left/through lane and a shared through/right lane. Solent Circuit is marked with a right turn lane and shared left/through lane. Reston Grange is provided with two lanes on approach to the intersection without any specific lane allocation.
- Norwest Blvd / Old Windsor Rd (traffic signals) – This is a grade separated intersection with Old Windsor Road providing two lanes in each direction and passing under the intersection. Traffic signals are provided for the turning movements from Old Windsor Road and Norwest Boulevard. The Old Windsor Road off-ramps provide two right turn lanes and two left turn lanes at the intersection for each of the approaches. Norwest Boulevard eastern approach provides a left turn slip lane, two through lanes and a right turn lane. The western approach of Norwest Boulevard provides a left turn slip lane, two through lanes and two right turn lanes.

Construction traffic from the construction site is estimated to be in the order of 7 vehicles in each direction in the Norwest Boulevard peak hour.

There will be no change to the existing key intersections.

As can be seen in **Table 4.11** the additional traffic would result in:

- An increase in the degree of saturation of 2% in the AM peak at the existing Norwest Boulevard / Windsor Road intersection with no change in the PM peak and no change to the AM/PM levels of service.
- No significant change to the operation of the Norwest Boulevard / Brookhollow Avenue / Columbia Cct and Norwest Boulevard / Brookhollow Avenue / Century Circuit roundabouts.

Table 4.11 Norwest Station - Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Norwest Boulevard / Windsor Road	C	0.90	D	0.92	C	0.92	D	0.92
Norwest Boulevard / Brookhollow Avenue / Columbia Cct	A	0.77	B	1.04	A	0.77	B	1.04
Norwest Boulevard / Brookhollow Avenue / Century Circuit	A	0.60	A	0.57	A	0.61	A	0.57

4.6.5 Buses

The Norwest Station construction site would have an impact on the westbound bus stop in Norwest Boulevard east of Century Circuit. This stop is currently an indented bus bay which would need to be removed to accommodate temporary roadway for diversion of the westbound lanes around the station construction site. This bus bay may need to be closed for the duration of the traffic diversion however the provision for buses to pull up safely at this location will be investigated as part of the future TMPs for the traffic diversion so as to retain the stop close to its current location during construction.

The nearest stops to this location are at the intersection with Brookhollow Avenue (east) or between Brookhollow Avenue and Reston Grange to the west of the site. The eastbound bus bay and stop can be retained during the works. No other bus stops are affected by the station works.

4.6.6 Pedestrians and Cyclists

At various stages of construction it is likely that one of the footpaths on either side of Norwest Boulevard would be closed, with the southern footpath being closed for the duration of the works. A pedestrian underpass under Norwest Boulevard is provided to the east of the site. Barricades would need to be erected as part of the site works to direct pedestrians to use this underpass to access the northern pathway. A pedestrian path along the northern side of Norwest Boulevard would need to be maintained for the duration of the works.

It is understood that RMS is considering the provision of traffic signals at some time in the future although it is still in the early stages of investigations. As part of the construction works it may require the provision of traffic signals to facilitate pedestrians crossing Norwest Boulevard to access the shopping centre from the western end of Brookhollow Avenue.

4.6.7 Parking, Taxis and Kiss-and-Ride

The Brookhollow Avenue carriageway is generally 11 metres wide and it may be necessary to restrict kerbside parking along Brookhollow Avenue during the station site works. There will be no loss of on-street parking as a result of construction activities on Norwest Boulevard as parking is not permitted at the present time. The only off-street parking that would be lost will be within the commercial land uses to be acquired on the southern side of Norwest Boulevard.

Taxi and kiss and ride users generally use Century Circuit adjacent to the retail precinct. Access to this area would remain unaffected during construction.

4.7 Bella Vista Station Construction Site

4.7.1 Site Context

This site would form one of the major site compounds for the construction of the NWRL. It is the site for the Bella Vista Station construction as an open cut station area, the launch site for the TBMs to excavate the tunnels to Cherrybrook. This site is expected to generate a significant number of truck movements with the removal of spoil and the delivery of materials. Access to the site is proposed from Celebration Drive at the end of the street or at the entrance to the existing Totally Home shopping centre.

Road Network

Celebration Drive is a collector road within Bella Vista serving both retail and commercial land uses. The road has two-traffic lanes with heavily-used on-street parking and significant pedestrian volumes. It is a cul-de-sac at its north-eastern end. An all-movement signalised intersection provides access to Old Windsor Road.

At this location the Transitway is located on the western side of Old Windsor Road. An underpass immediately north of Celebration Drive transfers the Transitway from the western to the eastern side of Old Windsor Road for the alignment to the north.

There will be no impact on the configuration of Old Windsor Road past the site during construction. Some widening of Celebration Drive will be undertaken to facilitate access from Old Windsor Road to the site entry opposite Lexington Avenue. This will provide two traffic lanes eastbound from Old Windsor Road to Lexington Avenue.

Table 4.12 Bella Vista Station – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Old Windsor Rd	RMS	4	49,004	Northbound	AM 1,241 (7.45-8.45am) PM 2,261 (4.15-5.15pm)
				Southbound	AM 1,771 (7-8am) PM 1,435 (4.30-5.30pm)
Celebration Dr	Hills Shire Council	2	14,533	Eastbound	AM 1,399 (8-9am) PM 602 (12-1pm)
				Westbound	AM 506 (11-12am) PM 744(5-6pm)
Balmoral Rd	Hills Shire Council	2	872	Eastbound	AM 16 (7-8am) PM 14 (5-6pm)
				Westbound	AM 112 (8-9am) PM 66 (3-4pm)

Planned Road Improvements

There are no planned road improvements in the vicinity of the site at the present time.

4.7.2 Construction Site Detail

Access to Bella Vista Station site and tunnel portal is proposed at a location off Celebration Drive to the east of the Lexington Avenue intersection. The Celebration Drive/Lexington Avenue intersection would be used as an access during the night and at low traffic times.

The proposed Celebration Drive access arrangement is the existing roundabout with Lexington Drive. This access location is suitable, in close proximity to Old Windsor Road, but may need to be converted to signals to provide for construction traffic. It is likely that such an intersection would be retained as part of the ultimate configuration of Bella Vista North Station.

The site would be one of the main generators of traffic on the project, particularly trucks removing spoil from the tunnel portal.

4.7.3 Heavy Vehicle Routes

It is proposed that heavy vehicle access would be from Old Windsor Road at Celebration Drive to either the entrance opposite the Lexington Drive intersection or the access road on Celebration Drive to the east of the Lexington Drive intersection. A secondary access would be provided off Balmoral Road although this would be restricted to right in/left out. The intersection of Balmoral Road at Old Windsor Road is controlled by traffic signals as it crosses the T-way and is restricted to left in/left out onto Old Windsor Road. Low traffic volumes on Balmoral Road mean that there would be minimal delay for vehicles turning in to, and out of, the site access.

A diagram of the proposed HV routes is shown in **Figure 4.7**, with larger scale diagrams provided in **Appendix A**.

Figure 4.7 Bella Vista Heavy Vehicle Routes



4.7.4 Road Network Operation and Intersection Performance

Key Intersections

- Old Windsor Rd / Celebration Dr (traffic signals) – This intersection is a channelised T-junction with Old Windsor Road provided with two through lanes in each direction. The southern approach is provided with two right turn lanes into Celebration Drive. The northern approach is provided with a left turn slip lane and a 'Bus Only' queue jump lane at the head of the left turn lane. Celebration Drive is provided with two right turn lanes, a 'Bus Only' queue jump lane and a left turn lane at the intersection. Access is also provided to and from the T-way into Celebration Drive.
- Lexington Dr / Celebration Dr (roundabout) – While the roundabout at this intersection has been designed to operate as a two lane roundabout, at the present time it effectively only operates as a single lane roundabout as each of the approaches are single lane only. The splitter islands at this intersection also act as pedestrian refuges with pedestrian paths provided.

This construction site will be a major tunnelling site and therefore construction heavy vehicle volumes will be significant. Total peak hour construction traffic is estimated to be in the order of 210 vph in each direction during the peak periods. There may be some modifications required to the layout of existing key intersections although background traffic volumes will decrease as a result of the removal of the Totally Home Centre.

As can be seen in **Table 4.13** the additional traffic would result in:

- An increase in the AM peak degree of saturation at the Old Windsor Road / Celebration Drive intersection but with no change to the level of service. In the PM peak the level of service at this intersection would drop from 'C' to 'D'.

- A drop in the level of service in both peak periods at the Lexington Drive / Celebration Drive roundabout, from 'C' to 'F' in the AM peak and 'B' to 'E' in the PM peak. The provision of two eastbound lanes on the approach to the intersection and replacement of the roundabout with traffic signals would be required as part of the construction works.

Table 4.13 Bella Vista Station – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Old Windsor Road / Celebration Drive	B	0.82	C	0.83	C	0.98	D	1.00
Lexington Drive / Celebration Drive	C	1.02	B	0.95	F	1.32	E	1.26

4.7.5 Buses

Bus routes in the area surrounding the construction site are largely confined to the North West Transitway which runs adjacent to Old Windsor Road. Two services connect from Norwest Boulevard to Lexington Dr and Brighton Dr adjacent to the construction site. None of these services would need to be re-routed during the construction period.

The "Celebration" Transitway station on the western side of Old Windsor Road, directly opposite Celebration Drive, would continue to operate as normal during the station construction.

4.7.6 Pedestrians and Cyclists

The area surrounding the proposed construction site has high levels of pedestrian activity due to the 'Totally Home Centre' and other commercial land uses.

Pedestrian and cycle routes surrounding the construction site would generally remain unaffected during construction, particularly the shared use path which runs on the eastern side of Old Windsor Road.

The new station may require additional pedestrian and bicycle connections, which would ultimately improve accessibility in the area. During construction, the Old Windsor Road / Celebration Drive intersection may be upgraded to include a pedestrian crossing on the northern leg of the intersection which would improve pedestrian accessibility in the area. This would need to be reviewed and accepted by RMS prior to implementation.

4.7.7 Parking, Taxis and Kiss-and-Ride

Parking in the vicinity of the construction site is in the form of unrestricted, on-street parking in the residential areas to the west and east of the construction site and private parking in commercial buildings to the south of the site.

Most on-street parking would not be affected by construction activities. The 522 off-street car parking spaces in the 'Totally Home' Centre would be lost as a result of construction however, this parking would no longer be required for staff and customer parking when the Totally Home Centre is closed. This parking would remain available until such time as the centre was closed.

4.8 Balmoral Road & Memorial Avenue Construction Sites

4.8.1 Site Context

This site is where the rail line transforms from cut to embankment and for the commencement of the elevated section of the NWRL. The northern part of the site would potentially be used for the construction of the segments for the elevated sections with the southern portion of the site to be used for the pre-cast concrete tunnel segments. Other site works would be the construction of the piers for the bridge segments. Access would be via a site access at Balmoral Road and at Memorial Avenue. The Balmoral Road access would be restricted to left in/right out toward Old Windsor Road. At Memorial Avenue, a full access intersection controlled by traffic signals is proposed to the east of the existing T-way intersection to allow for access in each direction along Memorial Avenue. This would be the main access to and from the site.

Road Network

Balmoral Road is a relatively low volume, 70 km/h narrow two lane rural road. It connects to both Old Windsor Road in the west and Memorial Ave to the east. However, the eastern section of the road has a 3 tonne load limit and is therefore not suitable for accommodating construction traffic. It is also expected that traffic on this road would increase as semi-rural land is converted to residential lots. Residential development and road changes have already been undertaken on the eastern end of the road.

The Old Windsor Road / Balmoral Road intersection is controlled by traffic signals with left in/left out access to Balmoral Road. The right turn into Balmoral Road from Old Windsor Road south and the right turn out of Balmoral Road to Old Windsor Road are therefore not permitted. The Transitway crosses Balmoral Road immediately east of the intersection and this movement is incorporated into the traffic signals. The "Balmoral" bus stop is on the northern side of Balmoral Road.

Memorial Ave is a busy 60 km/h two lane arterial with sealed shoulders. The Old Windsor Road / Memorial Ave / Sunnyholt Road intersection is a major junction where all movements are permitted. A separate signalised intersection, immediately east of Old Windsor Road, provides for the Transitway to cross Memorial Ave. A major Transitway bus stop ("Burns") and car park exists at this location.

It is expected that lane configurations on the surrounding road network will be maintained during the construction phase. The T-way operations will also be maintained throughout the construction phase.

Photo 4.9 Memorial Avenue, looking west from Arnold Avenue**Table 4.14 Balmoral Road & Memorial Avenue – Roads Summary**

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Old Windsor Road	RMS	4	49,004	Northbound	AM 1,241 (7.45-8.45am) PM 2,261 (4.15-5.15pm)
				Southbound	AM 1,771 (7-8am) PM 1,435 (4.30-5.30pm)
Balmoral Rd	Hills Shire Council	2	872	Eastbound	AM 16 (7-8am) PM 14 (5-6pm)
				Westbound	AM 112 (8-9am) PM 66 (3-4pm)
Memorial Ave	RMS	2	21,660	Eastbound	AM 1,406 (8-9am) PM 885 (5-6pm)
				Westbound	AM 744 (11-12am) PM 952 (4-5pm)
Sunnyholt Rd	RMS	4	39,433	Eastbound	AM 1,729 (7.45-8.45am) PM 942 (4-5pm)
				Westbound	AM 1,018 (7-8am) PM 992 (4.30-5.30pm)

Planned Road Improvements

Some road improvements are expected to occur on Balmoral Road to the east of the site as residential development progresses in the area. It is understood that RMS is also investigating the widening of Memorial Avenue to a four lane divided carriageway although a forecast year has not been determined.

4.8.2 Construction Site Detail

The current construction method for the NWRL would provide the rail corridor in cut at Balmoral Road with a bridge being provided for Balmoral Road to cross the rail corridor. This road may need to be closed for periods during the works however as the road may be required for access to and from the construction sites to the north and south. Access may be maintained through the provision of a side track around the bridgeworks.

The Memorial Ave access is proposed as an all movement intersection on Memorial Ave immediately east of Old Windsor Road. It would need to be controlled by traffic signals because use of traffic controllers would not be appropriate due to the high volume of Memorial Ave and site traffic, and the high number of heavy vehicles. The intersection would need to be located as far away as possible from the Transitway signals, or alternately it may be possible to combine it with these signals. Maintenance of a good level of service on the adjacent Transitway is essential at this construction site access location.

4.8.3 Heavy Vehicle Routes

The majority of heavy vehicles would access the site from the signalised intersection to be provided on Memorial Avenue to the east of the T-way intersection. Balmoral Road would be used as a secondary access only and any heavy vehicle movements would be restricted to the western end of the road, between the site access and Old Windsor Road.

A diagram of the proposed HV routes is shown in **Figure 4.8** with larger scale diagrams provided in **Appendix A**.

Figure 4.8 Balmoral Road & Memorial Avenue Heavy Vehicle Routes

4.8.4 Road Network Operation and Intersection Performance

Key Intersections

- Old Windsor Rd / Balmoral Rd (traffic signals) – The traffic signals at this location are principally to control traffic movements across the T-way. Movements to and from Balmoral Road are provided as a left in/left out restriction onto Old Windsor Road. Balmoral Road is a single lane in each direction with Old Windsor Road having a divided carriageway of two lanes in each direction. Slip lanes are provided for Balmoral Road traffic when entering or leaving Old Windsor Road.
- Old Windsor Rd / Memorial Ave / Sunnyholt Rd (traffic signals) – This is one of the major intersections in the area with a significant volume of traffic on all approaches. Old Windsor Road is provided with two through lanes in each direction on a divided carriageway. Two right turn lanes are provided on the northern approach, along with a left turn slip lane. The other approach is provided with a single right turn lane and left turn slip lane.

Sunnyholt Road is a divided carriageway and is provided with a left turn slip lane, two through lanes to Memorial Avenue, a 'Bus Only' lane that continues into Memorial Avenue to the signalised T-way intersection and two right turn lanes into Old Windsor Road.

Memorial Avenue on the approach to the intersection is a divided carriageway and is provided with a left turn slip lane, a 'Bus Only' lane which continues across into Sunnyholt Road, two through lanes and a right turn bay.

This construction site is estimated to generate low traffic volumes and there will be no change to the existing key intersections.

As can be seen in **Table 4.15** the additional traffic would result in:

- An increase of 2% in the AM peak degree of saturation at the Old Windsor Road / Balmoral Road intersection but with no change to the level of service.
- Whilst there is no significant forecast change to the already congested Old Windsor Road / Sunnyholt Road / Memorial Avenue intersection, this is one of several locations where peak period truck operations will need to be avoided.

Much of the above changes in intersection performance can be attributed to construction traffic from other construction sites using Old Windsor Road.

Table 4.15 Balmoral Road & Memorial Avenue – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Old Windsor Road / Balmoral Road	C	0.67	B	0.89	C	0.69	B	0.89
Old Windsor Road / Sunnyholt Road / Memorial Avenue	E	1.15	E	1.02	E	1.06	F	1.04

4.8.5 Buses

Existing bus services in the vicinity of the construction site are confined to the Transitway. It is expected that the Transitway would remain fully operational during the construction period including the Burns T-way station. No services would need to be re-routed and therefore there should be negligible impact on travel times. There may be the need for periodic closures of the T-way around the Burns Station and these will need to be managed to minimise any impact on bus services. The provision of a temporary road would be required in order to route the buses around the construction occurring whilst ensuring minimal disruption to bus operations and passenger access to the T-way station.

The Balmoral T-way station would be unaffected by the NWRL construction as the station is located outside the construction site compounds.

4.8.6 Pedestrians and Cyclists

There are no intensive land uses in the area immediately surrounding the construction site. Therefore the majority of pedestrian traffic is related to the Transitway bus stop. The regional cycleway is on the western side of Old Windsor Road at this location. There is a pedestrian/cycle path located along the eastern side of Old Windsor Road between Memorial Avenue and Celebration Drive which would be required to be closed for the duration of the construction works. Cyclists and pedestrians can be directed to the pathway located on the western side of Old Windsor Road at Memorial Avenue and Celebration Drive. Both of these intersections are provided with crossing facilities to enable this to occur.

4.8.7 Parking, Taxis and Kiss-and-Ride

The only parking to be affected by construction is the Burns T-way station car park. This has 159 spaces and it is expected that these would be displaced during construction and an alternative car

park would be provided. This car park is not currently heavily utilised. The car park will be relocated to a temporary site to the east of the existing bus station with access provided to and from Memorial Avenue.

The Balmoral T-way station does not have a car park with the main access being across Old Windsor Road at the signalised intersection with Miami Street.

Vehicular drop offs around the area are currently low, and is considered that the impact during construction would be minimal.

4.9 Kellyville Station

4.9.1 Site Context

This site is located on the south eastern corner of the Old Windsor Road/Samantha Riley Drive/North West T-way intersection and on the eastern side of Old Windsor Road and North West Transitway between Samantha Riley Drive and Windsor Road. The construction site for the station would occupy a portion of the existing car park. This portion of the car park would need to be relocated for the duration of the works. Pedestrian access would be maintained along Samantha Riley Drive between the car parks and the T-way station during the construction phase. The construction site for the viaduct north of Samantha Riley Drive would be accessed via a left in/left out arrangement.

It is not proposed, at this stage, to reduce the current lane configurations on Samantha Riley Drive or Old Windsor Road during the construction phase. There may be the need to close lanes temporarily to facilitate the placement of viaduct spans over Samantha Riley Drive. This will be further assessed and detailed in the preparation of final TMPs and traffic control plans as the design progresses.

Road Network

Samantha Riley Drive is a busy 60 km/h four lane regional road. The Old Windsor Road / Samantha Riley Dr / Newbury Ave and Windsor Road / Samantha Riley Dr intersections are major junctions where all movements are permitted. The Old Windsor Road junction also incorporates the T-way crossing of Samantha Riley Drive. A separate roundabout, immediately east of Old Windsor Road, provides for access to the Transitway car park.

The surrounding road network lane configurations will be maintained during the construction phase. T-way operations will also be maintained.

Table 4.16 Kellyville Station – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Old Windsor Road	RMS	4	49,004	Northbound	AM 1,466 (7.30-8.30am) PM 1,392 (4.15-5.15pm)
				Southbound	AM 1,769 (7-8am) PM 1,552 (4.15-5.15pm)
Samantha Riley Dr	Hills Shire Council	4	13,165	Eastbound	AM 748 (8-9am) PM 627 (6-7pm)
				Westbound	AM 627 (8-9am) PM 672 (5-6pm)

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Windsor Rd	RMS	4	37,382	Eastbound	AM 673 (7.15-8.15am) PM 593 (5-6pm)
				Westbound	AM 566 (7.45-8.45am) PM 1,056 (5-6pm)

Planned Road Improvements

Discussions with the Hills Shire Council and RMS have indicated that no road improvements are planned at the present time.

4.9.2 Construction Site Detail

Access to the Samantha Riley Drive Station construction site is proposed as an all movement intersection at the existing roundabout on Samantha Riley Drive immediately east of Old Windsor Road.

The proposed Samantha Riley Drive access would utilise the existing Riley T-way station car park roundabout so that it is located as far away as possible from the Transitway signals at Old Windsor Road. This would be subject to maintaining access to the Riley car park and the proposed alternative car park. Maintenance of a good level of service on the adjacent Transitway is essential at this construction site access location.

The viaduct site to the north of Samantha Riley Drive is proposed to be provided with a single access off Samantha Riley Drive between the Transitway and the roundabout.

4.9.3 Heavy Vehicle Routes

Heavy vehicle access to the site would occur along Samantha Riley Drive generally from Old Windsor Road with a secondary route along Samantha Riley Drive from Windsor Road.

A diagram of the proposed HV routes is shown in **Figure 4.9** and **Figure 4.10**, with larger scale diagrams provided in **Appendix A**.

Figure 4.9 Kellyville Station Heavy Vehicle Routes**Figure 4.10 Kellyville Heavy Vehicle Routes**

4.9.4 Road Network Operation and Intersection Performance

Key Intersections

- Old Windsor Rd / Samantha Riley Dr / Newbury Avenue (traffic signals) – This intersection provides the connection from the Stanhope residential area to the west and Kellyville area to the east to Old Windsor Road. The T-way also crosses Samantha Riley Drive at this point and forms part of the intersection. All approaches to the intersection are divided carriageways with Old Windsor Road providing two through lanes in each direction with two right turn lanes into Samantha Riley Drive and a single right turn lane into Newbury Avenue. The southbound left turn lane from Old Windsor Road is signal controlled to provide for bus movements along the T-way. The northbound left turn lane from Old Windsor Road is provided as a slip lane.

Samantha Riley Drive has its stop line set back to provide for the T-way. It is provided with a two lane left turn, single through lane to Newbury Avenue and single right turn lane.

Newbury Avenue is provided with a left turn slip lane, short through lane to Samantha Riley Drive and right turn lane.

- Windsor Rd / Samantha Riley Dr (traffic signals) – This intersection provides two through lanes on a divided carriageway in each direction along Windsor Road with separate right and left turn lanes at the intersection. Samantha Riley Drive is also provided with two through lanes in each direction on a divided carriageway. The northern approach is provided with a left turn slip lane and a right turn lane. The southern approach is provided only with a right turn lane, the left lane of the through movement also providing for left turn movements.

This construction site is estimated to generate low traffic volumes and there will be no change to the existing key intersections.

As can be seen in **Table 4.17** the additional traffic would result in:

- An increase of 3% in the AM peak and 5% in the PM peak degree of saturation at the Old Windsor Road / Samantha Riley Drive intersection. The level of service would drop from 'D' to 'E' in the PM peak.

The change in intersection performance can mainly be attributed to construction traffic from other construction sites using Old Windsor Road.

Table 4.17 Kellyville Station – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Old Windsor Road / Samantha Riley Drive	E	1.00	D	0.94	E	1.03	E	0.99

4.9.5 Buses

Existing bus services in the vicinity of the construction site are confined to the Transitway and along Samantha Riley Drive. It is expected that the Transitway would remain fully operational during the construction period including the Riley T-way station. No services would need to be re-routed and therefore there should be negligible impact on travel times.

The main impact on the T-way at this location will be on the car parking and access from the car parks to the T-way station. As described below a portion of the car park will need to be relocated to

accommodate the construction site for the NWRL station. In addition passengers accessing the T-way station from the car parks will be required to use the footpath on the southern side of Samantha Riley Drive between the roundabout and the T-way station.

4.9.6 Pedestrians and Cyclists

There are no intensive land uses in the area immediately surrounding the construction site. Therefore the majority of pedestrian traffic is related to the Transitway bus stop. The regional cycleway is on the western side of Old Windsor Road.

Pedestrian and cycle routes would therefore remain largely unaffected during construction. Some modification to pedestrian paths around the bus stop and along Samantha Riley Dr would occur.

4.9.7 Parking, Taxis and Kiss-and-Ride

The only parking to be affected by construction is the Riley T-way station car park. This has 141 spaces and it is expected that an equivalent number of these would be retained during construction. It would be necessary to relocate some of the car parking spaces to accommodate the station construction works. The proposed location for the temporary car park is to the south of the existing access road, with access provided to and from the roundabout located on Samantha Riley Drive.

Site inspections have highlighted that the use of this car park is significant, with a significant amount of overflow parking on the access road and the car park circulation road. This volume of car parking will need to be considered with any proposed changes.

Vehicular drop offs around the area are currently low, and is considered that the impact during construction would be minimal.

4.10 Windsor Road Construction Site

4.10.1 Site Context

The Windsor Road construction site is proposed to be located on the north eastern side of the intersection of Windsor and Old Windsor Roads. It would occupy a site which currently operates as a landscaping supplies and Amber Tiles store. This site provides for the continuation of the pier construction for the viaduct. The location of the creek opposite the Merriville Road intersection may require additional access to the site from Sanctuary Drive to the construction sites located south and north of this road. Final access requirements for this area of work are yet to be finalised.

It is not proposed, at this stage, to reduce the current lane configurations on Old Windsor Road, Windsor Road or Sanctuary Drive during the construction phase. There may be the need to close lanes temporarily to facilitate the placement of viaduct spans over Windsor Road and Sanctuary Drive. This will be further assessed and detailed in the preparation of final TMPs and traffic control plans as the design progresses.

Road Network

This construction site is located immediately to the northeast of the Old Windsor Road / Windsor Road signalised intersection where all movements are permitted. The junction also incorporates the North West Transitway and bus priority lanes.

The Windsor Road / Sanctuary Drive intersection is a signalised intersection which incorporates the Transitway and all movements are permitted.

Table 4.18 Windsor Road Construction Site – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Windsor Rd	RMS	4	37,382	Northbound	AM 566 (7.45-8.45am) PM 1,056 (5-6pm)
				Southbound	AM 673 (7.15-8.15am) PM 593 (5-6pm)
Old Windsor Rd	RMS	4	49,004	Northbound	AM 1,466 (7.30-8.30am) PM 1,392 (4.15-5.15pm)
				Southbound	AM 1,769 (7-8am) PM 1,552 (4.15-5.15pm)
Sanctuary Dr	Hills Shire Council	2	2,657	Eastbound	AM 94 (10-11am) PM 116 (3-4pm)
				Westbound	AM 183 (8-9am) PM 153 (5-6pm)

Planned Road Improvements

There are no planned road improvements in the area at the present time.

4.10.2 Construction Site Detail

Traffic generation at the Windsor Road construction site would be relatively low compared to the major tunnelling sites. The key access point is proposed in Windsor Road near Old Windsor Road at the existing service road entry. Sanctuary Drive may be used as a supplementary access if necessary.

The Windsor Road access point would utilise the existing left in/left out access to the landscaping supplies business. Construction traffic would need to approach from either Windsor Road from the north or Old Windsor Road from the south, and would depart along Windsor Road to the southeast. Traffic departing the site would be aided by breaks in the traffic provided by the adjacent traffic signals.

Access would be required from Sanctuary Drive to service the northern section of this site. This access could be provided as a fourth leg to the Sanctuary Drive/Bellcast Road intersection and operate as a right in/left out access.

4.10.3 Heavy Vehicle Routes

The main heavy vehicle routes to and from the Windsor Road site would be along Old Windsor Road from the south and Windsor Road from the north and to the south. Heavy vehicles needing to travel north on Windsor Road would leave the site and travel via Windsor Road and Samantha Riley Drive to Old Windsor Road.

A diagram of the proposed Heavy Vehicle routes is shown in **Figure 4.11**, with larger scale diagrams provided in **Appendix A**.

Figure 4.11 Windsor Road Site Heavy Vehicle Routes

4.10.4 Road Network Operation and Intersection Performance

Key Intersections

- Old Windsor Rd / Windsor Rd (traffic signals) – Similar to the Samantha Riley Drive/Old Windsor Road site the North West T-way runs adjacent to Old Windsor Road and is incorporated in the operation of the traffic signals. Old Windsor Road and Windsor Road are divided carriageways on the approach to the intersection. Old Windsor Road is provided with three through lanes in each direction at the intersection with the northern approach having two left turn lanes and the southern approach having a right turn bay provided.

Windsor Road has two lanes in each direction generally, although this expands to three right turn lanes and a left turn lane at the intersection. A 'Bus Only' slip lane is provided for buses to enter the T-way from Windsor Road

This construction site is estimated to generate low traffic volumes and there will be no change to the existing key intersections.

As can be seen in **Table 4.19** the additional traffic would result in:

- No significant change to the operation of the Old Windsor Road / Windsor Road intersection

The change in intersection performance can mainly be attributed to construction traffic from other construction sites using Old Windsor Road.

Table 4.19 Windsor Road – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Old Windsor Road / Windsor Road	B	0.46	C	0.54	B	0.47	C	0.56

4.10.5 Buses

Existing bus services in the vicinity of the construction site are confined to the North West Transitway. It is expected that the Transitway would remain fully operational during the construction period including the Merriville T-way station. No services would need to be re-routed and therefore there should be negligible impact on travel times.

4.10.6 Pedestrians and Cyclists

There are no significant land uses in the area immediately surrounding the construction site apart from the existing uses of the properties to be acquired. The regional cycleway is on the western side of Old Windsor Road and southern side of Windsor Road at this location. Pedestrian and cycle routes would therefore remain largely unaffected during construction.

4.10.7 Parking, Taxis and Kiss-and-Ride

There is no on-street parking in the vicinity of the construction site. The off-street car parking spaces in the landscaping supplies business site would be lost as a result of construction, when this property becomes a site for the construction of the NWRL.

4.11 Rouse Hill Station Construction Site

4.11.1 Site Context

The Rouse Hill Station site would provide for the continuation of the elevated rail segments and, for the section of the site on the northern side of Rouse Hill Drive, and receiving of the viaduct construction over Windsor Road. The station is proposed to be constructed above the existing bus interchange on the western side of the Rouse Hill Town Centre. This work would require relocation of the bus interchange for the duration of the works.

At this stage, it is proposed to launch the viaduct across Windsor Road from the western side of Windsor Road to the Rouse Hill station site.

Road Network

The Rouse Hill construction site is located adjacent to Rouse Hill Town Centre and Windsor Road. White Hart Drive and Rouse Hill Drive are located to the south and north of the site respectively and intersecting with Windsor Road.

All movement signalised intersections provide access from Windsor Road at White Hart Drive and Rouse Hill Drive / Schofields Road. The White Hart Drive intersection incorporates north-south

Transitway movement. Bus access at the northern end of the bus interchange is in the form of a channelised intersection on Rouse Hill Drive some distance from the traffic signals. A southbound bus-only left-in entry is also provided directly from Windsor Road immediately south of Rouse Hill Drive.

Changes to the road network during the construction phase are minimal with all general vehicle movements being retained. There will be some minor realignment of one of the Windsor Road carriageways north of the Schofield Road intersection to facilitate the construction of bridge piers in the median of Windsor Road. The through traffic lane configuration will be retained.

Discussions are currently being undertaken with the operators of the Rouse Hill Town Centre with the view to retaining two way traffic movements on Tempus Street. There may be the need for temporary lane closures of White Hart Drive, Rouse Hill Drive and Windsor Road for installation of viaduct segments as the viaduct crosses each of these roads. This will be detailed in subsequent TMPs as the construction program is further developed.

Photo 4.10 White Hart Drive, looking south along T-way and Windsor Road



Table 4.20 Rouse Hill Station – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Windsor Rd	RMS	4	48,001	Northbound	AM 1,598 (8-9am)
					PM 2,338 (4-5pm)
				Southbound	AM 1,845 (7-8am)
					PM 1,611 (4.15-5.15pm)

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
White Hart Dr	Hills Shire Council	4	10,820	Eastbound	AM 860 (11-12am) PM 822 (12-1pm)
				Westbound	AM 512 (11-12am) PM 584 (5-6pm)
Rouse Hill Dr	Hills Shire Council	4	9,319	Eastbound	AM 612 (9-10am) PM 576 (6-7pm)
				Westbound	AM 695 (11-12am) PM 711 (12-1pm)
Commercial Rd	Hills Shire Council	4	5,676	Eastbound	AM 207 (8-9am) PM 308 (6-7pm)
				Westbound	AM 361 (8-9am) PM 282 (3-4pm)

Planned Road Network Improvements

Discussions with RMS have indicated that future consideration for the intersection of Windsor Road/Schofields Road/Rouse Hill Drive is for grade separation of the intersection. This is considered a long term plan however, RMS has indicated that any proposed bridge piers on either side of Windsor Road and in the median should allow for the potential lowering of Windsor Road.

4.11.2 Construction Site Detail

The Rouse Hill construction site would occupy the existing bus interchange which is the northern terminus of the North West Transitway. Access to the construction site would operate as a one way configuration with the entry off White Hart Drive using the T-way entry road to the bus interchange and exiting onto Rouse Hill Drive:

- White Hart Drive (left turn in)
- Rouse Hill Drive (left out)

Construction site access for Rouse Hill would involve converting the existing bus-only interchange access arrangements to a construction vehicle-only arrangement.

4.11.3 Heavy Vehicle Routes

Access to the site can occur from both Windsor Road (both directions) and Schofields Road. The southern approach along Windsor Road would turn into White Hart Drive and then via a new opening along the bus interchange access. Exiting the site trucks would enter Rouse Hill Drive at the existing exit to the bus interchange as a left turn to travel via Rouse Hill Drive to Windsor Road.

A diagram of the proposed heavy vehicle routes are shown in **Figure 4.12**, with larger scale diagrams provided in **Appendix A**.

Figure 4.12 Rouse Hill Station Site Heavy Vehicle Routes

4.11.4 Road Network Operation and Intersection Performance

Key Intersections

- Windsor Rd / White Hart Dr (traffic signals) – The North West T-way runs adjacent to this intersection and parallel to Windsor Road. It is incorporated into the traffic signal operation for the intersection. Windsor Road is provided with three through lanes in each direction, two right turn lanes on the southern approach and a left turn lane on the northern approach.

White Hart Drive is provided with two right turn and two left turn lanes at the intersection.

- Windsor Rd / Schofields Rd / Rouse Hill Dr (traffic signals) – Windsor Road is provided with three through traffic lanes and two right turn lanes in each direction at the intersection. The southern approach also has a two lane left turn into Schofields Road while the northern approach has a single left turn slip lane.

Schofields Road has a left turn lane, two through lanes and two right turn lanes at the intersection.

Rouse Hill Drive has two left turn lanes, a 'Bus Only' lane, two through lanes and a right turn lane on the approach to the intersection.

- Windsor Rd / Commercial Rd (traffic signals) – Windsor Road has two through lanes in each direction at the intersection with a two lane right turn bay provided for the southern approach and a left turn slip lane for the northern approach. Commercial Road is provided with two right turn lanes and a left turn slip lane at the intersection.

This construction site is estimated to generate low traffic volumes and there will be no change to the existing key intersections, apart from some re-routing of buses within the town centre.

As can be seen in **Table 4.21** the additional traffic would result in:

- A small increase in the degree of saturation at the Windsor Road / White Hart Drive intersection but no change to the level of service
- An increase of 6% in the AM peak and 4% in the PM peak degree of saturation at the Windsor Road / Schofields Road / Rouse Hill Drive intersection but no change to the level of service.

The change in intersection performance can mainly be attributed to construction traffic from other construction sites using Windsor Road and Schofields Road.

Table 4.21 Rouse Hill Station Construction Site – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Windsor Road / White Hart Drive	B	0.65	B	0.66	B	0.68	B	0.70
Windsor Road / Schofields Road / Rouse Hill Drive	D	0.95	D	0.93	D	1.01	D	0.97

4.11.5 Buses

As the Rouse Hill construction site would occupy the existing bus interchange, it requires all bus stops and layover areas to be relocated for the duration of the works. It is anticipated that the bus stops would be relocated to the adjoining service road, Tempus Street, with new bus stops established on the eastern side of the road.

This would require minimal change to bus operations to Rouse Hill however, would require the provision of a short length of 'Bus Only' road at the southern end of the construction site for buses to access the T-way from Tempus Street and to cross White Hart Drive at the existing T-way intersection. The southern portion of the site compound is expected to be used for site car parking and thus could cater for the bus movements.

There would be some changes to the approach and departure routes for buses accessing the Rouse Hill bus interchange in order to enter the bus interchange from Rouse Hill Drive and to exit the interchange via White Hart Drive.

At this stage, bus layover during construction is proposed to be accommodated in a linear access road along the eastern boundary of the construction site between Commercial Road and Rouse Hill Drive. This will be further investigated as the construction program develops.

4.11.6 Pedestrians and Cyclists

As a town centre station the area surrounding the Rouse Hill construction site generates a higher level of pedestrian activity relative to other construction sites. Maintaining pedestrian and cycle connections during construction is therefore considered important.

Informal east-west pedestrian routes through the existing Transitway interchange would be lost during the construction period. Pedestrians would be redirected via either Rouse Hill Drive or White Hart Drive, which at most would result in a diversion of approximately 200m. The key pedestrian desire lines from the Transitway interchange are east through the town centre to the car parks and residential

areas, with only a minor pedestrian movement west towards Windsor Road. The impact of the construction activity on these pedestrian routes is therefore considered minor.

The key cycle route in the precinct is the shared use path on the western side of Old Windsor Road, which would be unaffected by the construction.

There are a number of cycle lockers located within the existing interchange area. An alternative location for these will be identified as the construction program is further developed.

4.11.7 Parking, Taxis and Kiss-and-Ride

The construction site is likely to displace all the existing parking adjacent to Windsor Road, i.e. between Windsor Road and the town centre and north of Rouse Hill Drive. There are approximately 170 spaces around Tempus Street and these are either time restricted (along the western side of Tempus Street) or restricted access (in the car park at the southern end of the street. There are approximately 240 spaces located to the north of Rouse Hill Drive, adjacent to Windsor Road which would need to be relocated during construction. It is understood that this area is mainly used for staff and overflow parking.

Some of the affected parking could be relocated to other vacant parts of Rouse Hill Town Centre, possibly as part of the next stage of the development. There is significant below ground car parking available under the town centre

Some vehicular drop offs may be restricted on Tempus Street adjacent to the construction site. Alternative arrangements are generally available in other parts of the town centre.

4.12 Schofields Road Site

4.12.1 Site Context

This site is split into two sites with the eastern site being from Windsor Road to Cudgegong Road and the western site being from Cudgegong Road to near Hambledon Road.

The eastern site would provide the launch site for the viaduct across Windsor Road toward the Rouse Hill Station and, to the west, see the rail line move from the viaduct to a cut and fill alignment with Cudgegong Road being reconstructed as an overpass of the rail line.

The western section would include the construction of the Cudgegong Station, the Tallawong Road overpass and the stabling yards.

During the construction phases of this section of the NWRL, it is proposed to provide for both Cudgegong Road and Tallawong Road to cross over the rail line on bridges. During the construction of the bridges it will be necessary to provide diversions of the existing road in order to facilitate bridge construction and the approaches. The layout and alignment of these diversions will be detailed further in subsequent TMPs as the construction program is developed.

Road Network

Schofields Road is a two lane arterial with narrow sealed shoulders and a rural character. It currently carries a relatively low traffic volume and is signposted as 80 km/h for most of its length, although this is likely to be reduced as residential development occurs to the south (Alex Avenue precinct) and to the north (Area 20). Schofields Road connects to Windsor Road via an all movement signalised intersection.

Tallawong Road and Cudgegong Road are local north-south roads connecting Schofields Road to Guntawong Road. Most intersections in this area are priority controlled.

Photo 4.11 Schofields Road, looking east toward Tallawong Road



Photo 4.12 Schofields Road, looking west toward Cudgegong Road



Table 4.22 Schofields Road – Roads Summary

Road	Agency Responsibility	Lanes	AADT	2011 Peak Hour Volume	
Schofields Rd	RMS	2	11,594	Eastbound	AM 571 (9-10am) PM 553 (6-7pm)
				Westbound	AM 523 (11-12am) PM 676 (5-6pm)
Cudgegong Rd	Blacktown City Council	2	1,461	Northbound	AM 112 (8-9am) PM 117 (3-4pm)
				Southbound	AM 93 (8-9am) PM 97 (3-4pm)
Tallawong Rd	Blacktown City Council	2	950	Northbound	AM 44 (8-9am) PM 73 (5-6pm)
				Southbound	AM 63 (7-8am) PM 44 (4-5pm)

Planned Road Network Improvements

RMS has plans to upgrade Schofields Road from west of Windsor Road to the intersection with Hambledon Road, with construction works expected to commence toward the end of 2012. The initial stage of construction would provide for two lanes in each direction on Schofields Road on a divided carriageway, with future provision to provide three lanes in each direction. This work will also incorporate the realignment of Tallawong Road to align with Ridgeline Drive on the southern side of Schofields Road approximately 90 metres east of the existing intersection.

Longer term plans include a new connection to Richmond Road and grade separation at Windsor Road.

4.12.2 Construction Site Detail

A number of construction site accesses are proposed on Schofields Road between Windsor Road and Hambledon Road, including:

- Site access to the west of Windsor Road at the potential extension of Terry Road
- Cudgegong Road
- Tallawong Road
- Direct access to Schofields Road east of Hambledon Road

Heavy vehicle routes would generally be along Schofields Road to Windsor Road. Use of Schofields Road to the west of the construction sites towards Schofields town centre is undesirable due to a lack of connectivity to arterial roads.

The Tallawong Stabling Facility would be one of the main generators of construction traffic on the project, particularly trucks removing spoil as part of major earthworks operations.

The site access on the potential extension of Terry Road is anticipated to be a minor access that could be managed by traffic controllers.

Access to Cudgegong Road would be managed by traffic controllers with traffic directed to/from the south to Schofields Road. The Schofields Road / Cudgegong Road intersection is currently a standard priority T-junction with no channelisation and improvements may be required.

The Schofields Road / Tallawong Road intersection is a priority T-junction with a right turn bay for the right turn from Schofields Road into Tallawong Road. Traffic signals may be required to safely accommodate site traffic.

The direct access to Schofields Road east of Hambledon Road is anticipated to be a minor access that could be managed by traffic controllers.

If construction of NWRL occurs before the Schofields Road upgrade, interim upgrading of the road may be required with improved pavement quality and wider sealed shoulders to accommodate significant heavy vehicle usage.

4.12.3 Heavy Vehicle Routes

As indicated above, all heavy vehicle access would be from Windsor Road along Schofields Road to the three identified site access points.

A diagram of the proposed HV routes are shown in **Figure 4.13** and **Figure 4.14** with larger scale diagrams provided in **Appendix A**.

Figure 4.13 Schofields Road Heavy Vehicle Routes

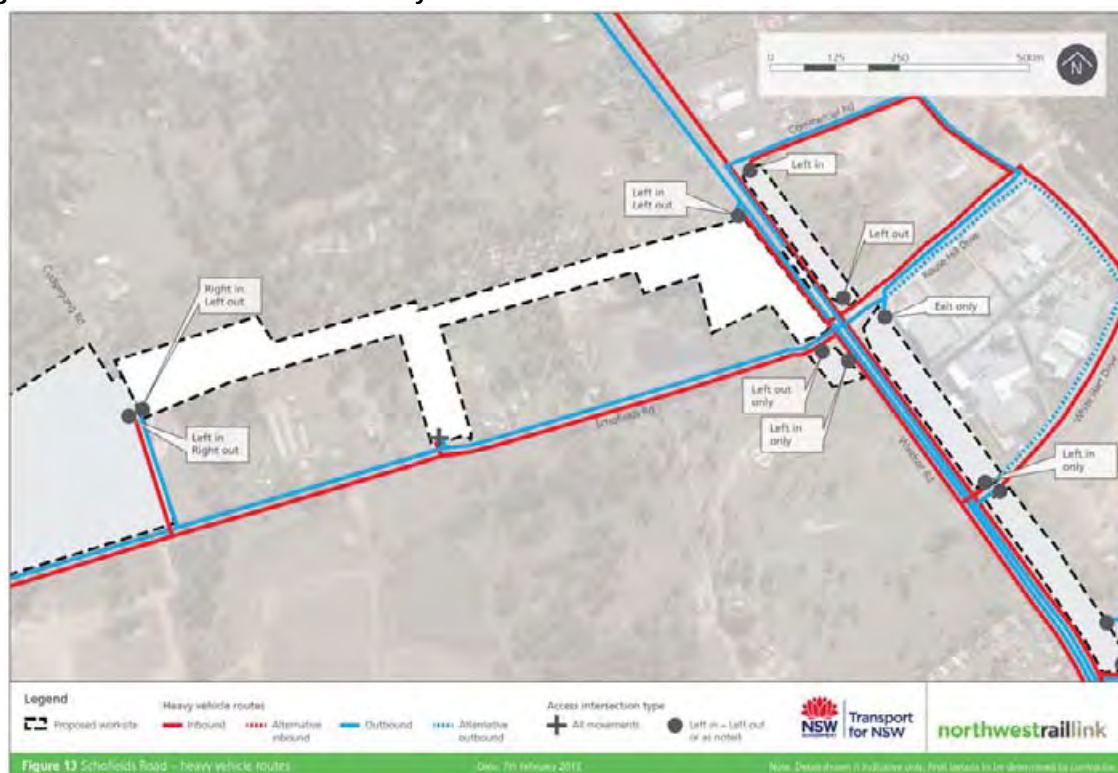


Figure 4.14 Cudgegong Station and Tallawong Stabling Facilities Heavy Vehicle Routes

4.12.4 Road Network Operation and Intersection Performance

Key Intersections

- Windsor Rd / Schofields Rd / Rouse Hill Dr (traffic signals) – Windsor Road is provided with three through traffic lanes and two right turn lanes in each direction at the intersection. The southern approach also has a two lane left turn into Schofields Road while the northern approach has a single left turn slip lane.

Schofields Road has a left turn lane, two through lanes and two right turn lanes at the intersection.

Rouse Hill Drive has two left turn lanes, a 'Bus Only' lane, two through lanes and a right turn lane on the approach to the intersection.

- Schofields Rd / Cudgegong Rd (priority controlled) – At the present time both Schofields Road and Cudgegong Road are two lane rural roads with unsealed shoulders. The future development of Schofields Road would see this intersection signalised as part of the upgrade works of Schofields Road.
- Schofields Rd / Tallawong Rd (priority controlled) – As for the Cudgegong Road intersection both Schofields Road and Tallawong Road are two lane rural roads with unsealed shoulders. The upgrade works for Schofields Road would see these intersections signalised.

Construction traffic on Schofields Road from these sites is estimated to be in the order of 60 vph in the peak periods with a significant proportion of heavy vehicles. Construction traffic will use Schofields Road between the various access points and Windsor Road.

The priority controlled intersections of Schofields Road / Cudgegong Road and Schofields Road / Tallawong Road currently operate at a good level of service and will continue to do so with construction traffic.

Table 4.23 Schofields Road Sites – Intersection Performance

Location	Existing				During Construction			
	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)	LOS (AM)	DoS (AM)	LOS (PM)	DoS (PM)
Schofields Road / Cudgegong Road	NA	0.51	NA	0.37	NA	0.73	NA	0.45
Schofields Road / Tallawong Road	NA	0.30	NA	0.33	NA	0.41	NA	0.40

Note: 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 (SIDRA outputs)

4.12.5 Buses

There are currently no bus services along Schofields Road east of Tallawong Road. There is one route, operated by Busways, along Tallawong Road – Schofields Road (Route T75) that may need to be re-routed for part of the construction period. This service could potentially be rerouted via Cudgegong Road should it be required to close Tallawong Road for any length of time. Access along Tallawong Road or Cudgegong Road should be provided at all times during construction.

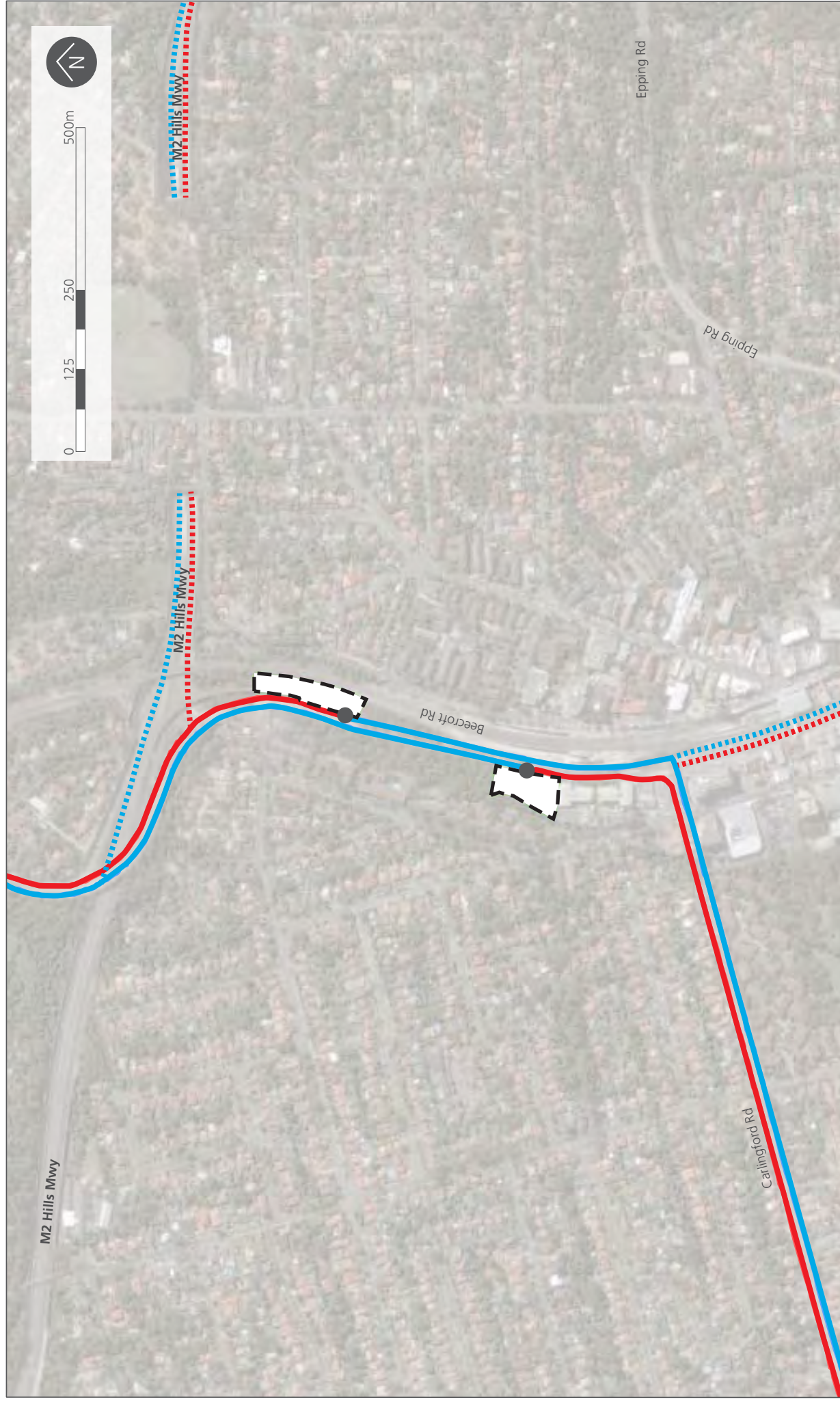
4.12.6 Pedestrians and Cyclists

Pedestrian and cyclist activity in the vicinity of the Schofields Road construction sites is low. Pedestrian and cycling routes would remain largely unaffected.

4.12.7 Parking, Taxis and Kiss-and-Ride

There is little demand for on-street parking in the vicinity of the Schofields Road construction sites and therefore the impact on parking would be low.

Appendix A Heavy Vehicle Route Maps



Legend



Proposed worksite

Heavy vehicle routes



Inbound



Alternative inbound



Outbound



Alternative outbound

Access intersection type



All movements



Left in - Left out
or as noted



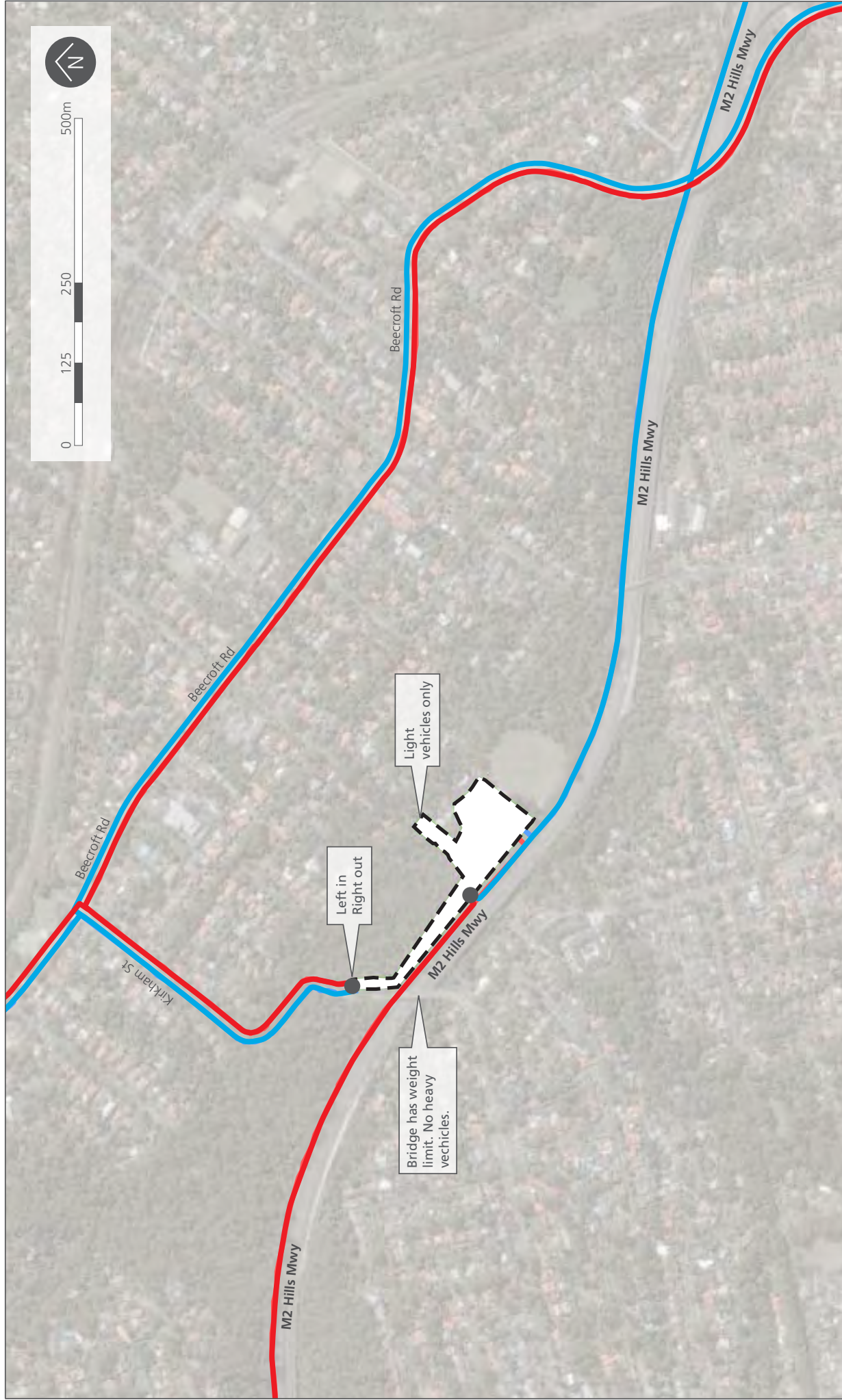
Transport
for NSW

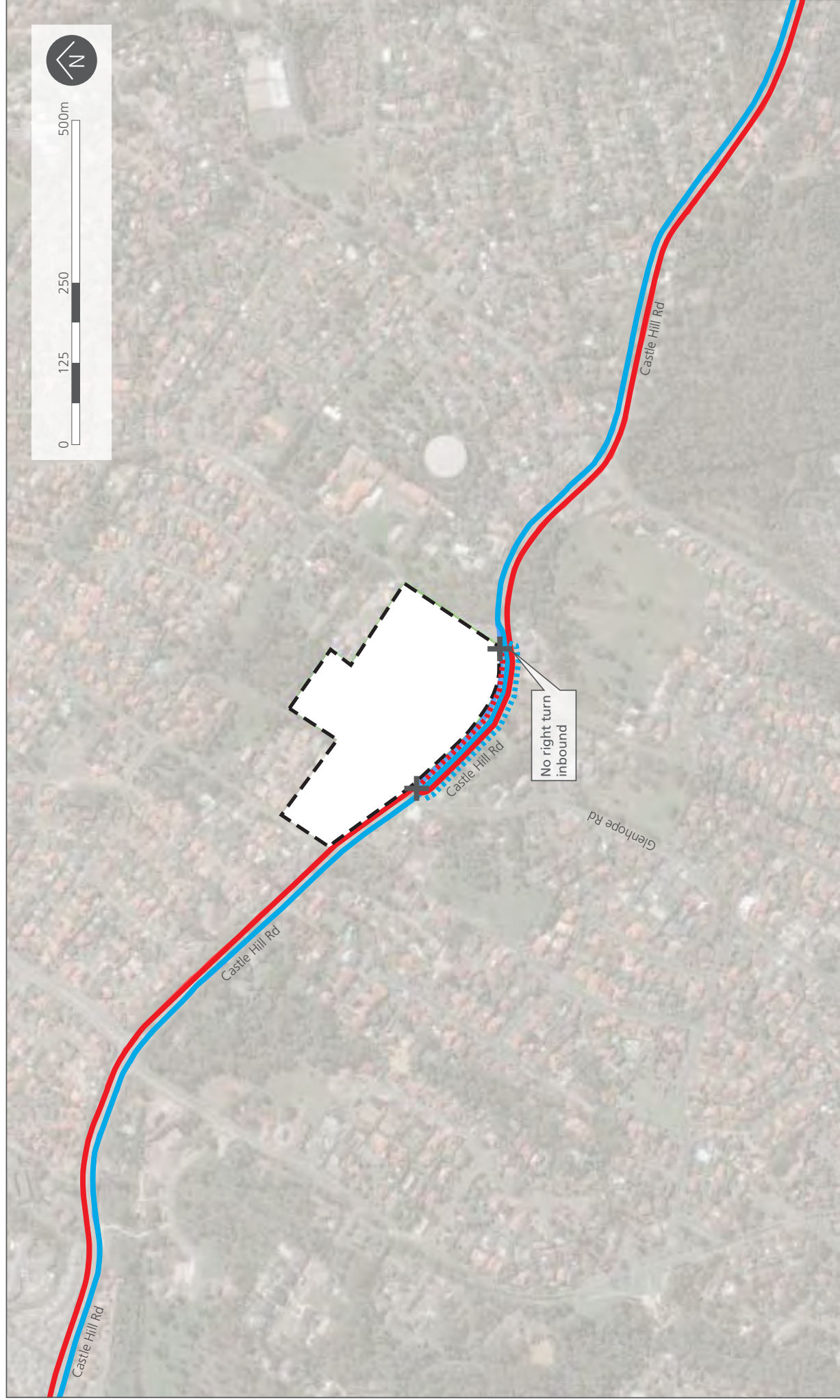
northwestrailink

Figure 1 Epping service facility – heavy vehicle routes

Date: 7th February 2012

Note: Detail shown is indicative only, final layouts to be determined by contractor.





Legend

Proposed worksite

Heavy vehicle routes

Outbound

Alternative outbound

Access intersection type

Left in – Left out or as noted



Transport for NSW

northwestrailink

Figure 3 Cherrybrook station – heavy vehicle routes

Date: 7th February 2012

Note: Detail shown is indicative only, final layouts to be determined by contractor.



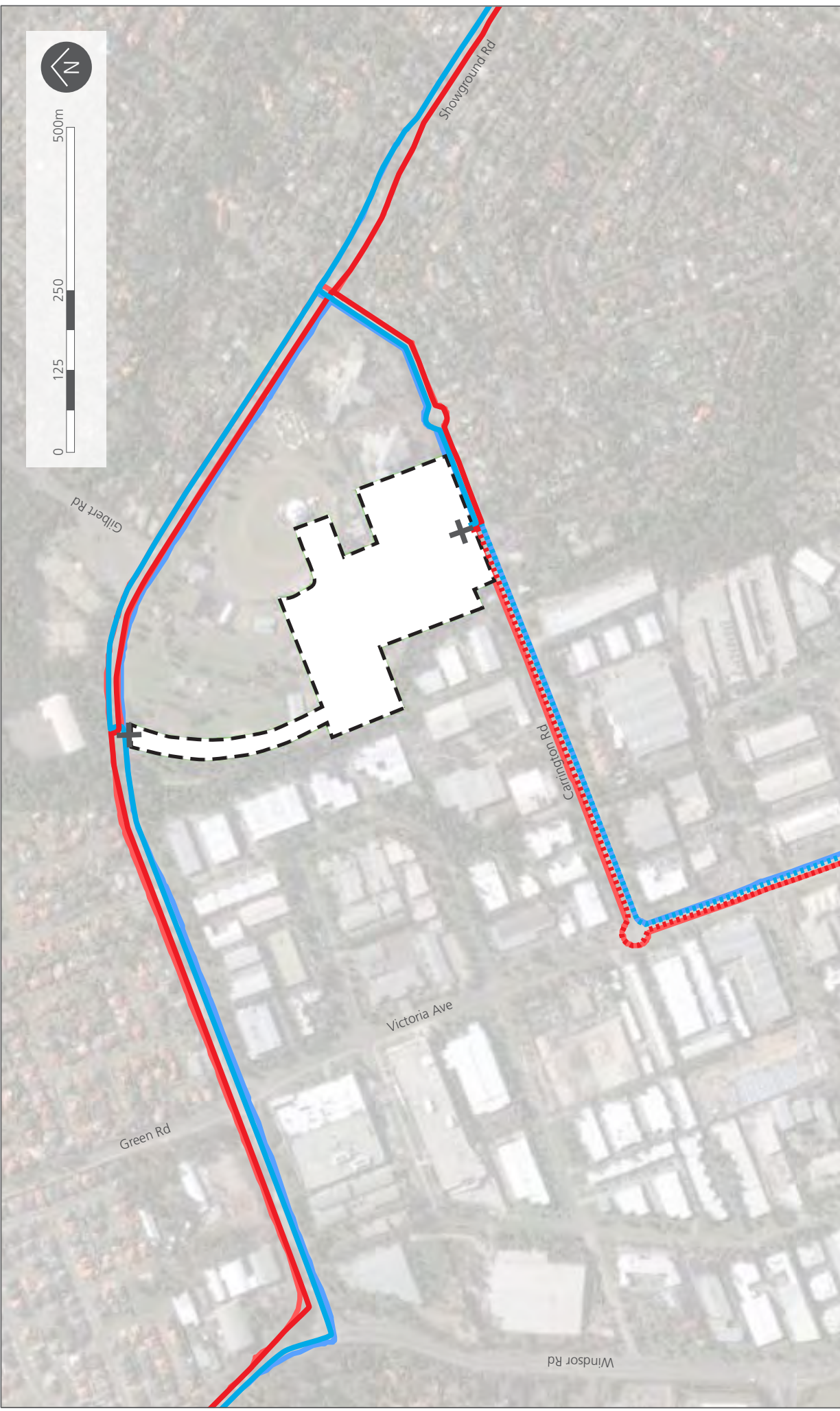
Legend
 Proposed worksite
Heavy vehicle routes
 Inbound
 Outbound
 Alternative inbound
 Alternative outbound
Access intersection type
 All movements
 Left in – Left out or as noted

Transport for NSW

Figure 4 Castle Hill station – heavy vehicle routes

Date: 7th February 2011

Note: Detail shown is indicative only, final layouts to be determined by contractor.



Legend

Proposed worksite

Heavy vehicle routes

Inbound

Outbound

Access intersection type

All movements

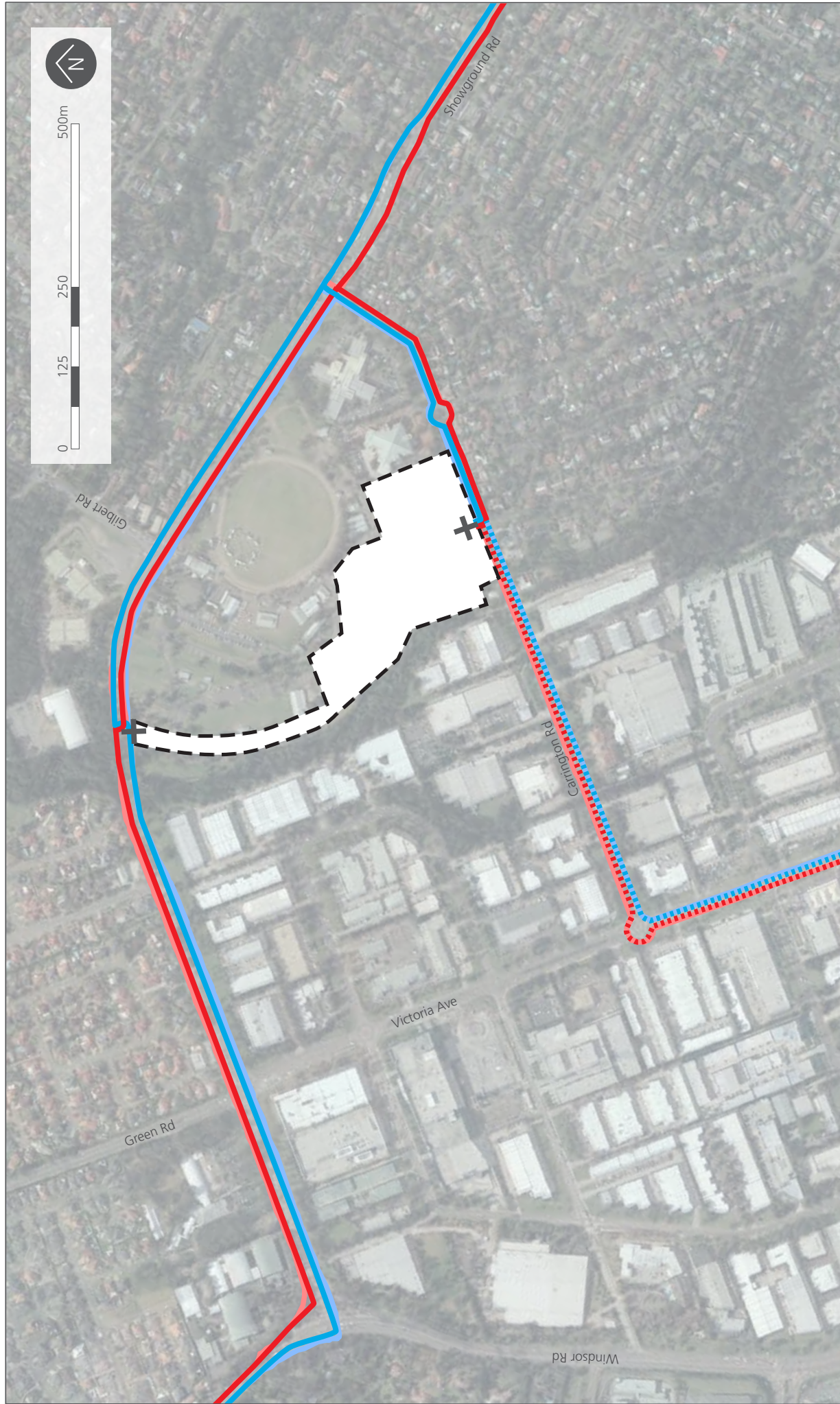
Transport for NSW

northwestrailink

Figure 5 Hills Centre station – heavy vehicle routes

Date: 7th February 2011

Note: Detail shown is indicative only, final layouts to be determined by contractor.



Legend

Proposed worksite

Heavy vehicle routes

Outbound

Alternative
outbound

Access intersection type

+ All movements

● Left in – Left out
or as noted

Transport
for NSW

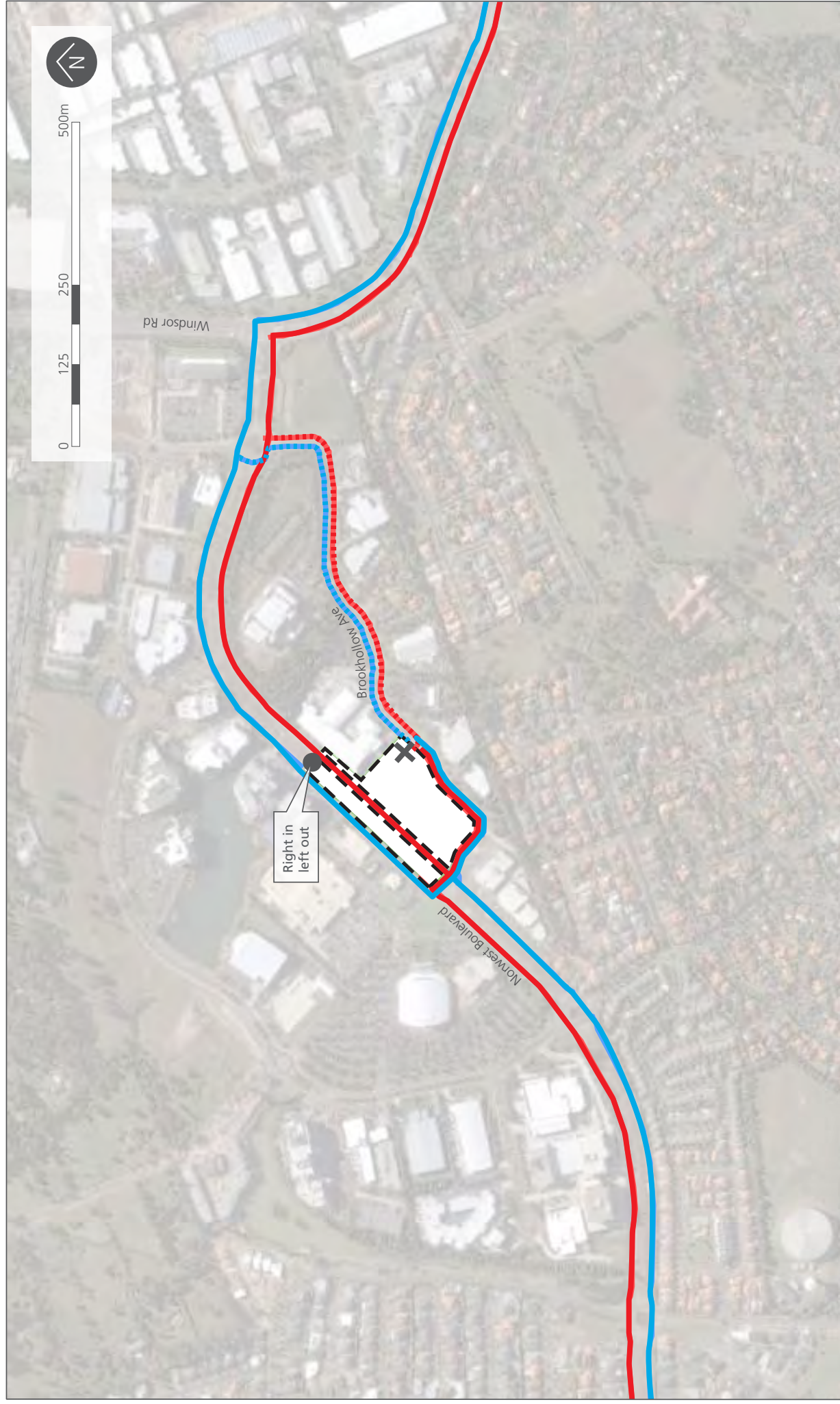


northwestrailink

Figure 5 Hills Centre station – heavy vehicle routes

Date: 10th February 2011

Note: Detail shown is indicative only, final layouts to be determined by contractor.



Legend



Proposed worksite

Heavy vehicle routes



Inbound



Alternative inbound



Outbound



Alternative outbound

Access intersection type



All movements



Left in - Left out or as noted



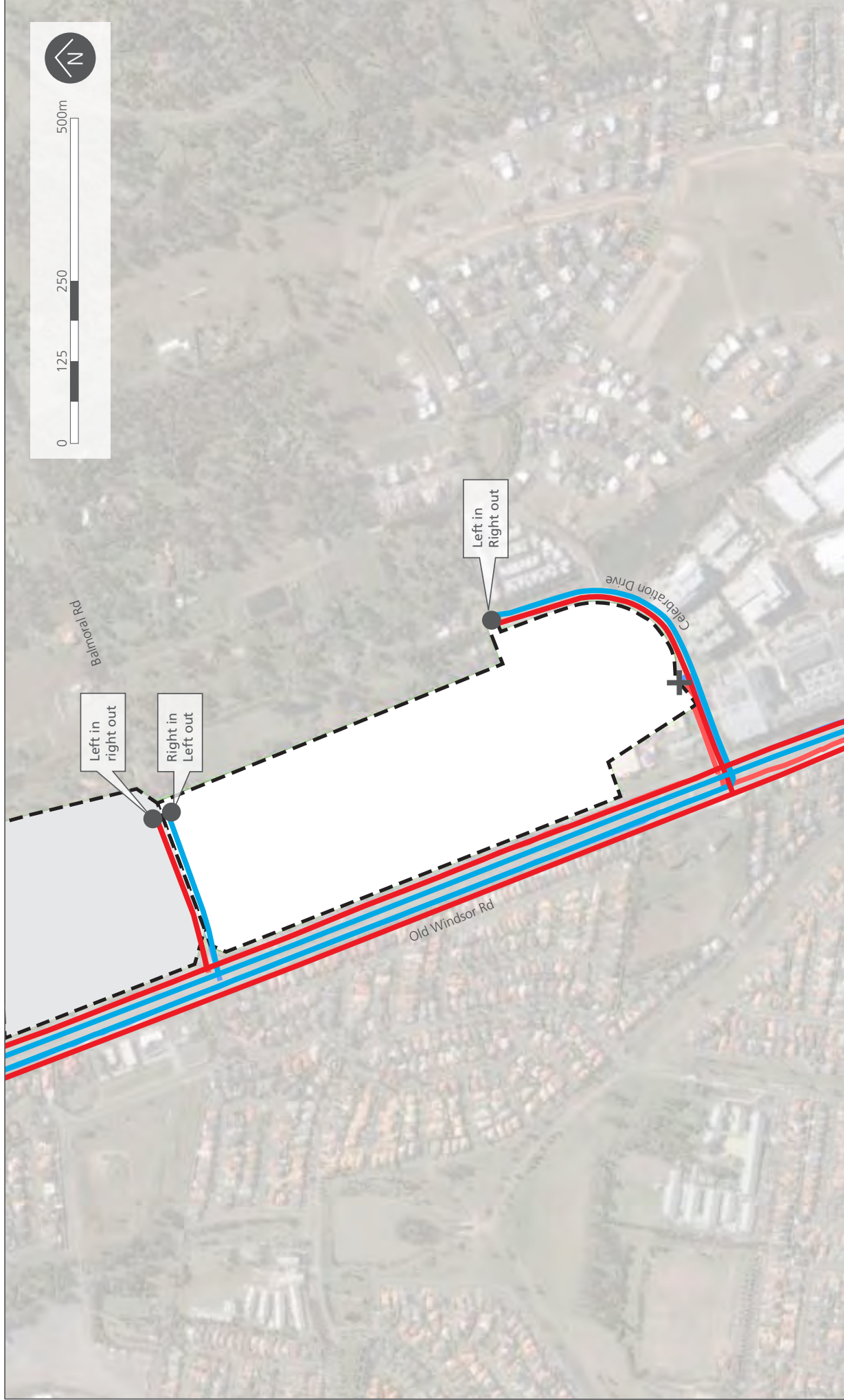
Transport
for NSW

northwestrailink

Figure 6 Norwest station – heavy vehicle routes

Date: 7th February 2011

Note: Detail shown is indicative only, final layouts to be determined by contractor.



Legend

Proposed worksite

Heavy vehicle routes

Outbound

Alternative
outbound

Access intersection type

Left in – Left out
or as noted



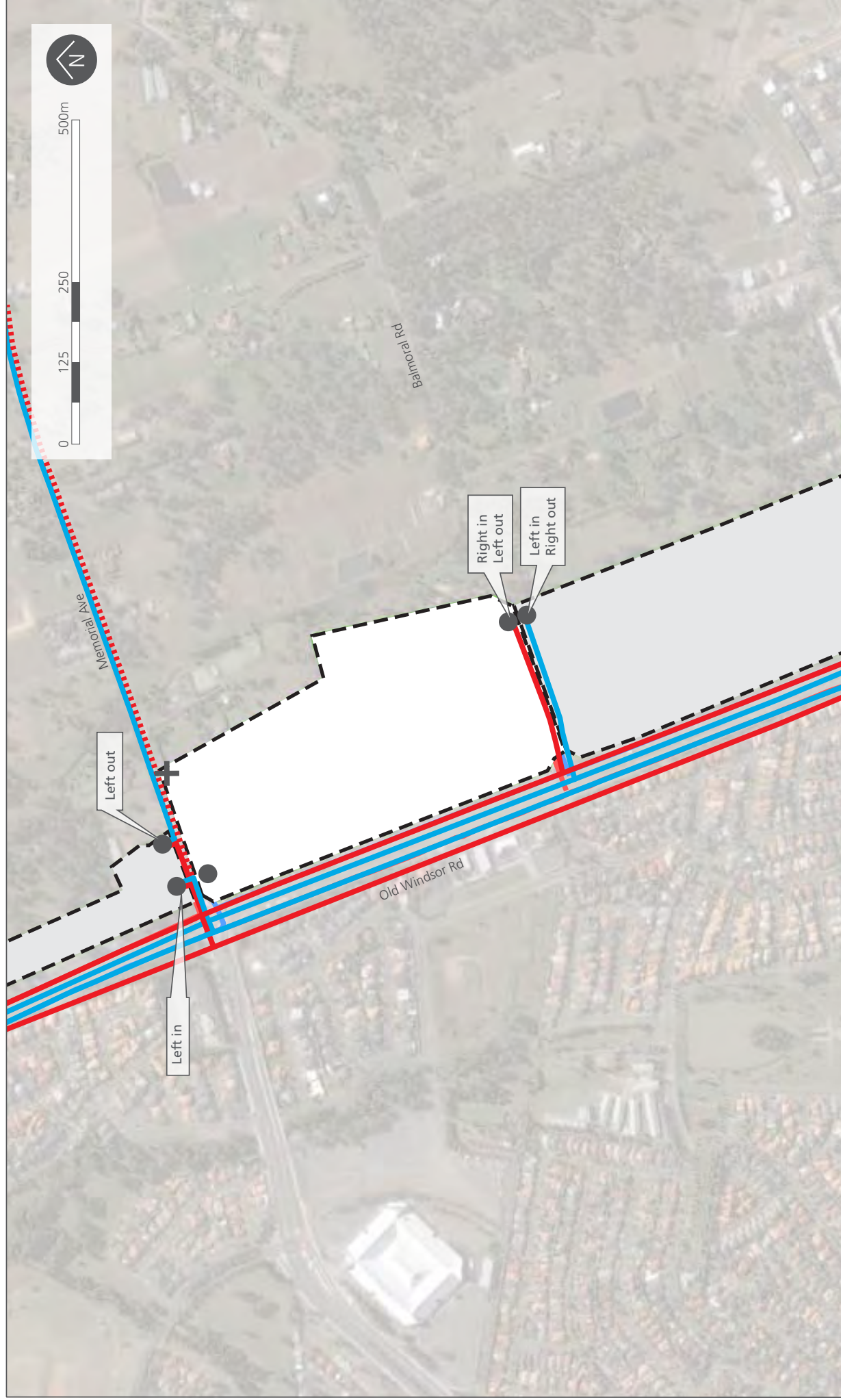
Transport
for NSW

northwestrailink

Figure 7 Bella Vista station – heavy vehicle routes

Date: 7th February 2011

Note: Detail shown is indicative only, final layouts to be determined by contractor.



Legend

Proposed worksite

Heavy vehicle routes

Inbound

Outbound

Alternative inbound

Alternative outbound

Access intersection type

All movements

Left in – Left out or as noted



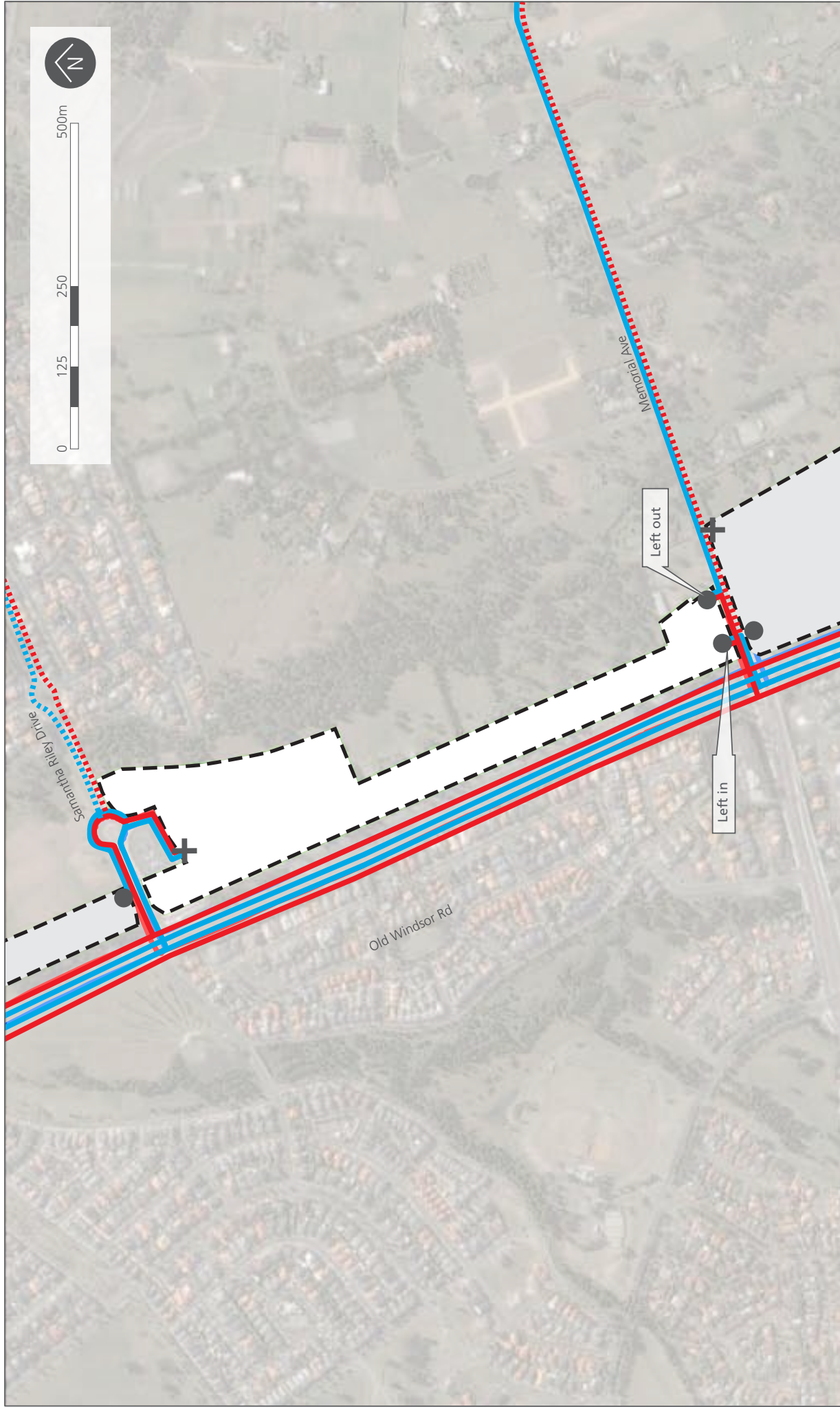
Transport for NSW

northwestrailink

Figure 8 Balmoral Road to Memorial Ave – heavy vehicle routes

Date: 7th February 2011

Note: Detail shown is indicative only, final layouts to be determined by contractor.



Legend

Proposed worksite

Heavy vehicle routes

Inbound

Outbound

Alternative inbound

Alternative outbound

Access intersection type

All movements

Left in - Left out or as noted



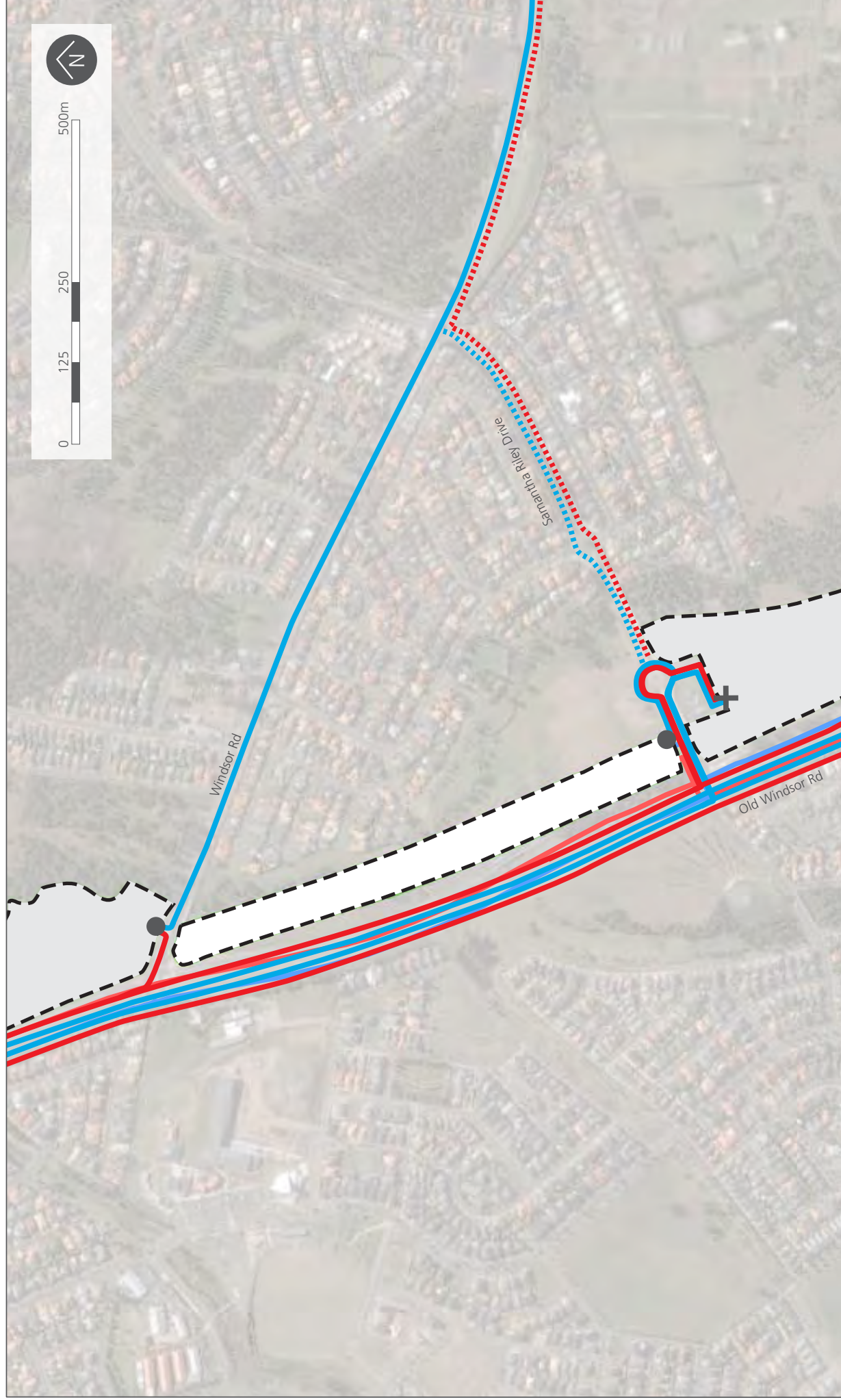
Transport for NSW

northwestrailink

Figure 9 Kellyville station – heavy vehicle routes

Date: 7th February 2012

Note: Detail shown is indicative only, final layouts to be determined by contractor.



Legend



Proposed worksite

Heavy vehicle routes



Inbound



Outbound



Alternative inbound



Alternative outbound

Access intersection type



All movements



Left in - Left out
or as noted



Transport
for NSW

northwestrailink

Figure 10 Samantha Riley Drive to Windsor Road – heavy vehicle routes

Date: 7th February 2012

Note: Detail shown is indicative only, final layouts to be determined by contractor.

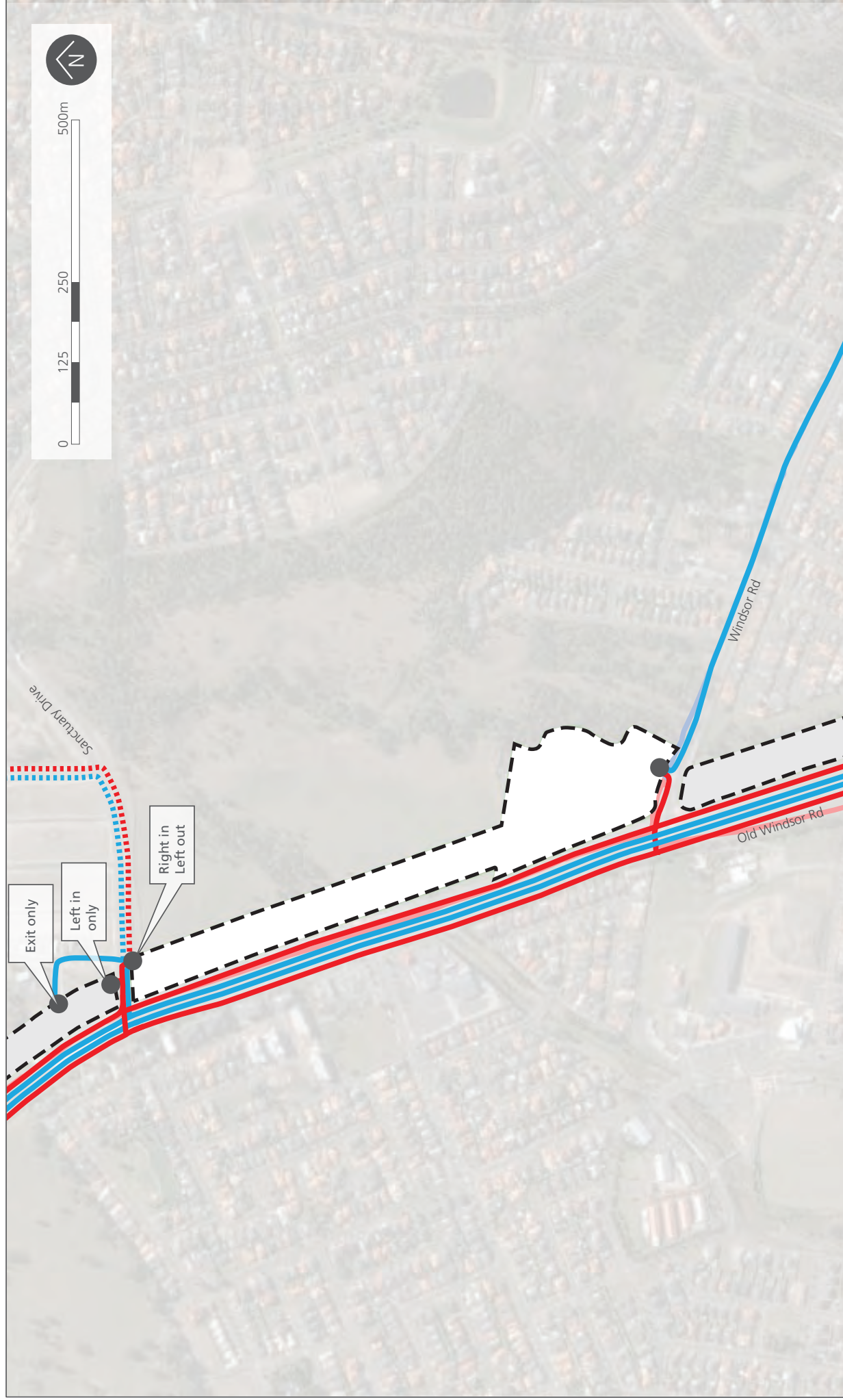
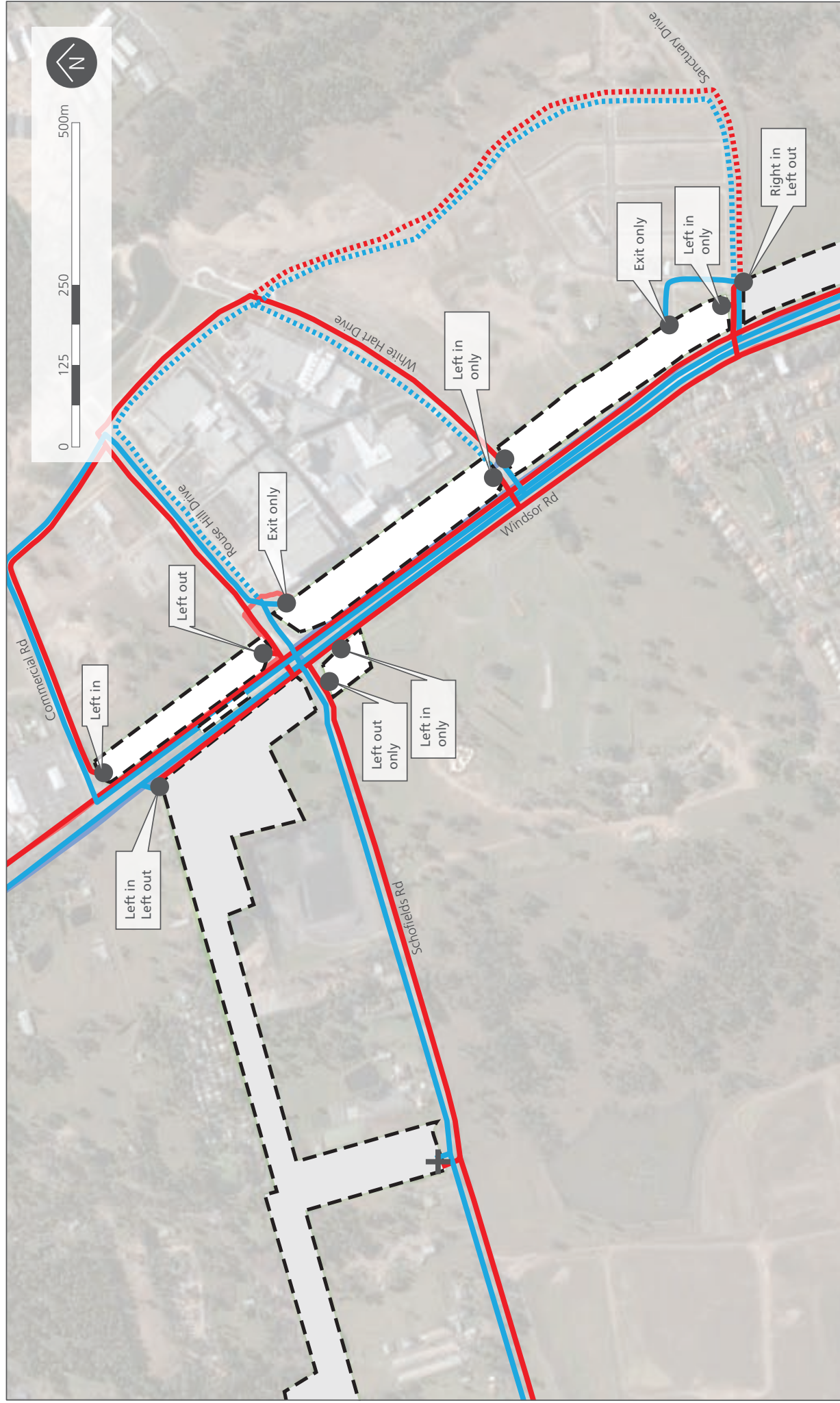


Figure 11 Windsor Road to Sanctuary Drive – heavy vehicle routes

Date: 7th February 2012

Note: Detail shown is indicative only, final layouts to be determined by contractor.



Legend

Proposed worksite

Heavy vehicle routes

Inbound

Alternative inbound

Outbound

Alternative outbound

Access intersection type

Left in – Left out or as noted

All movements



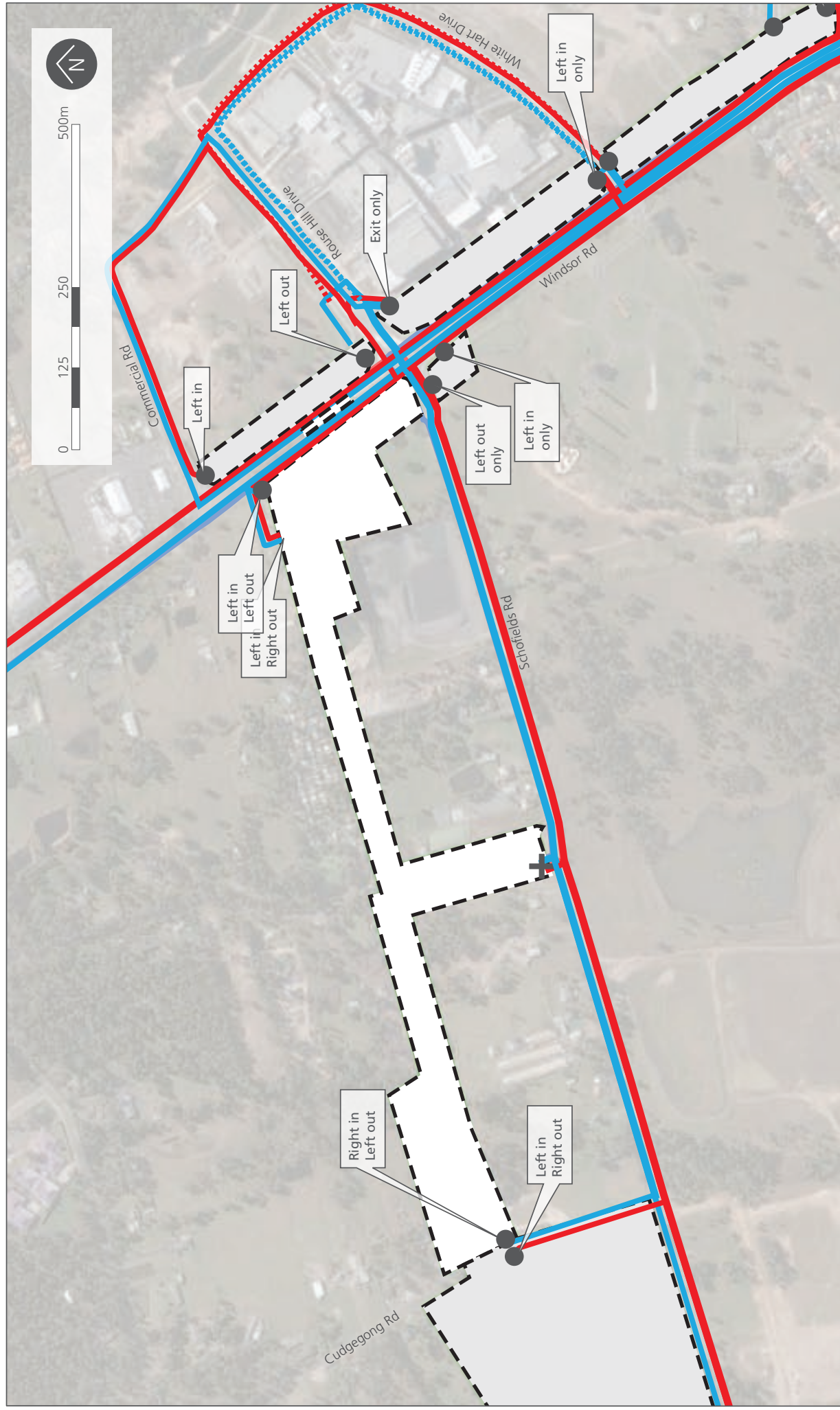
Transport for NSW

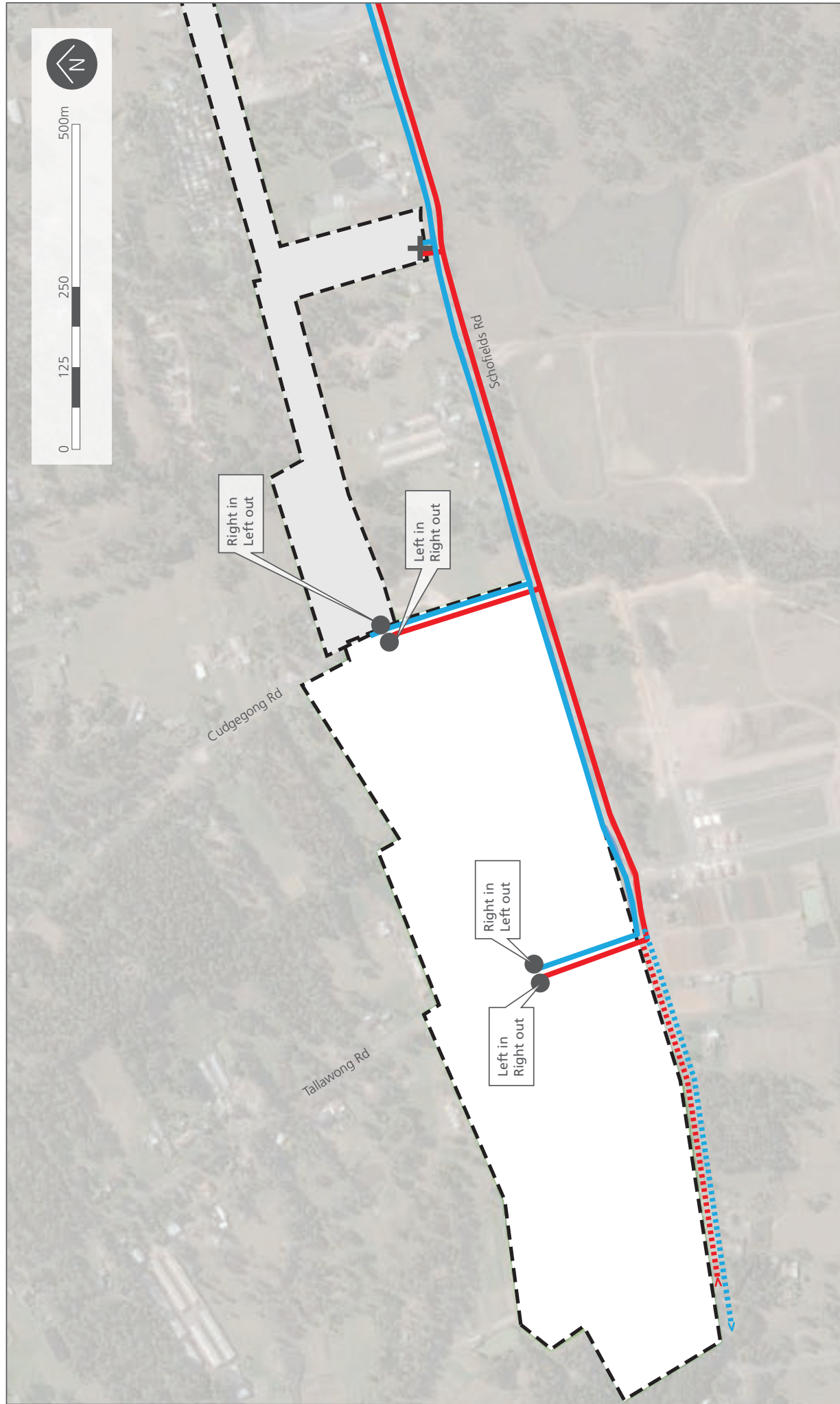
northwestrailink

Figure 12 Rouse Hill – heavy vehicle routes

Date: 7th February 2012

Note: Detail shown is indicative only, final layouts to be determined by contractor.





Legend

Proposed worksite

Heavy vehicle routes

Inbound

Outbound

Alternative inbound

Alternative outbound

Access intersection type

All movements

Left in – Left out or as noted



Transport for NSW

northwestlink

Figure 14 Cudgong Road and Tallawong Road – heavy vehicle routes

Date: 7th February 2012

Note: Detail shown is indicative only, final layouts to be determined by contractor.

Appendix B Peak Hour Vehicle Movements Table

AM & PM PEAK HOUR VEHICLE MOVEMENTS

Site	Access Point	AM Peak						PM Peak						Peak Staff	
		Spoil HV		Delivery HV		LV ¹		HV		Delivery HV		LV ¹			
		In	Out	In	Out	In	Out	In	Out	In	Out	In	Out		
Epping Services Facility	Beecroft Road	3	3	1	1	10 ²	5 ²	3	3	1	1	5 ²	10 ²	40	
Epping Decline Facility	Beecroft Road	3	3	1	1	10 ²	5 ²	3	3	1	1	5 ²	10 ²	20	
Cheltenham Services Facility	Kirkham Street	2	2	1	1	5 ²	2 ²	2	2	1	1	2 ²	5 ²	40	
	Castle Howard Road					5 ²	3 ²					3 ²	5 ²		
	M2	1	1	1	1	0	0	1	1	1	1	0	0		
Cherrybrook Station site	Franklin Road	6	6	1	1	47	27	6	6	1	1	27	47		
Castle Hill Station site	Castle Hill Road (at Glenhope Road)	9	9	5	5	48	28	9	9	5	5	28	48	100	
	McMullen Avenue			1	1					1	1				
	Old Northern Road	6	2	1	1	10 ²	5 ²	6	2	1	1	5 ²	10 ²	30	
	Crane Road	0	4					0	4						
Hills Centre Station Site	Showground Road	20	20	5	5	48	28	20	20	5	5	28	48	100	
	Carrington Road					48	28					28	48		
Norwest Station site	Norwest Boulevard	6	6	1	1			6	6	1	1			20	
	Brookhollow Street					16	0					0	16		
Bella Vista Station site	Celebration Drive	15	15	5	5	190 ³	190 ³	15	15	5	5	190 ³	190 ³	100	
Balmoral Road	Balmoral Road	9	9	1	1	128 ³	128 ³	9	9	1	1	128 ³	128 ³	100	
Memorial Avenue	Memorial Avenue	2	2	1	1	150	0	2	2	1	1	0	150	180	
Kellyville station site	Samantha Riley Drive	2	2	1	1			2	2	1	1			50	
	Samantha Riley Drive	2	2	1	1	88	47	2	2	1	1	47	88	56	
Windsor Road	Windsor Road	2	2	1	1	47	0	2	2	1	1	0	47		
	Sanctuary Drive (South)	2	2	1	1	47	0	2	2	1	1	0	47	56	
	Sanctuary Drive (North)	2	2	1	1	47	0	2	2	1	1	0	47	56	
Rouse Hill Station Site	White Hart Drive	2	0	1	0	42	0	2	0	1	0	0	0	50	
	Rouse Hill Drive	0	2	0	1	0	0	0	2	0	1	0	42		
Windsor Road Viaduct Site	Rouse Hill Drive	1	1	1	1			1	1	1	1				
	Windsor Road	1	1	1	1	108	0	1	1	1	1	0	108	130	
Schofield Road Site	Schofield's Road	1	1	1	1			1	1	1	1				
Cudgong Station Site	Cudgong Road	8	8	2	2	42	0	8	8	2	2	0	42	50	
Tallawong Stabling Facility															
	Tallawong Road	20	20	3	3	50	0	20	20	3	3	0	50	60	
	Schofield's Road														

Assumptions

- 1 - Vehicle numbers have been estimated on 1.2 persons per vehicle for light vehicles
- 2 - Light vehicle volumes shown shaded have been calculated on the basis of minimal vehicles accessing the site as on-site parking is not proposed for staff. Light vehicle numbers for these sites would generally consist of shuttle vehicles from off-site parking areas setting down or picking up staff, site supervisors or trades and sub-contractors who require a vehicle on site.
- 3 - Light vehicle volumes shown for the Bella Vista Station site have been based on the site being used as remote parking site for the eastern (tunnel) sections works sites. Approximately 60% of light vehicles are proposed to access the site from Celebration Drive and 40% from Balmoral Road.

