West Metro

Preliminary Environmental Assessment

August 2009

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Glossary of terms

Acoustic	Pertaining to the sense of organs of hearing, or to the science of sound.
Ambient	Surrounding or existing.
Bored tunnel	An underground tunnel constructed by a tunnel boring machine.
CityRail Station	Existing rail station on the CityRail network.
Consent	Approval to undertake a development received from the consent authority. Also referred to as development consent.
Construction Environmental Management Plan	A document setting out the management, control and monitoring measures to be implemented during construction of a development, to avoid or minimise the potential environmental impacts identified during an environmental impact assessment process.
Crossover	Track form to allow trains to move to an adjacent track.
Cut and cover construction	Method of construction for underground structures where a hole is excavated from the surface down, the structure is built and then covered.
Diamond crossover	Two crossovers located adjacent to each other in a diamond formation to allow trains to cross between both tracks in each direction.
Director-General's requirements	Requirements for an environmental assessment issued by the Director-General of the Department of Planning in accordance with the *Environmental Planning & Assessment Act 1979*.
Geotechnical conditions	Relating to the form, arrangement and structure of geology, soils etc.
Kiss-and-ride	Where a car passenger is dropped off or picked up at a public transport station/bus interchange by a private car. This is generally by a family member, hence the 'kiss' goodbye.
Maintenance depot	Land including buildings and facilities for the maintenance of the metro system, including rolling stock and the infrastructure.
Metro railway	A guided system designed to transport passengers on a railway track, together with its infrastructure and associated sidings, that: (a) provides high-frequency commuter and other passenger services, and

	(b) is operated using automated systems, that are integrated with trains, from one or more central control points, and (c) is operated using dedicated rail infrastructure facilities that are not operationally connected with other types of rail infrastructure facilities.
Metro railway system	(a) A metro railway and its rail infrastructure facilities, and (b) Stations, platforms, maintenance facilities, depots and other transport interchanges, works, structures and facilities associated with or incidental to the metro railway or rail infrastructure facilities (including commercial and retail facilities).
Paid concourse	Area of the station that can only be accessed by ticket holders.
Project	The construction and operation of the proposed West Metro as considered by this Preliminary Environmental Assessment (PEA).
Proponent	The person proposing to carry out development comprising all or any part of the project, including any person certified by the Minister for Planning to be the proponent (such certification to be obtained prior to commencement of the relevant part of the project). Sydney Metro is the proponent for the West Metro project.
Product	The new metro railway in total, including assets, brand, systems, intellectual property, interfaces and metro services.
Road header	Machine used to excavate tunnels with a boom-mounted cutting head.
Rolling stock	Standard single deck metro trains used on the metro railway.
Spoil	Excess material resulting from the cut and fill balance. Generally comprises soil and rock material. All volumes refer to solid volume.
Stabling facility	Location where rolling stock (trains) are stored when not in service.
Station	Refers to proposed metro station infrastructure, including platforms, concourse, entrance, pedestrian connections, staff facilities and associated requirements/facilities to service the station.
Station Plan	Plans that may be prepared for land on which metro railway stations are to be situated, and land in the vicinity of such metro railway stations, with respect to development, traffic and parking management arrangements, pedestrian links and access facilities, retail and commercial development associated with metro railway stations, public domain amenities and improvements, and other matters ancillary to the operation of metro railway stations and any associated transport or other facilities.

Sydney Metro	The NSW Government agency constituted under the *Transport Administration Act 1988* to develop a metro railway system, including procuring the West Metro.
Traction power	Term used for electric power supply used on electric railways to power the movement of trains.
Transitway	Strategic bus service with limited stopping pattern, operated along dedicated bus corridors and/or with bus priority measures.
Tunnel boring machine	Machine used to excavate tunnels with a circular cross section through a variety of soil and rock strata.
Turnback	Configuration of tracks allowing a train to terminate a service and return to its starting point without interfering with through trains.
Unpaid concourse	Areas of the station that can be accessed by any member of the public.
Virgin excavated natural material	Natural material (such as clay, gravel, sand, soil and rock) that: (a) is not mixed with any other type of waste; and (b) has been excavated from areas of land that are not contaminated.

List of abbreviations

ATO	Automatic Train Operation
ATP	Automatic Train Protection
BSP	Bulk Supply Point
CBD	Central Business District (of Sydney)
DECC	Department of Environment and Climate Change
DEWHA	Department of Environment, Water, Heritage and the Arts (Commonwealth)
DoP	Department of Planning
EA	Environmental Assessment
EEC	Endangered Ecological Community
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
GDP	Gross Domestic Product
IGANRIP	*Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects*
km	Kilometre
km/hr	Kilometres per hour
kV	Kilovolt
POEO Act	*Protection of the Environment Operations Act 1997*
LEP	Local Environmental Plan
LGA	Local government area
m	Metre
m^3	Cubic metre
m^2	Square metre
NES	National Environmental Significance

NES matters	Matters of national environmental significance, which are referred to in the *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
OCC	Operations Control Centre
REP	Regional Environmental Plan
SEPP	State Environmental Planning Policy
STM	Sydney Strategic Travel Model
TBM	Tunnel boring machine
T-way	Transitway
VENM	Virgin excavated natural material

1 Executive summary

1.1 Introduction

A new metro rail system will be an integral part of the NSW Government's comprehensive transport plan for Sydney's future.

Metro rail is a rapid, frequent and reliable train system offering high quality and customer-focused underground public transport. It will improve travel times between key destinations, and serve new markets which are currently not on the rail network. Metro will offer a viable option for a range of trips around the clock, not just for the journey to and from work. In doing so, it will make centres along its path more accessible and give the people using it a greater choice of job, retail, and recreational opportunities.

The CBD Metro is the first key step towards building the metro network. Detailed planning and assessment for the 7 kilometre line between Rozelle and Central are well advanced, with construction planned to start in 2010.

The West Metro linking the CBD with Parramatta and western Sydney will be the first extension of the CBD Metro. It will provide a new rail line with high-frequency, rapid train services, serving strategically-located stations between Sydney CBD, Parramatta and Westmead. It has the potential to reduce travel times between western Sydney and the Sydney CBD significantly, and to relieve congestion in the western rail corridor, as well as across the broader rail network. The West Metro will considerably strengthen Parramatta's role as Sydney's second CBD. It will also provide significant support for transit-oriented development, promote urban revitalisation, and deliver services to new rail markets.

The Sydney Metro system will be fully integrated with the roads, heavy rail and buses that underpin Sydney's communities and its economy, and ultimately just as significant. The metro rail system will be capable of carrying up to 40,000 passengers per hour per line, and will provide a major injection of higher service quality and capacity into a constrained network.

The metro network will serve and stimulate population and employment growth around key transport centres and corridors, promoting urban renewal, reducing road congestion and ensuring economic prosperity. Its benefits will also flow across the whole of the Sydney region, as the metro system grows, as extra rail capacity becomes available, and as land uses, bus services, and road networks adapt.

The NSW and Australian Governments have allocated significant levels of funding to proceed with pre-construction work for a West Metro. This Preliminary Environmental Assessment (PEA) is an important step towards realising the West Metro.

1.2 Metro rail as part of an integrated approach

Sydney is the only global city in Australia, and is the country's gateway for economic development, business and tourism. The NSW Government has forecast a growth in population of 1.1 million for the Sydney region by 2031, and strong regional land use and transport strategies are required to support continued economic growth, improved lifestyles and sustainability outcomes.

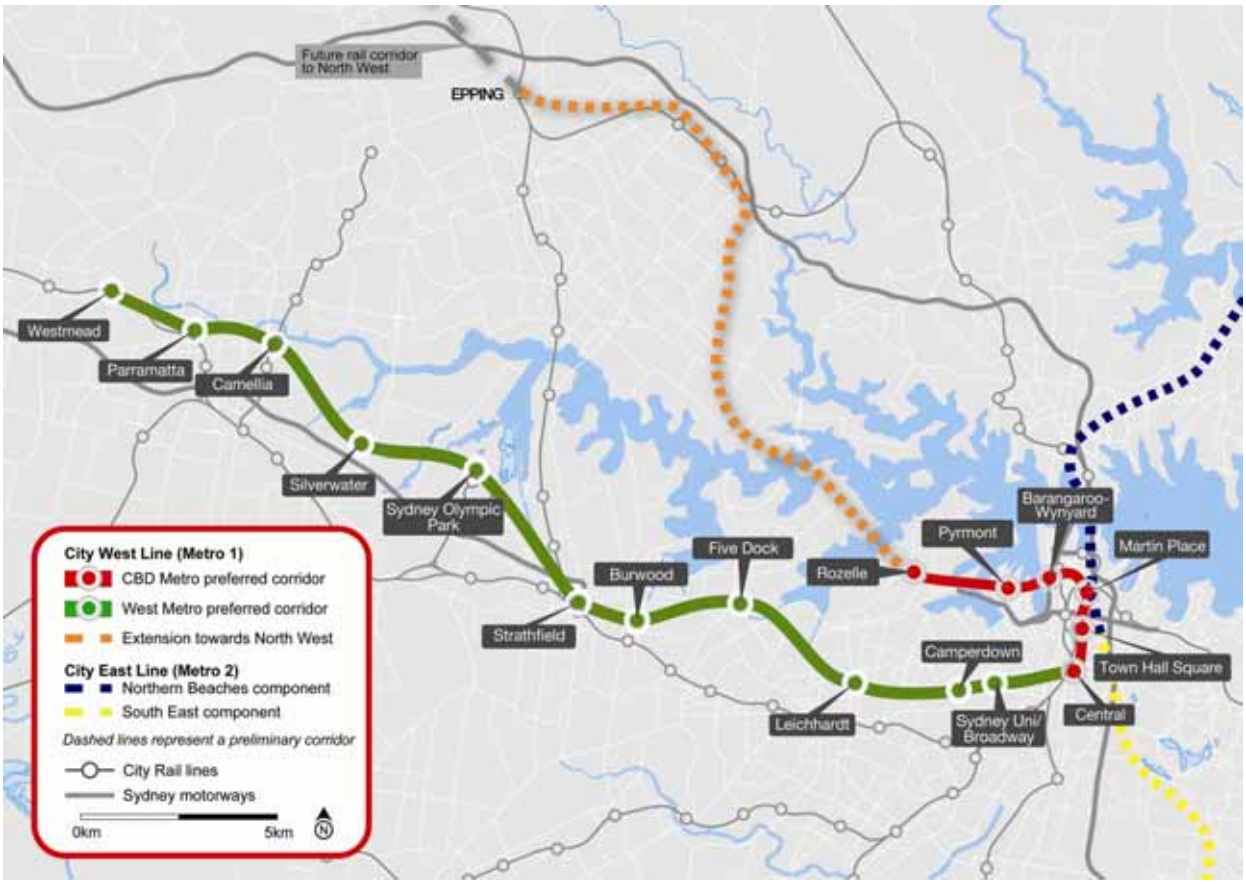
The NSW Government's *Metropolitan Strategy* is the central planning framework for Sydney. It focuses on residential and economic development in centres and corridors linked by improved transport infrastructure and services.

The Government's commitment to developing a metro network supports the objectives of the *Metropolitan Strategy* by strengthening the role of existing centres and corridors. It also provides the catalyst for the growth of new centres and corridors. Two major metro lines will form the metro network: Metro 1: the City West Line and Metro 2: the City East Line. These are shown in Figure 1.1.

Metro 1 comprises three stages:

- The CBD Metro – a new rail corridor through Sydney's CBD from Central Station to Rozelle.
- The West Metro – reaching from Westmead to Central Station via Parramatta, Sydney Olympic Park and the Inner West.
- The North West Metro – following the Victoria Road corridor from Rozelle to Macquarie Park and linking to a potential future rail corridor to the North West Growth Centre from Epping.

Figure 1.1 Sydney metro network



The western corridor from Parramatta to central Sydney is Sydney's busiest, accounting for 9.26 million passenger kilometres of daily travel. This corridor generates $125 billion in economic activity per annum, 12 per cent of the total national Australian Gross Domestic Product (GDP) and over 38 per cent of the GDP of the Sydney area.

Up to 25 per cent of employment growth is expected to occur in the CBD and western corridor. By 2031, employment in the City of Sydney is likely to grow by 80,000 jobs. Sydney Metro's forecasts suggest that employment in Parramatta CBD will grow by 20,000 jobs by 2031, while its population is forecast to grow to 40,000 in the same period. Sydney Olympic Park will accommodate 20,000 new jobs and homes for 7,500 people by 2031.

This population growth will create even further pressure on the corridor's major transport links, which are already severely tested at peak hours, resulting in crowded and over-subscribed trains and buses, and road traffic congestion and delay which affects commuting and goods traffic.

The western corridor also contains major opportunities for significant urban change and renewal, such as in the lower density areas of Harris Park, Rosehill, Camellia, Silverwater and Homebush Bay.

Jointly with the Australian Government, in 2008 the New South Wales Government allocated funding to examine the feasibility of a metro rail line to link the CBD with Parramatta and western Sydney. Since then, feasibility work has been underway. A range of 23 multi-modal strategic transport options was identified and the capacity of each to meet the forecast needs of the corridor was assessed through strategic merit test, multi-criteria analysis and rapid economic appraisal. Technical and environmental analysis, transport planning, demand forecasting, infrastructure design and preliminary economic assessment identified that a new, underground West Metro rail line linking the Sydney CBD with Parramatta/Westmead was the preferred option for the corridor.

As the first extension of the CBD Metro, the West Metro will aim to:

- Provide fast and reliable rail access to Sydney's western corridor with reduced travel times and substantially more frequent services.
- Extend the coverage of rail services to additional areas of Sydney, including along the congested Parramatta Road corridor.
- Provide bus congestion relief along the congested Parramatta Road corridor and into Sydney CBD.
- Improve existing public transport systems.
- Provide strategic locations for new housing and jobs, supporting the Government's challenge to accommodate growth in population while sustaining the economic and environmental character of Sydney.
- Provide greater passenger capacity to supplement traditional Sydney heavy rail, requiring smaller stations and tunnels providing significant savings on infrastructure and operating costs.
- Extend the benefits of rail services by catering to new markets.

1.3 The project

The West Metro will consist of a twin-track passenger metro railway, 24.1 km in length extending from the CBD Metro station at Central to Westmead, with eleven stations. As the first extension of the CBD Metro, the West Metro would create a continuous metro line extending from Westmead via Parramatta, the inner west, Central, and the Sydney CBD to Rozelle.

The key features of the West Metro are described in Table 1.1.

Table 1.1 West Metro transport product

Description	Details
Station and service access	
Stations	• 11 stations: Westmead, Parramatta, Camellia, Silverwater, Sydney Olympic Park, Strathfield, Burwood, Five Dock, Leichhardt, Camperdown and Broadway-Sydney University.
Bus interchanges	• Key bus/metro interchanges at Westmead, Parramatta, Strathfield, Burwood, Five Dock and Leichhardt.
Rail interchanges	• Direct interchange with CityRail services at Parramatta, Camellia and Strathfield.
Park and ride	• Camellia, Silverwater.
Station features	• Safe and secure. • Platform screen doors. • Automatic ticket gates. • Accessible. • Well-lit (through natural light and ventilation where practicable.) • Long-term capacity for 6-car trains.
Ticketing	• Smart card system, which is tag-on tag-off, contact-less. • Integrated with Sydney's wider transport network.
Operations	
Frequency of service	• 2-3 minutes in the peak; a daytime maximum wait of 5 minutes in the off-peak.
Hours of operation	• 24/7 operational capability with proposed 05:30 to midnight opening (Sunday to Thursday) extended to 01:00 Friday/Saturday night.
Patronage	• 144 million per annum, and 45 - 60,000 in the am peak hour (2031).
Infrastructure	
Route length	• 24.1 km, all underground.
Alignment	• Designed for up to 100 km/hr and maximum gradient of 4.5%.
Tunnel dimensions	• Twin 5.7-metre internal diameter segmentally-lined tunnels, consistent with CBD Metro.
Bulk power supply	• Designed in conjunction with CBD Metro.
Traction power	• 1500 volt direct current (recommended) and consistent with CBD Metro.
Rolling stock	
Train type	• Single-deck metro air-conditioned trains. • 110 metres long. • Body width: 3.2 metres. • 5 cars per train, with provision for 6-car operation. • 3 bi-parting doors per side per car to allow easy entry and exit.
Train control	• Automatic driverless trains controlled from a central Operations Control Centre at Rozelle, consistent with CBD Metro.
Train capacity	• Capacity for between 29,000 and 40,000 passengers per hour, per direction (depending on frequency and train seating arrangements).

1.4 The approval process

The Minister for Planning has declared all metro projects to be critical infrastructure under Section 75C of the *Environmental Planning and Assessment Act 1979* (EP&A Act), which was gazetted on 2 May 2008). On 10 July 2009, an order declaring the West Metro to be a project to which Part 3A of the EP&A Act applies was gazetted.

This PEA has been prepared to support a Project Application in accordance with Section 75E of the EP&A Act for the project. It responds to the statutory approval process requirements by describing the project and the baseline environmental conditions, and undertaking a preliminary assessment of likely environmental impacts. It identifies the key environmental issues to be addressed during the Environmental Assessment (EA) and seeks environmental assessment requirements for the project in accordance with Section 75F(3) of the EP&A Act.

1.5 The proponent

Sydney Metro is the NSW Government agency constituted under the *Transport Administration Act 1988* as amended by the *Transport Administration Amendment (Metro Rail) Act 2008* to develop a metro railway system, including procuring the West Metro.

The principal function of Sydney Metro is to develop safe and reliable metro railway systems for Sydney. It will be the governing body responsible for the development and delivery of the West Metro and the proponent for the purposes of the EP&A Act.

1.6 Constructability

Construction of the CBD Metro is planned to commence in 2010, with the line being operational by 2015.

West Metro is currently proposed to be built in a single stage, with construction works anticipated to commence in 2011 and trains operating on the line by the end of 2017.

The 24.1 km tunnels from Central to Westmead are likely to be constructed using tunnel boring machines (TBMs) which will be launched from TBM launch and retrieval sites and operate concurrently. Road headers will also be used for tunnel construction.

Pre-cast rings will be erected behind the excavation to provide a continuous pre-cast concrete lining.

Below ground activities are proposed to occur up to 24 hours per day, seven days per week, along with certain above ground sites that support tunnelling and fit out activities. However at above ground locations where sensitive noise receptors are close to the proposed construction works, specific noisy activities will be more restricted during evening and night-time periods.

1.7 Key environmental issues

This PEA identifies a number of key environmental issues during the construction and operational phases that will require further investigation as part of the detailed EA, including:

- Operational transport and traffic impacts and implications.
- Spoil management (including contamination).
- Construction traffic and transport.

- Operational noise and vibration.
- Construction noise and vibration.
- Land use and socio-economic implications.
- Impacts on indigenous and non-indigenous heritage.

This PEA identifies the proposed scope of environmental investigations which will be documented in the EA report. That report will also specify how the identified impacts will be managed effectively, or mitigated through the design process and application of standard and/or tailored mitigation measures.

The proposed scope of the detailed EA is summarised in section 9.

1.8 Next steps

A Project Application, supported by this PEA, is the first key step in the planning approval and environmental assessment process. It identifies the benefits and potential impacts of the West Metro and outlines the scope of the required further studies.

Once the PEA has been lodged, the Director General of the Department of Planning will issue environmental assessment requirements for the project in accordance with Section 75F (3) of the EP&A Act. These will form the scope of work for the EA. During preparation of the EA, a range of technical studies and consultations about the project will be undertaken on behalf of Sydney Metro.

There will also be information days and other opportunities for the public to hear more about the West Metro proposal, and to make their views known. Maximum use will be made of web-based communications and other innovative community engagement procedures to provide improved access to information and facilitate community feedback. This consultation will assist with the design development and preparation of the EA.

A toll-free information line has been established (1800 636 910) to receive and respond to all public enquiries and the Sydney Metro website (www.sydneymetro.nsw.gov.au) includes project information.

In 2010, the EA will be exhibited at the Department of Planning's head office, relevant regional offices, local council offices, and on the Department of Planning's website, and public comment will be invited.

Advertisements will be placed in appropriate newspapers, and relevant State agencies and local councils will be notified, as well as affected and adjacent landowners. During the exhibition period any person will be able to make a written submission to the Director-General of the Department of Planning regarding the project.

Once all comments have been reviewed, Sydney Metro will prepare a submissions report, providing a response to the issues raised in the submissions; and/or a preferred project report, outlining any proposed changes to the project; and/or a revised statement of commitments.

The Director-General will then prepare a report to the Minister for Planning, on the basis of which the Minister for Planning will determine whether to approve or refuse the project.

2 Introduction

2.1 Metro rail as part of an integrated network

Sydney is a global city, with a growing employment base and rapidly increasing population. Its transport networks have been key parts of the Sydney region's sustained growth for many years. But extra capacity is now required to meet future development challenges. Metro rail is a rapid, frequent and reliable train system offering high quality and customer-focused underground public transport. A new metro rail system will be an integral part of the NSW Government's comprehensive transport plan for Sydney's future.

Metro rail will play an important and specific role in an integrated transport network for Sydney. It is not intended as a replacement for traditional rail services, which will continue to carry large numbers of people over relatively long distances, primarily for journeys to work, education or sporting and other special events. Rail's large carrying capacity allows long distance, low-cost commuting between suburban housing and city centre employment in the established rail corridors, and the movement of large numbers of people in a concentrated time.

Bus services, often serving lower-density residential areas, will continue to provide increasingly frequent and flexible services for inter-suburban trips, medium-length commuter trips, and limited-stop trips along strategic bus corridors. Buses, like the trams before them, provide the core of local and suburban public transport, responding to short term demand peaks; and operating feeder, special event, and rail-replacement services.

Metro rail will bring rapid and frequent rail services to high density or growing areas which are currently not served by rail services, or where rail or trunk bus services are at capacity. By providing the option for rail/metro and bus/metro interchange at key locations, metro will offer a relief valve to existing public transport services, and bring other places within reach of rail services.

Metro rail is ideally suited to this task since it can nimbly and affordably be retro-fitted into existing urban areas. Its trains are shorter and turn more easily than heavy rail trains, meaning there is more flexibility in terms of alignment. Its tunnels are narrower, and can be built in most environments. Its services are frequent, consistent, and not prone to network delays. Its stations are unobtrusive and can integrate seamlessly with their surrounding environment, which is often an established and constrained town centre. Its operating systems are automated, allowing train services to run on frequency, rather than timetables, and making ticketing quick and easy to use.

Metro will improve travel times between key destinations, and will offer a viable option for a range of short and long trips around the clock, not just for the journey to and from work. In doing so, metro will make centres along its path more accessible and stimulate urban regeneration, while will giving the people using it a greater choice of job, retail, and recreational opportunities.

In summary, as part of an integrated approach to transport and urban development, metro will become a popular and important part of Sydney's life, just like the London Underground, or Paris *Metropolitain.*

2.2 West Metro

The CBD Metro is the first key step towards building the metro network. Detailed planning and assessment for the 7 km line between Rozelle and Central are well advanced, with construction planned to start in 2010. The NSW Government has committed to delivering the CBD Metro which will link Central station to Rozelle and in February 2009 Sydney Metro lodged a Project Application under Part 3A of the EP&A Act to the Planning Minister for approval.

The proposed West Metro consists of a high-frequency rapid train service which will connect Central station to Westmead, with eleven new stations located at Westmead, Parramatta, Camellia, Silverwater, Sydney Olympic Park, Strathfield, Burwood, Five Dock, Leichhardt, Camperdown and Broadway-Sydney University.

The new rail line will offer patrons from the inner west a direct link between Westmead and Parramatta to Rozelle through Sydney CBD. It is a key component of a metro network for Sydney and will be complemented in time with extensions towards north western Sydney, the Warringah Peninsula and Sydney's south east. The metro network will form an integral aspect of the integrated Transport Blueprint for Sydney which is currently being prepared by NSW Transport and Infrastructure.

Together with the CBD Metro, the West Metro will provide a completely new mode of mass transit which will significantly improve public transport for Sydney and strengthen Sydney's global standing. Importantly, West Metro and the metro network will provide an integrated land use and public transport solution which will:

- Complement and support the NSW Government's *Metropolitan Strategy* objectives for Sydney by facilitating the renewal of inner and middle ring suburbs, linking population and employment centres and encouraging Parramatta's role as Sydney's second CBD.
- Reduce travel times between Western Sydney and the Sydney CBD, reduce road congestion, and improve bus services, conditions in the western rail corridor and the broader rail network.
- Provide a mass transit service to inner and middle ring suburbs in Sydney's west which have not been not served by a railway network.

The West Metro provides the opportunity to relieve pressure on the rail network, improving journey quality for passengers travelling from western Sydney. It also provides the opportunity to accommodate the expected population and employment growth in specific centres with excellent accessibility to a new, high quality and frequent mode of transport. The West Metro will be integrated with the bus network to relieve pressures on the Sydney CBD, reallocate buses to better serve western Sydney and facilitate cross-regional movements.

2.2.1 Sydney Metro

Sydney Metro is the NSW Government agency constituted under Part 6A of the *Transport Administration Act 1988*. Its principal function is the development of a safe and reliable metro rail system for Sydney and to select and manage a private operator for the ongoing operation of the metro system. Sydney Metro is responsible for planning, delivering, and commissioning the metro system and, over the long term, managing all contractual arrangements and performance of the metro's private operator.

Sydney Metro will be the entity responsible for the development and delivery of the West Metro and will be the proponent for the purposes of the EP&A Act.

2.2.2 Key West Metro outcomes

West Metro, linking the Sydney CBD with Parramatta/Westmead and the new stations along its alignment will:

- Provide a new, world class rail line with high-frequency, rapid and accessible train services.
- Significantly improve public transport travel times and reliability, especially for travellers from areas currently served by buses.
- Relieve congestion in the western corridor and the broader rail network.
- Deliver eleven strategically-located stations, directly accessible to employment and other key destinations.
- Strengthen Parramatta's role as Sydney's second CBD.
- Enable strategic interchange opportunities with other transport networks.
- Provide significant support for transit-oriented development and urban regeneration within the corridor.
- Deliver services to new rail markets, in areas which have limited public transport services.
- Stimulate employment and residential growth in Australia's most significant urban corridor, thereby driving national productivity and competitiveness.

2.3 Metro product

The 'metro product' refers to the new metro railway in total, including assets, brand, systems, intellectual property, interfaces and customer experience (Table 2.1). The West Metro will be the first extension of the CBD Metro, delivering significant economic benefits for Sydney and NSW.

The metro network will be designed to a specification that sets new benchmarks for customer experience with fast, frequent and reliable services.

Table 2.1 Metro product statement and principles

Metro product statement	Metro product principles
A fast, frequent and reliable transport system that: • Is customer focused. • Is fully integrated into its urban context and existing transport infrastructure. • Supports the long term competitiveness and attractiveness of Sydney.	• A customer-focused product that benefits passengers and the wider community. • Integrated land use and transport outcomes. • Integrated transport services across all modes. • A 100 year investment that supports Sydney's global competitiveness and attractiveness. • Optimal sustainability and environmental outcomes. • Efficient and effective governance of product development, delivery and operation.

2.4 Stakeholder consultation

A large number of government agencies are being consulted during the development of the West Metro to ensure an integrated approach to planning.

The Commonwealth Department of Transport, Infrastructure, Regional Development and Local Government have been closely involved in the development of the project, as has Infrastructure Australia. Within NSW, liaison has been undertaken with the Chief Executive Officers/Directors-General of the Department of Premier and Cabinet, Treasury, and the Department of Planning.

The development of NSW Transport and Infrastructure provides the opportunity for a co-ordinated whole of Government approach to transport planning and delivery. Regular consultation has been undertaken, and will continue, with the department and its constituent agencies, including RailCorp, State Transit Authority and the Roads and Traffic Authority (RTA).

General managers of all councils along the route were contacted to advise them of the feasibility work being undertaken. Subsequently, specific briefings were provided to general managers and/or staff of Parramatta City Council, Burwood Council, Leichhardt Council, Strathfield Council and Auburn Council. Discussions were also held with Sydney Olympic Park Authority. Specific meetings will be arranged with individual councils as part of the consultation process.

Consultation is ongoing with government agencies, local councils and other key organisations. Several interagency reference groups have been established to ensure a structured and integrated approach to communication and consultation within government during the planning approval process and preparation for the project delivery phases. Consultation will also take place with landowners and occupants.

Maximum use will be made of web-based communications and other innovative community engagement procedures to provide people with improved access to information and facilitate community feedback. This consultation will assist with the design development and preparation of the EA.

Community information sessions will be held during the preparation and public exhibition of the EA.

Dedicated Place Managers for West Metro have been appointed and will be the direct points of contact between the community and the Sydney Metro project team.

An 1800 information line (1800 636 910) has been established to receive and respond to all public enquiries and the Sydney Metro website (www.sydneymetro.nsw.gov.au) includes information on the project. Access to web-based community forums is also available via this website.

2.5 The purpose of this report

On 10 July 2009 the West Metro was declared to be a project to which Part 3A of the Environmental Planning and Assessment Act, 1979 (EP&A Act) applies.

This PEA has been prepared by Sydney Metro to support a Project Application in accordance with Section 75E, Part 3A of the EP&A Act for the project.

It responds to the statutory approval process requirements by characterising the project and the baseline environmental conditions, and undertaking a preliminary assessment of likely environmental impacts. It identifies the key environmental issues to be addressed during the detailed EA and seeks environmental assessment requirements for the project in accordance with Section 75F(3) of the EP&A Act.

2.6 Structure of this report

This report is structured as follows:

- An overview of the strategic justification for the project is provided in Section 3.
- A description of the project is provided in Section 4.
- An overview of the planning framework and statutory requirements is provided in Section 5.
- An outline of the methodology utilised to complete the preliminary environmental risk analysis is provided in Section 6.
- An overview of the benefits and potential impacts of identified key environmental issues and the required further studies is provided in Section 7.
- An overview of the benefits and potential impacts of other environmental issues and preliminary management measures is provided in Section 8.
- Concluding statements and a proposed scope for the EA are outlined in Section 9.

3 Strategic need and justification

3.1 Planning for Sydney's growth

Sydney is a city of significance to the world as well as to Australia. Its population is expected to grow to six million in the next 25 years (DoP 2008), with resulting pressure on transport infrastructure. Decisions that are made now will shape Sydney's future significantly, and will contribute not only to its liveability in the coming decades, but also its economic status as a global city.

City of Cities: A Plan for Sydney's Future (DoP 2005) (the *Metropolitan strategy)* is the overarching planning framework for Sydney, setting the parameters for residential and economic development in centres and corridors. The *Metropolitan Strategy* deals with the region as a composite of a number of subregions served by five regional cities: Sydney, North Sydney, Parramatta, Liverpool and Penrith.

The *Metropolitan Strategy* is the first planning strategy for Sydney that has adopted a subregional structure and reflects the expected future pattern of growth across a number of centres and enterprise corridors, with the aim of improving equality of access to employment, services and community and recreation facilities.

The vision for Sydney in 2031 as articulated in the *Metropolitan Strategy* is for:

- A series of stronger cities within the metropolitan area providing jobs and services closer to where people live.
- Improved opportunities for the growth and expansion of employment, housing, retailing and services within major centres.
- A robust Global Economic Corridor providing a concentration of economic and employment activity in centres along the corridor from Port Botany and the Airport through to the Sydney CBD, North Sydney and Macquarie Park.
- More jobs in centres such as Parramatta and Penrith, and in Western Sydney around the junction of the M4 and M7 Motorways.
- The urban footprint of the city to be contained to preserve valuable agricultural lands in the Sydney Basin.
- More equitable access to housing, employment, services and open space while preserving the character of existing neighbourhoods.
- An expanded transport network to improve connectivity and access between centres and enterprise corridors.

3.1.1 Population and employment

The *Metropolitan Strategy* plans that by 2031, 70 per cent of Sydney's growth would be in the existing urban footprint. However, market forces have concentrated development so that 90 per cent is occurring in existing urban areas. This concentrated development reflects changing demographics of the existing population (smaller households); the type of housing sought by recent immigrants (typically high and medium density); and rising energy costs associated with long distance commuting. This trend is expected to intensify.

The *Metropolitan Strategy* also plans for the dispersed aggregation of employment across the strategic centres.

Population and employment growth within Sydney is expected to be concentrated within the Global Economic Corridor – from Macquarie Park through North Sydney and the CBD to the Airport/Port Botany precinct – and along the western corridor from Parramatta through Sydney Olympic Park to the CBD.

Up to 25 per cent of employment growth is expected to occur in the CBD and western corridor. By 2031, employment in the City of Sydney is likely to grow by 80,000 jobs, with significant new developments at the Bays Precinct and Barangaroo. Employment in Parramatta is forecast to grow by 20,000 jobs by 2031. Over the same period, its population is forecast to quadruple, from 10,000 in 2006 to 40,000 in 2031. Sydney Olympic Park will accommodate 20,000 new jobs and homes for 7,500 people by 2031.

3.1.2 Travel and transport in the western corridor

The western corridor from Parramatta to central Sydney is Sydney's busiest, accounting for 9.26 million passenger kilometres of daily travel (NSW Government, 2006a). This corridor, shown in Figures 3.1 and 3.2, generates $125 billion in economic activity per annum, 12 per cent of the total national Australian Gross Domestic Product (GDP) and over 38 per cent of the GDP of the Sydney area. The corridor generates economic activity greater than the entire output of New Zealand, which had an annual GDP of A$116 billion in 2008.

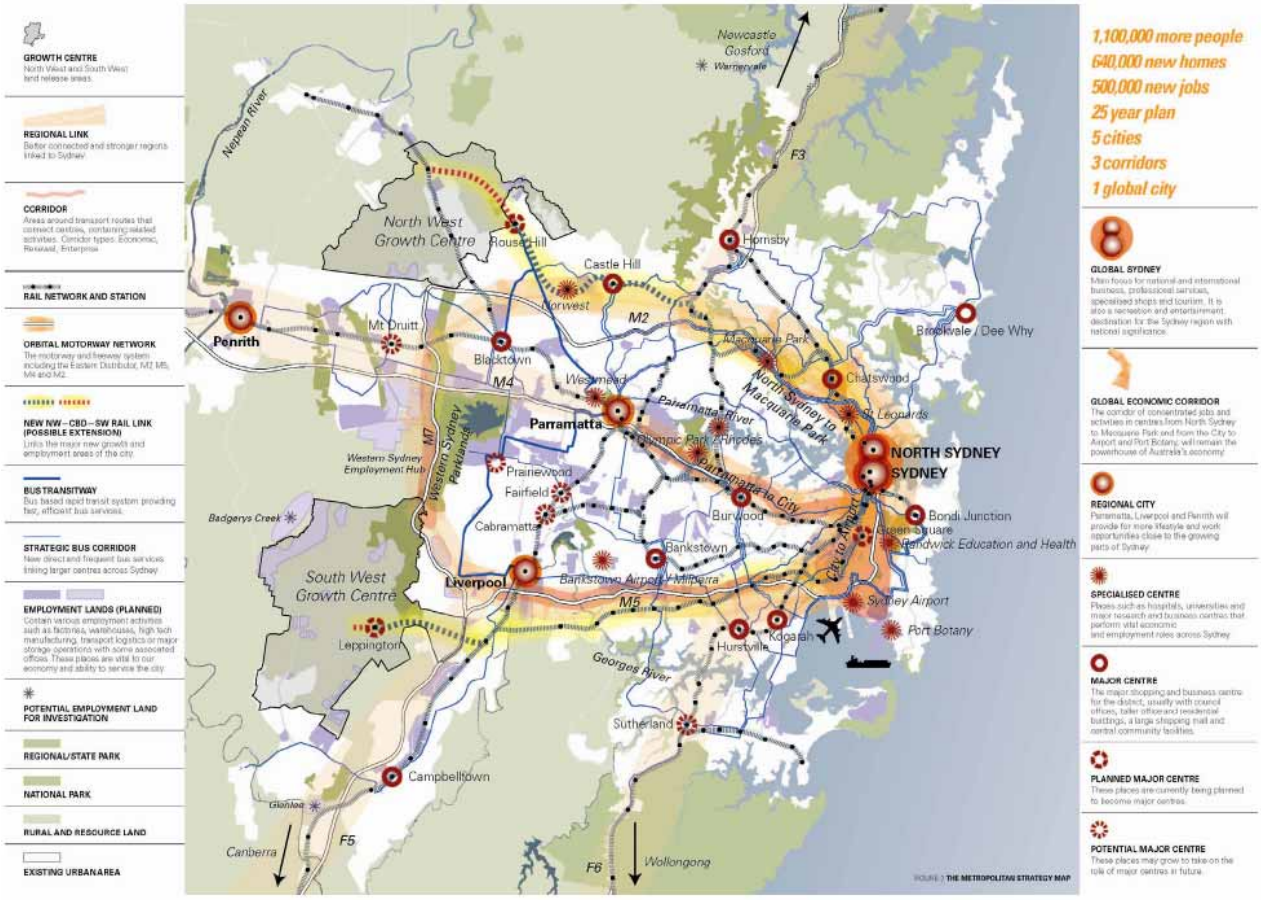
Figure 3.1 Sydney's major transport corridors

Source: *Urban Transport Statement*, (NSW Government, 2006)

The spine of the western corridor is formed by the:

- Great Western Highway/M4 Motorway/Parramatta Road arterial road network.
- The Western Rail Line and the Blue Mountains Line (Intercity) from Penrith to Sydney CBD, with the Richmond Branch, South Line, Northern Line, Newcastle and Central Coast Line (Intercity) and Inner West Line converging into the corridor to the east of Blacktown.
- Strategic Bus Corridors 10 (Parramatta–City, via Ryde), 13 (Parramatta–Burwood) and 37 (Burwood–City).
- Parramatta River.

Figure 3.2 Role of corridors within the metropolitan urban framework



Source: *City of Cities: A Plan for Sydney's Future, Metropolitan Strategy*, (NSW Government, 2005)

The M4 Motorway provides the primary road link (via the Parramatta Road and City West Link to the east) between western Sydney, Parramatta and the Sydney CBD. The NSW Government is considering opportunities to extend the M4 Motorway to the east, to improve the performance of Parramatta Road and the wider road network. James Ruse Drive (Parramatta), Silverwater Road/St Hilliers Road (Silverwater), Homebush Bay Drive (Sydney Olympic Park) and Great North Road (Five Dock) provide cross-regional links between centres to the north and south of the corridor.

Within the corridor, a dense network of transport links provides access into and between activity centres via trains, buses, ferries, roads, light rail and cycle paths. Parramatta, Strathfield and Burwood are key interchange locations for bus and rail travellers.

Demand for train trips experienced the biggest increase (2.7 per cent) among all modes between 2005 and 2006 (RailCorp, June 2008). Current congestion on the Main West rail corridor is the highest on the Sydney network, with an AM peak hour average loading of 130 per cent (where a loading of 100 per cent means all passengers have a seat). A significant number of services exceed 'crush capacity' of 135 per cent, with loads often up to 180 per cent (Transport Data Centre, 2008). By 2031, overcrowding on public transport in the corridor is forecast to reach levels which will force a significant percentage of travellers to either change the times of their journeys, switch modes, or not travel, imposing a very significant economic and social cost to the NSW economy and to individual travellers, and leading to increased environmental damage as private vehicle journeys will increase.

Road speeds have been gradually reducing over time, with congestion increasing. The cost of congestion in Australia was estimated at $9.4 billion in 2005, of which Sydney contributed $3.5 billion. These costs are estimated to more than double by 2020 (Department of Transport & Regional Services, 2007). Increasing travel times will impair the movement of people between their homes and work, education, health and leisure facilities, reducing social amenity, and affecting the liveability and global competitiveness of Sydney.

Significant congestion is also likely to occur on parts of the bus network by 2031. Major changes will be required if the Sydney CBD is to be able to accommodate the increasing number of buses needing to access it.

3.1.3 Land supply potential

Land supply potential in the corridor is significant compared to more constrained areas elsewhere in the metropolitan area. The Strathfield to Parramatta segment of the West Metro corridor provides significant scope for intensification, especially at or near Sydney Olympic Park and around Rosehill Racecourse, assuming supportive government intervention to permit conversion of land to mixed use, including residential and higher intensity employment. Redevelopment opportunities are fewer in Leichhardt and towards Camperdown, with established communities and already dense housing.

Residential and employment growth is expected to be focussed in centres and corridors, in line with the principles in the *Metropolitan Strategy*. Housing markets tend to operate on a subregional basis, meaning that a high share of homebuyers typically buy near to, or the next suburb or two out from, where they are currently living. The western corridor, however, is located within the central metropolitan Sydney housing markets and its amenity is very high. Central metropolitan Sydney markets generally draw from a wider catchment and are the main settlement locations for in-migrants (from overseas and from elsewhere in Australia). In this respect, the western corridor has a much broader market compared to other areas of Sydney.

3.1.4 The need for change

The predicted increases in the concentration of population and employment growth in inner areas will exacerbate urban congestion unless significant, transformational investment is made in the transport system. There is an opportunity to harness and shape the pattern of growth to maintain and improve Sydney's global competitiveness and quality of life. The best model is to ensure that a significant proportion of growth occurs in corridors supported by new, high quality transport. Otherwise, scattered development across the metropolitan area will either dislocate much of the new housing from high quality public transport or concentrate it around corridors that have significant transport capacity constraints. This will create unsustainable pressure on existing services and a greater dependency on cars, leading to increasing competition on the roads between private vehicles and essential freight movements.

3.2 A metro network for Sydney

Sydney's complex network of roads, rail lines and bus routes requires additional capacity on key points of the network which are experiencing the highest rates of population and employment growth. To maximise and support growth and sustainability, Sydney must have a comprehensive transport solution for the future.

Metro is an essential addition to Sydney's transport system and, over time, it is expected to be as significant as, and fully integrated with, the roads, rail and buses that underpin Sydney's communities and economy. A metro system will be a major injection of higher service quality and capacity into a constrained network. It will be key in meeting the land use challenges as outlined in the *Metropolitan Strategy*, by driving population and employment growth around key transport centres and corridors, promoting urban renewal, reducing road congestion and ensuring economic prosperity.

Metro rail has the proven ability to step up and meet the sustainable mass transit challenges of modern, global cities. The CBD Metro and its extension to the west are key steps towards a metro network for Sydney, bringing greater choice, efficiency and reliability to the existing public transport network.

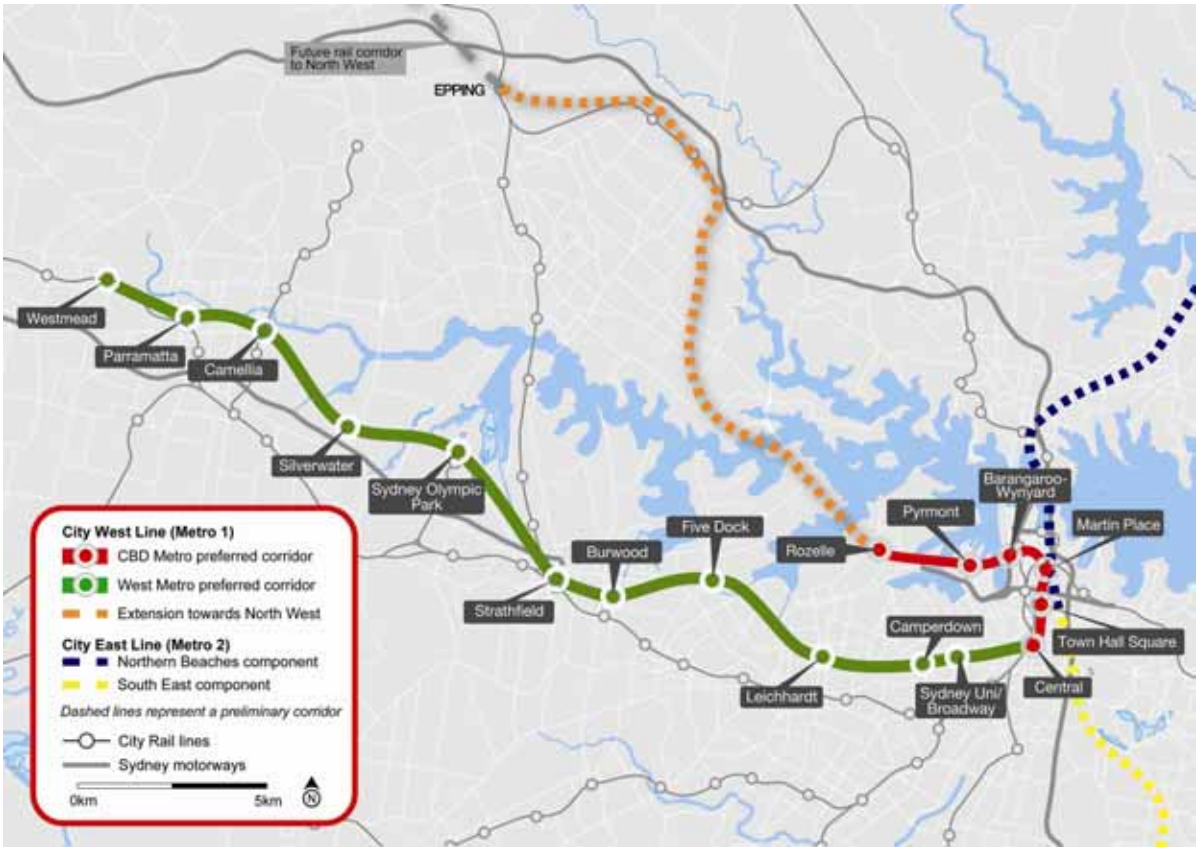
In the longer term, a broader network of metros is planned, including an extension beyond Rozelle following Victoria Road towards the north west. The metro network will be targeted to serve major transport corridors that are not currently serviced by mass transit, or do not have the capacity to meet future needs. This is expected to include many of Sydney's most heavily used and congested bus corridors, such as Parramatta Road, Victoria Road, Anzac Parade and Military Road.

Two major metro lines would form this broader metro network, as follows:

- Metro Line 1 City West line – from Westmead to the CBD and then beyond Rozelle to the north west.
- Metro Line 2 City East line – from Malabar via Maroubra, the Prince of Wales Hospital and University of NSW to the city and beyond to the northern beaches.

In the long term, this network could be extended to major cross-regional corridors of demand. The future development of the metro system will be guided by a wider *Metro Network Strategy* being developed by Sydney Metro. Figure 3.3 illustrates the potential future Sydney metro network.

Figure 3.3 Potential future Sydney metro network



The proposed Metro Network Strategy links land use and transport planning and delivers on the State's strategic objectives for improved urban environments with reliable transport access. It would provide a fast and frequent rail service linking key population and employment centres, and support major destinations such as Parramatta and Macquarie Park, making them more attractive as employment locations.

Consistent with the *Metropolitan Strategy*'s vision for Sydney in 2031, a metro network for Sydney would:

- Support a series of stronger cities within the metropolitan area providing jobs and services closer to where people live.
- Support the growth and expansion of employment, housing, retailing and services within major centres.
- Support the development of the Global Economic Corridor.
- Support urban intensification to preserve valuable agricultural lands.
- Provide more equitable access to housing, employment, services and open space while preserving the character of existing neighbourhoods.
- Provide an expanded transport network to improve connectivity and access between centres and enterprise corridors.

It will also support the key objectives in *Action for Air* and the *NSW Greenhouse Plan* for protecting and improving air quality across NSW.

3.2.2 Metro Line 1

The Government is committed to developing a metro network for Sydney, with its initial focus on Metro Line 1 City West line – from Westmead to the CBD and then beyond Rozelle to the north west.

The line would provide fast and frequent rail services linking key population and employment centres, and support major destinations, such as Parramatta, Sydney Olympic Park and Macquarie Park, making them more attractive as employment locations. The Metro 1 line is also targeted to connect major health and education precincts such as Westmead, University of Sydney, the University of Technology, and Macquarie University.

CBD Metro as the first stage

CBD Metro as an enabling project is fundamental to the establishment of a broader metro network. The NSW Government has committed funding for the construction of the CBD Metro.

Consistent with the transport planning framework for the Sydney CBD, the key strategic benefits of the CBD Metro include:

- Relief to the greatest capacity constraint on the entire transport network – the CBD – while providing for future metros to the west and north west.
- Provision of an alternative means for commuters to move around the CBD, attracting passengers away from existing crowded rail and bus networks, particularly at key locations such as Central, Wynyard and Town Hall.
- Facilitation of wider timetable and investment choices for the existing commuter rail network.
- Relief to heavily congested bus services operating into and through the CBD, which currently compete with pedestrians, cyclists, delivery vehicle and car movements.
- Support planned major development at Barangaroo, and in the future, the Bays Precinct and Blackwattle Bay area.

Whilst the CBD Metro would provide significant benefits on its own, of most critical and strategic importance is that it would be the enabler of the entire metro network. That is, the CBD Metro forms the central spine to which all other metros would link or interchange. Accordingly, it is considered by Government to be the first logical and critical step in the transformation of Sydney's transport system.

The western component of a Metro 1 line (the West Metro) would be focusing on Sydney's busiest transport corridor between the Sydney CBD and Parramatta. Parramatta and the inner west will continue to grow as employment, retail, entertainment, education, health and residential precincts, with accelerated urban renewal and growth expected to occur.

An extension to the north west from Rozelle will provide fast travel options for residents in the Victoria Road and Epping Road/M2 corridors. This includes a section of Sydney's second busiest transport corridor - linking Macquarie Park to the CBD and Airport/Port - which accounts for 8.3 million passenger kilometres of daily travel. The north western component of a Metro 1 line would provide an expanded transport network and supporting the Global Economic Corridor, which accounts for over 32 per cent of Sydney's total jobs.

3.3 West Metro objectives

As the first extension of the CBD Metro, the West Metro will aim to:

- Provide fast and reliable rail access to Sydney's western corridor with reduced travel times and substantially more frequent services.
- Extend the coverage of rail services to additional areas of Sydney, including along the congested Parramatta Road corridor.
- Provide bus congestion relief along the congested Parramatta Road corridor and into Sydney CBD.
- Improve existing public transport systems.
- Provide strategic locations for new housing and jobs, supporting the Government's challenge to accommodate growth in population while sustaining the economic and environmental character of Sydney.
- Provide greater passenger capacity to supplement traditional Sydney heavy rail, requiring smaller stations and tunnels providing significant savings on infrastructure and operating costs.
- Extend the benefits of rail services by catering to new markets.

3.4 West Metro feasibility analysis

This section describes the process undertaken for the initial feasibility assessment of the West Metro, and provides a summary of the feasibility study findings.

3.4.1 Methodology

Jointly with the Australian Government, in 2008 the New South Wales Government allocated funding to examine the feasibility of a metro rail line linking the CBD with Parramatta and western Sydney. The feasibility study set out the economic, environmental and social policy goals sought in New South Wales and Australia, quantified the economic significance of the western corridor and identified its current and future transport needs.

A range of 23 multi-modal strategic transport options was identified and the capacity of each to meet the forecast needs of the corridor was assessed through a range of techniques including strategic merit test, multi-criteria analysis and a rapid economic appraisal. These options were all evaluated as part of an integrated package of measures, not just the introduction of one new piece of infrastructure, but the core mode of each package included such options as:

- Improvements to existing rail infrastructure and capacity.
- Partial conversion of heavy rail line to metro operation.
- Metro rail along a new alignment.
- Light rail through the corridor.
- Strategic bus services on all or parts of the corridor.
- Various packages of measures involving modes like ferry, cycle routes, and other modes.

Technical and environmental analysis, transport planning, demand forecasting, infrastructure design and preliminary economic assessment identified that a new, underground West Metro rail line linking the Sydney CBD with Parramatta/Westmead was the preferred option for the corridor. The line would follow an alignment south of the Parramatta River and north of the existing rail line, connecting to the CBD Metro at Central.

3.4.2 Station location analysis

Once the strategic merit of the West Metro had been established potential station locations were assessed in more detail. A range of criteria was used to determine stations which would provide the best mix of origins and destinations with a direct and operable alignment. This mix aimed to reflect a variety of station types, origins and destinations, primary access modes, demand patterns and timing for their peak potential growth, to ensure a viable system from the start while aiming for sustainable growth over the corridor in the longer term.

The assessment criteria included:

- Transport and land use planning principles.
- Demand forecasting.
- Environmental constraints and risk.
- Architectural and place-making principles.
- Alignment and station infrastructure design.
- Constructability and capital cost.
- Operational issues.
- Property acquisition and opportunities for cost recovery.

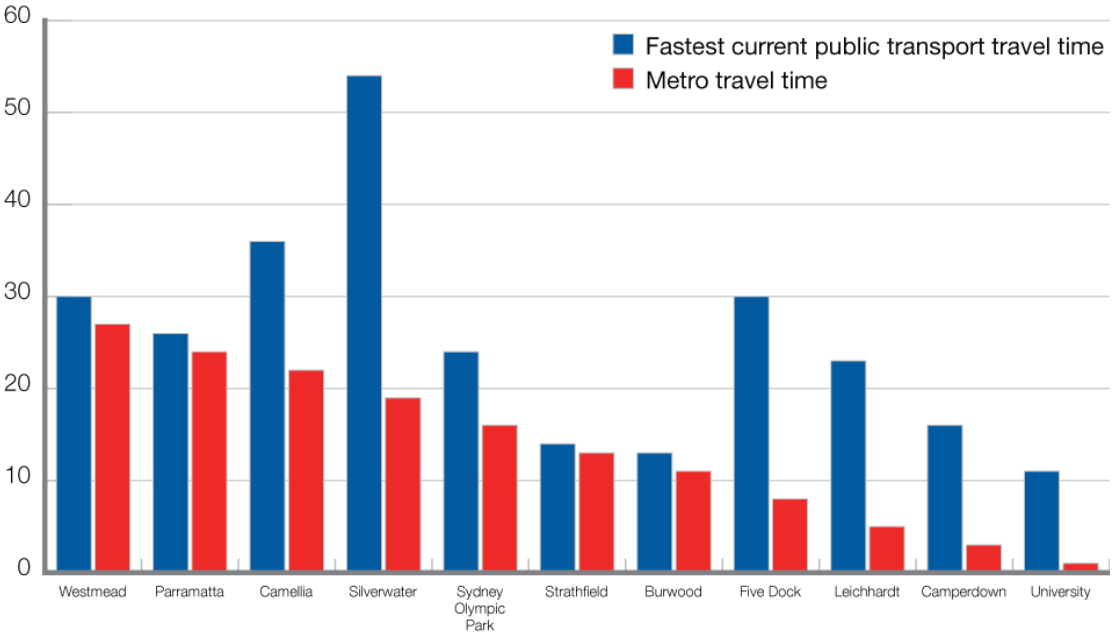
3.4.3 Preliminary demand forecasting

Travel times

Travel times for the West Metro have been estimated using the horizontal and vertical alignment, and a series of operating specifications. Indicative travel times for metro trips have been prepared, based on train simulations.

A comparison of these times to the fastest comparable journeys as defined by service timetables is shown Figure 3.4. Currently, CityRail journeys from Westmead, Parramatta and Strathfield stations can be an additional 5 to 10 minutes slower as passengers need to wait for the next train. Bus travel times from the Inner West are unreliable and vary considerably due to road congestion during peak hours. West Metro travel times will be consistent and average wait times would be no more than 3 minutes.

Figure 3.4 Comparison of peak hour travel times to Central station (minutes)



Demand modelling

The Sydney Strategic Travel Model (STM) was used to prepare a series of preliminary demand forecasts for the feasibility study. These forecasts assisted in identifying station locations and assessing preliminary project viability. The STM is a strategic, metropolitan-wide policy model for the Greater Sydney area, operated by NSW Transport and Infrastructure's Transport Data Centre. The STM is used by the NSW Government to make policy decisions regarding integrated transport strategies for Sydney and underpins most decisions regarding Sydney's future directions.

Further demand modelling has been undertaken using the Zenith model of Sydney, developed for Sydney Metro by Veitch Lister Consulting. The model reflects the choice of trip frequency, destination, mode and route for travel undertaken by residents and visitors during an average weekday.

The model is calibrated against surveys of travel behaviour in Australian capital cities to reflect the demand for travel by residents and visitors during an average weekday, within Sydney. The model has been validated against the Sydney Household Travel Survey (HTS) and Journey-to-Work (JTW) information (2006 Census), as well as traffic counts provided by the RTA and passenger and ticket counts provided by RailCorp.

The Zenith model provides a range of demand forecasts, resulting from changes in land use or demography, and from changes in transport infrastructure, services or prices. Factors such as changes to preferences for transport modes, economic development, fare levels and structures, parking policies and road congestion levels would also influence future patronage.

The Zenith outputs have been compared with available literature and with outputs from the STM to ensure an appropriate basis for use in metro planning and evaluation.

Preliminary analysis of a Metro 1 line from Parramatta/Westmead, via Sydney CBD along the Victoria Road corridor towards the north west indicates that the line would attract between 55,000 and 74,000 boardings in the AM peak hour (2031). Between 24,500 and 32,500 of these boardings are estimated to occur on the West Metro component of the Metro 1 line – that is from Westmead to Sydney University station. The peak line load in 2031 is estimated to be between Sydney University and Central, with between 17,000 and 23,000 people travelling in an eastbound direction. The peak line load on the West Metro component of the Metro 1 line is estimated to be between 16,500 and 22,500 people travelling from Camperdown to Sydney University.

Table 3.1 provides an overview of the AM peak line load[1] and boarding estimates[2] for 2031 for the CBD Metro with the West Metro extension, and the Metro 1 line (CBD Metro extended to the west and north west).

It should be noted that these estimates are based on total population and employment growth forecasts that are consistent with the planned growth as indicated in the *Metropolitan Strategy*, that is, 6 million people and 2.5 million jobs by 2031. A higher growth assumption and/or a redistribution of growth around corridors/nodes with good public transport services would further increase the estimated range of metro boardings by 5-10%.

Table 3.1 West Metro patronage forecasts – AM peak boardings (2031)

	CBD + West Metro	**CBD + West + North West Metro**
Boardings		
	45,000 – 60,000	55,000 – 74,000
	West Metro component 26,000 – 35,000	**West Metro component** 24,500 – 32,500
Peak line load (direction, location)		
	18,000 – 25,000 (University - Central)	17,000 – 23,000 (University - Central)
	West Metro component 18,000 – 25,000 (Camperdown - University)	**West Metro component** 16,500 – 22,500 (Camperdown - University)

Source: Sydney Metro, Zenith demand estimates (LU3a), July 2009

The metro system will be capable of carrying from 29,000 up to 40,000 passengers per hour in each direction, depending on the frequency, train configuration and seating arrangement. These forecasts are manageable within the planned capacity of the line.

[1] Line load is the number of people on the metro train at a particular part of the line in between stations, travelling in one direction.

[2] Boardings are the number of people getting on the metro at all stations.

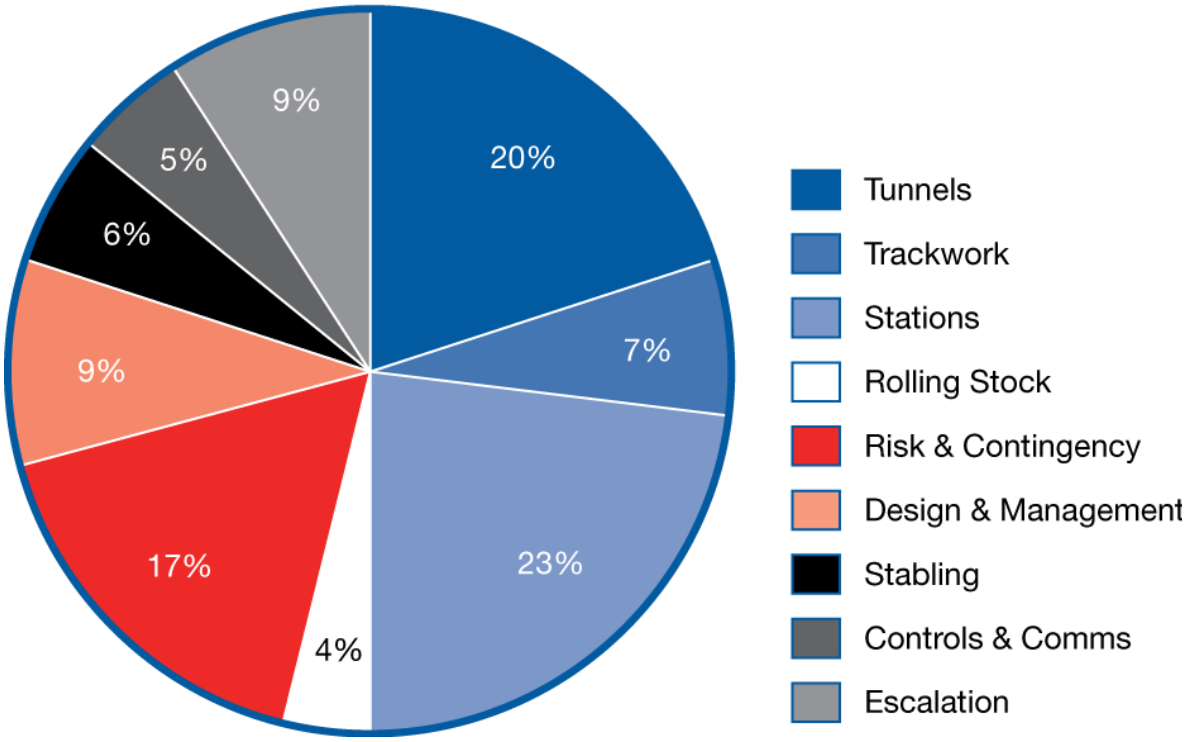
Western rail line relief

The preliminary analysis with STM indicates that total demand in the western rail corridor toward the Sydney CBD is likely to be between 57,000 and 62,000 passengers in the morning peak hour (east of Burwood) in 2031. When the West Metro is in place, the remaining demand on CityRail services is approximately 32,000 to 35,000 passengers (east of Burwood), diverting approximately 40 per cent of the passenger trips from CityRail in the morning peak.

3.4.4 Cost estimation

The West Metro from Westmead to Central station is currently estimated to have a capital cost of approximately $8,300m. A breakdown of the base cost elements, as a percentage, is shown below.

Figure 3.5 Base cost elements



Operating costs have been estimated to reflect the particular circumstances of the CBD and West Metro, including the use of the latest proven technology and assumed levels of outsourcing. Overseas cost information has been treated with caution given variations in prevailing market conditions and exchange rates. The cost estimates used are life cycle average (annualised) costs which have been built from the bottom up.

3.4.5 Preliminary economic analysis

The preliminary economic appraisal was undertaken in accordance with the relevant guidelines for cost-benefit analysis as provided by NSW Treasury and the Australian Transport Council. It also addressed the Infrastructure Australia criteria for project prioritisation. The appraisal used a generalised multi-modal cost-benefit analysis framework and discounted cash flow model. This framework assessed the potential change in economic welfare of the preferred corridor option by considering the following parameters:

- Project capital costs.
- Project recurrent costs.
- Vehicle operating costs.
- Public transport user travel time costs (including crowding).
- Net incremental revenue.
- Road decongestion costs.
- External costs (such as environmental costs).

The general assumptions used in this economic appraisal were as follows:

- Cash flows were included in the period in which they occur.
- The base year is 2008/09.
- All values were expressed in constant dollars, unless otherwise stated.
- Prices were expressed in 2008/09 dollars.
- The evaluation period for the West Metro starts in 2008/09 and ends in 2046/47 (30 years after the Project Case opens in 2017/18). This is in line with the Treasury and ATC Guidelines that the project is to be evaluated over a 30 year period from the first year of full operation.
- Future net benefits were discounted to the base year of 2008/09 using a real discount rate of 7 per cent.

The base case against which the costs and benefits of West Metro options were assessed included the public and private transport infrastructure and service improvements which would occur in the absence of the West Metro.

The economic appraisal was based on the demand forecasting outputs generated using the STM. These forecasts were used in this economic appraisal to identify:

- Changes in patronage following the opening date of the project.
- Changes in passenger trips and hours attributable to mode stayers, mode diverters and induced trips, by mode.
- Changes in vehicle kilometres travelled (VKT).
- Changes in fare revenue.

Preliminary passenger demand forecasts were estimated for the morning peak hour. Annualisation factors were used to expand the morning peak hour to yearly figures.

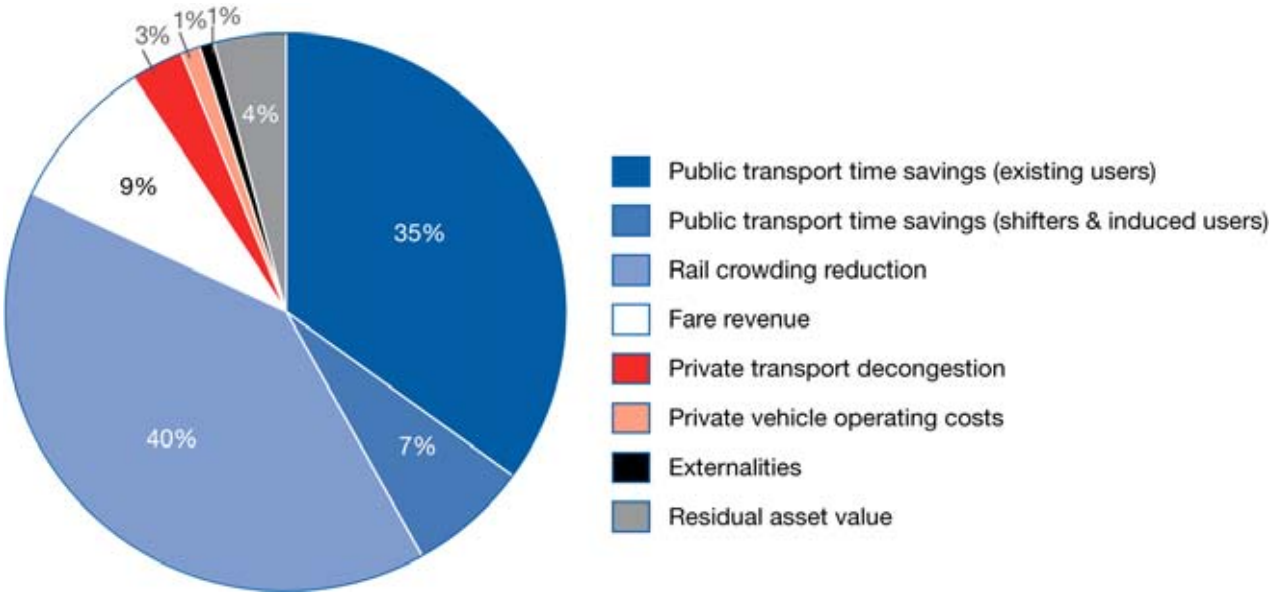
Economic benefits

Public transport infrastructure, such as the West Metro, provides a wide range of benefits to society. The following benefits have been included in this economic appraisal:

- Public transport user cost savings (savings in travel time costs).
- Private transport user cost savings unperceived savings in the resource value of vehicle operating costs).
- Third party savings (savings in decongestion and savings in externality costs).
- Incremental fare revenues.
- Residual value of assets.

The figure below illustrates the proportions of the different benefits calculated in the preliminary economic analysis.

Figure 3.6 Distribution of benefits



3.4.6 Preliminary business case

The station locations and alignment established in the West Metro feasibility study have been used as the basis for patronage forecasts, engineering and infrastructure designs, and preliminary environmental investigations. Together with operational specifications derived from the CBD Metro and an initial risk assessment, a preliminary cost plan was prepared to develop the preliminary business case.

The economic analysis demonstrated that the West Metro would generate significant benefits in the form of public transport travel time savings and congestion relief. Train passengers in the western corridor will benefit from faster travel times on the West Metro and reductions in crowding on CityRail services. Bus passengers in inner areas will be able to reach the CBD and other destinations much faster and more reliably on the West Metro. Road congestion will be alleviated by people switching from cars to the metro, and from reductions in bus traffic, particularly in the CBD.

The incremental network revenue generated by West Metro will cover incremental network operating expenses within 12 years of opening.

Other unquantified benefits identified include:

- Potentially under-estimated benefits of the West Metro for non-passengers.
- The long term city-shaping nature of major transit infrastructure.
- The contribution a metro network would make to Sydney's international competitiveness.
- Uncertainties regarding the true cost of carbon.

The construction of West Metro is likely to result in wider economic impacts that will increase the benefits quantified in the economic appraisal. Wider economic impacts include agglomeration (commercial activities being located closer together), densification of labour markets, and the transition to more productive/higher value employment activities, as well as organisations' and households' behavioural adaptations to changes in transport costs and improvements in accessibility.

3.5 Summary

The West Metro feasibility study demonstrated that the western corridor is the busiest transport corridor in Sydney, with businesses contributing 12 per cent of the total national Australian GDP and over 38 per cent of the GDP of the Sydney area. Transport links in this corridor are currently experiencing congestion during peak periods. This congestion increasingly extends into business hours and occurs on weekends. Rail services, buses and the road network will be significantly constrained into the future without significant investment in infrastructure.

With the recent acceleration in Sydney's population growth driven by high rates of immigration and a spike in the fertility rate, Sydney is expected to increase its dominance of the State's population as it grows from 4.3 million in 2006 to 6.0 million in 2036. The western corridor contains many opportunities for significant urban change and renewal, such as in the lower density areas of Harris Park, Rosehill, Camellia, Silverwater and Homebush Bay. Achieving such urban change has been an important element of station and alignment planning.

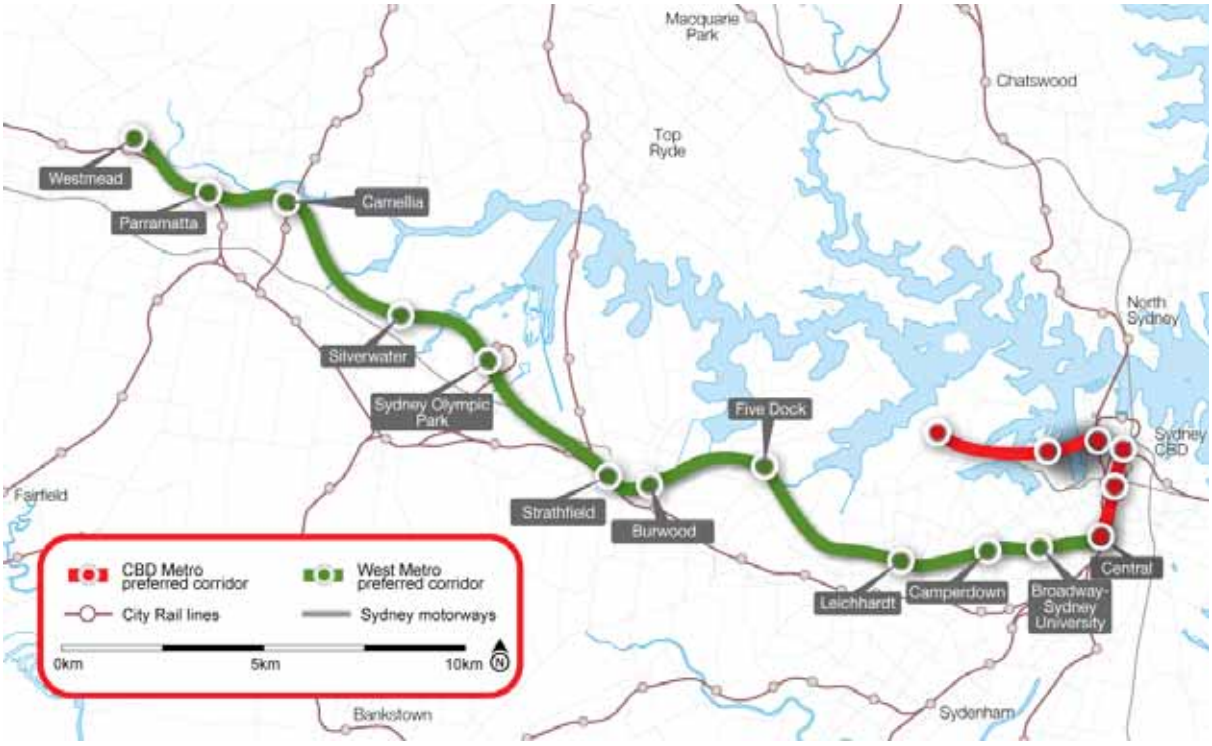
As part of a future metro network for Sydney, the West Metro will provide a new rail line with high-frequency, rapid train services, serving strategically-located stations between Sydney CBD, Parramatta and Westmead. It has the potential to significantly reduce travel times between western Sydney and the Sydney CBD, and to relieve congestion in the western rail corridor and the broader rail network. The West Metro will considerably strengthen Parramatta's role as Sydney's second CBD. It will also provide significant support for transit-oriented development, urban revitalisation and services to new rail markets.

4 Description of the project

4.1 Overview

The West Metro is a metro rail line from Westmead to Central, connecting directly to the CBD Metro, with new stations at Westmead, Parramatta, Camellia, Silverwater, Sydney Olympic Park, Strathfield, Burwood, Five Dock, Leichhardt, Camperdown and Broadway-Sydney University. The alignment and stations of the CBD Metro and West Metro are shown in Figure 4.1.

Figure 4.1 CBD Metro and West Metro showing indicative alignment and station localities



Appendix A shows the indicative preliminary alignment and Appendix B shows the indicative station locations in more detail.

The station locations have been selected to provide a range of station types, origins and destinations, urban environments, interchange opportunities, and trip purposes, so as to build a robust patronage pattern and to encourage full use of the system.

Construction of the West Metro could commence by 2011, with operation to commence in 2017.

The key features of the transport product for the West Metro are described in Table 4.1.

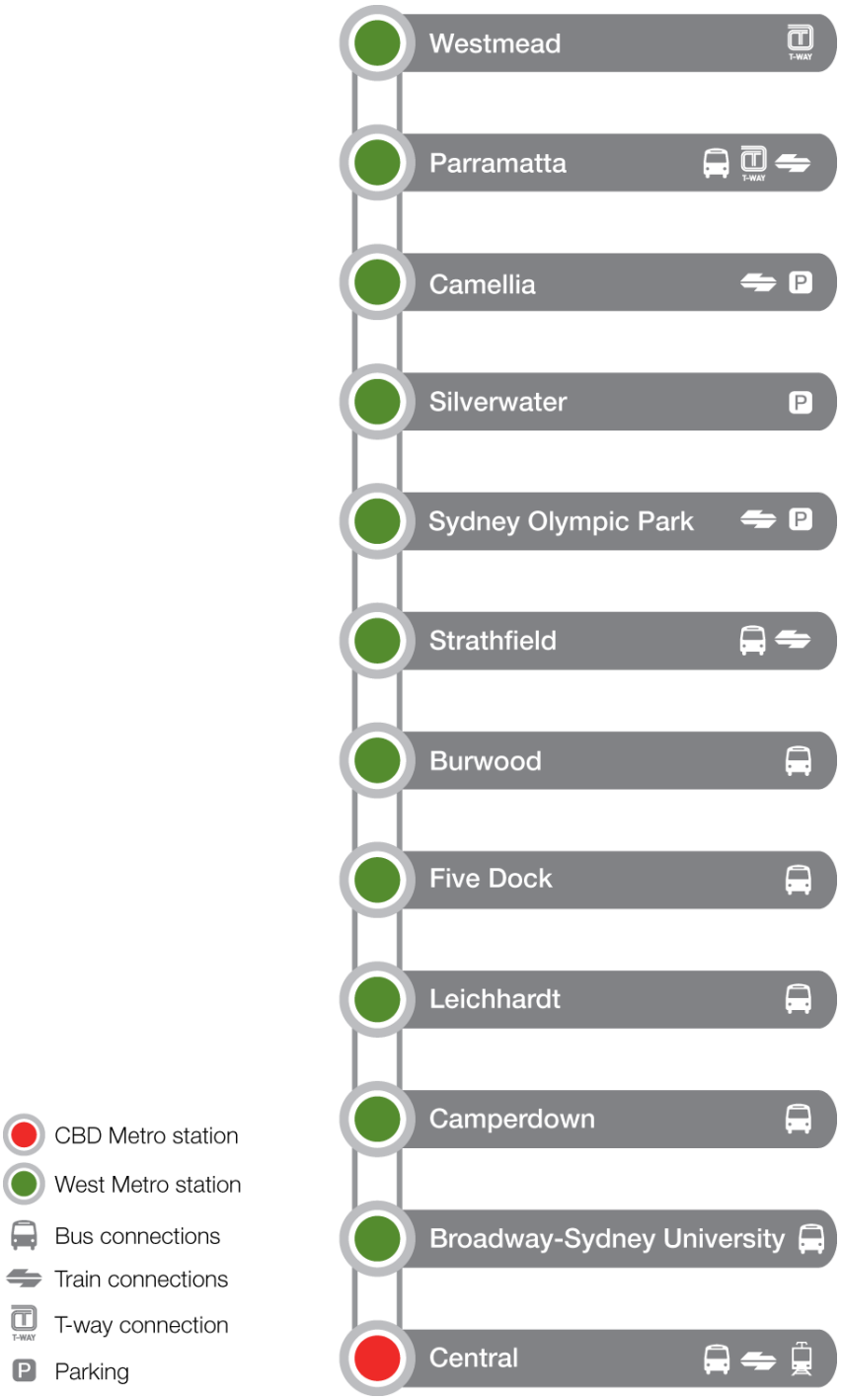
Table 4.1 Metro transport product

Description	Details
Station and service access	
Stations	• 11 stations: Westmead, Parramatta, Camellia, Silverwater, Sydney Olympic Park, Strathfield, Burwood, Five Dock, Leichhardt, Camperdown and Broadway-Sydney University.
Bus interchanges	• Key bus/metro interchanges at Westmead, Parramatta, Strathfield, Burwood, Five Dock and Leichhardt.
Rail interchanges	• Direct interchange with CityRail services at Parramatta, Camellia and Strathfield.
Park and ride	• Camellia, Silverwater.
Station features	• Safe and secure. • Platform screen doors. • Automatic ticket gates. • Accessible. • Well-lit (through natural light and ventilation where practicable). • Long-term capacity for 6-car trains.
Ticketing	• Smart card system, which is tag-on tag-off, contact-less. • Integrated with Sydney's wider transport network.
Operations	
Frequency of service	• 2-3 minutes in the peak; a daytime maximum wait of 5 minutes in the off-peak.
Hours of operation	• 24/7 operational capability with proposed 05:30 to midnight opening (Sunday to Thursday) extended to 01:00 Friday/Saturday night.
Patronage	• 144 million per annum, and 45 - 60,000 in the am peak hour (2031).
Infrastructure	
Route length	• 24.1 km, all underground.
Alignment	• Designed for up to 100 km/hr and maximum gradient of 4.5%.
Tunnel dimensions	• Twin 5.7-metre internal diameter segmentally-lined tunnels, consistent with CBD Metro.
Bulk power supply	• Designed in conjunction with CBD Metro.
Traction power	• 1500 volt direct current (recommended) and consistent with CBD Metro.
Rolling stock	
Train type	• Single-deck metro air-conditioned trains. • 110 metres long. • Body width: 3.2 metres. • 5 cars per train, with provision for 6-car operation. • 3 bi-parting doors per side per car to allow easy entry and exit.
Train control	• Automatic driverless trains controlled from a central Operations Control Centre at Rozelle, consistent with CBD Metro.
Train capacity	• Capacity for between 29,000 and 40,000 passengers per hour, per direction (depending on frequency and train seating arrangements).

4.2 Stations

The eleven new underground West Metro stations will be located at Westmead, Parramatta, Camellia, Silverwater, Sydney Olympic Park, Strathfield, Burwood, Five Dock, Leichhardt, Camperdown and Broadway-Sydney University. The transport characteristics of each station are illustrated diagrammatically in Figure 4.2.

Figure 4.2 West Metro stations



Together with the CBD Metro, the West Metro will set a new benchmark for customer experience with fast, frequent and reliable services.

West Metro stations will be safe, well-lit and visually appealing. Each station will be designed for easy access, providing access for pedestrians (including mobility and sensory-impaired customers and people with strollers) and cyclists, with appropriate bicycle storage, and interchange with rail, bus and T-way.

Consistent with the Ministry of Transport Interchange Guidelines, the key focus is on efficient, sustainable modes of travel. Station design priority will be given to pedestrian and cycling access, followed by public transport, taxi and kiss-and-ride. Conflict between pedestrians and cyclists and other station access modes will be minimised.

An access strategy will be developed for each of the West Metro stations, based on an assessment of station connectivity and accessibility in the context of specific customer needs. Bus and rail connectivity and walking and cycling to stations will play a key role in accessing the West Metro.

Stations will be sized to provide adequate space for:

- Suitable access points to the street level that suit the needs of the customer.
- Public areas e.g. unpaid concourse, paid concourse and platforms.
- Staff facilities.
- Retail and commercial development.
- Station electrical and mechanical services.
- Tunnel services, including ventilation systems.
- Rail systems.
- Egress in the event of an emergency.

There will be ventilation (air vent) shafts incorporated at each station. An air vent shaft is a vertical passage to bring fresh air underground and prevent the build up of hot air in the metro tunnel. There will be nominally four ventilation fans at each station. During operation, tunnel emissions (via ventilation points) will not affect air quality, as the project will use electric trains (see Section 7).

Each proposed station location is described in further detail below, focusing on the strategic role of each station. The areas and sites identified represent a preferred position, but will be subject to further design development, environmental assessment, constructability investigations, property negotiations, and community consultation. A flexible approach to property requirements will be adopted, with a focus on minimising property acquisition.

Further detailed assessment and design at each station location is required to confirm station entrance points, including construction areas. Entrance points will be integrated with surrounding land uses (existing and planned future, as relevant) and be designed to integrate with public space.

Concurrent with preparation of the EA document, Station Plans will be prepared to ensure development in the vicinity of the proposed stations proceeds in a coordinated way that supports the metro (i.e., improves access and patronage) and other strategic plans or developments. It is a requirement of the Sydney Metro legislation that Station Plans are prepared.

4.2.2 Westmead

The preferred location is beneath the existing T-way stop on Darcy Road.

Key outcomes
The preferred Westmead station location will provide:

- Better access to hospital and education facilities for patients, visitors, students and employees.
- A better pedestrian environment through Westmead's health and education campus, for example by providing better connection across Darcy Road.
- Improved travel choice options for people of the north west who could use T-way and metro services for fast, frequent and reliable trips to a wider range of destinations than currently available.
- Better access for people from other parts of Sydney to Westmead for work, health care and education.
- Support to land use change and redevelopment of government-owned lands.
- An alternative link for local trips between Parramatta and Westmead.

Projected travel times
The preferred Westmead station location is 24.1 kilometres from Central station. Travel times from Westmead station to key destinations are shown in Table 4.2.

Table 4.2 Westmead station summary

Westmead		
Type	Specialised centre	
Station function(s)	• Health/education destination. • Bus/metro interchange.	
2031 population catchment (1000m)	18,900 (93% increase from 2006)	
2031 employment catchment (1000m)	18,400 (23% increase from 2006)	
Distance to Central	24.1 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	27 mins (3 min faster)
	Wynyard	33 mins (5 min faster)
	Parramatta	2 mins (2 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.3 Station construction plan – Westmead

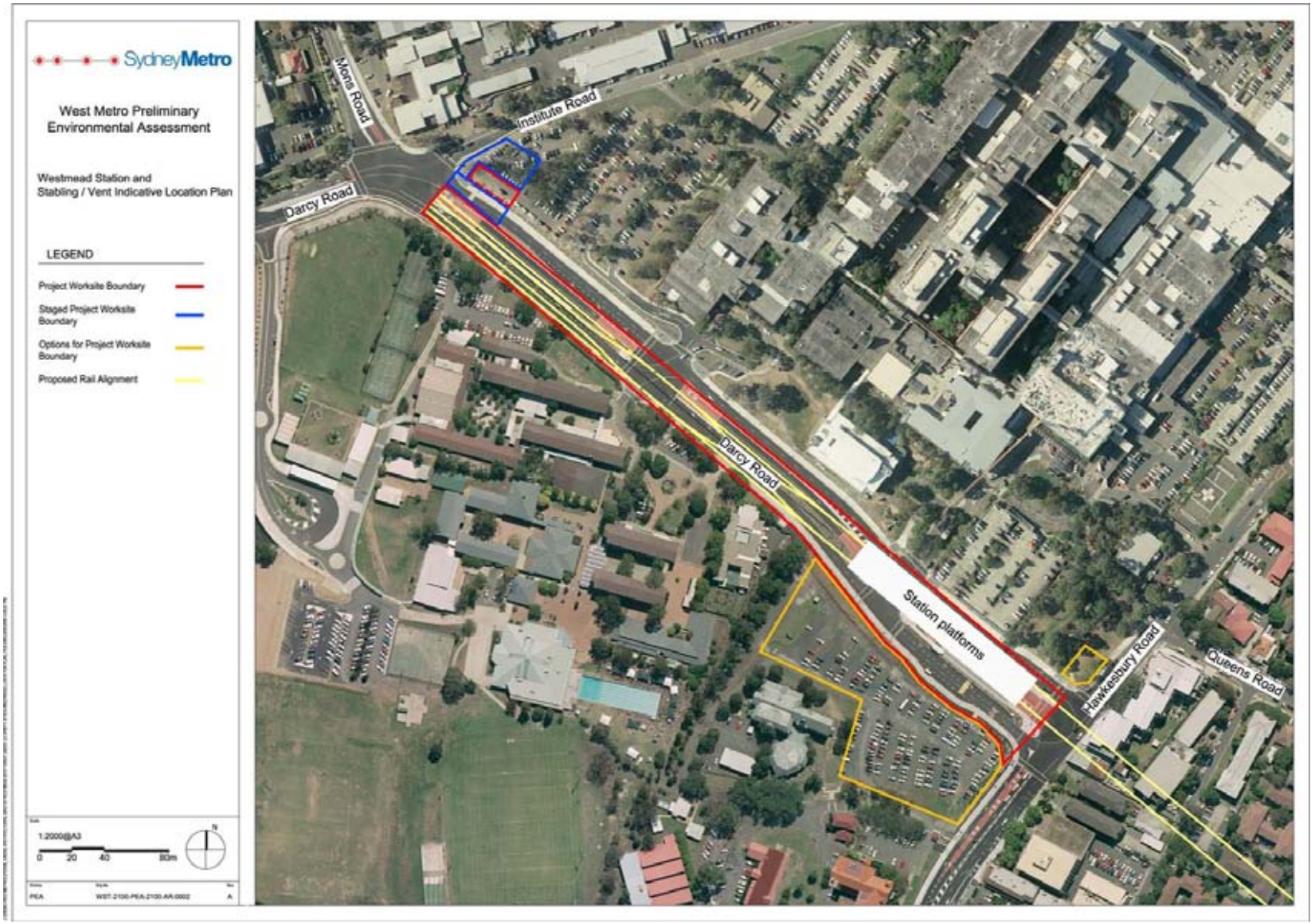
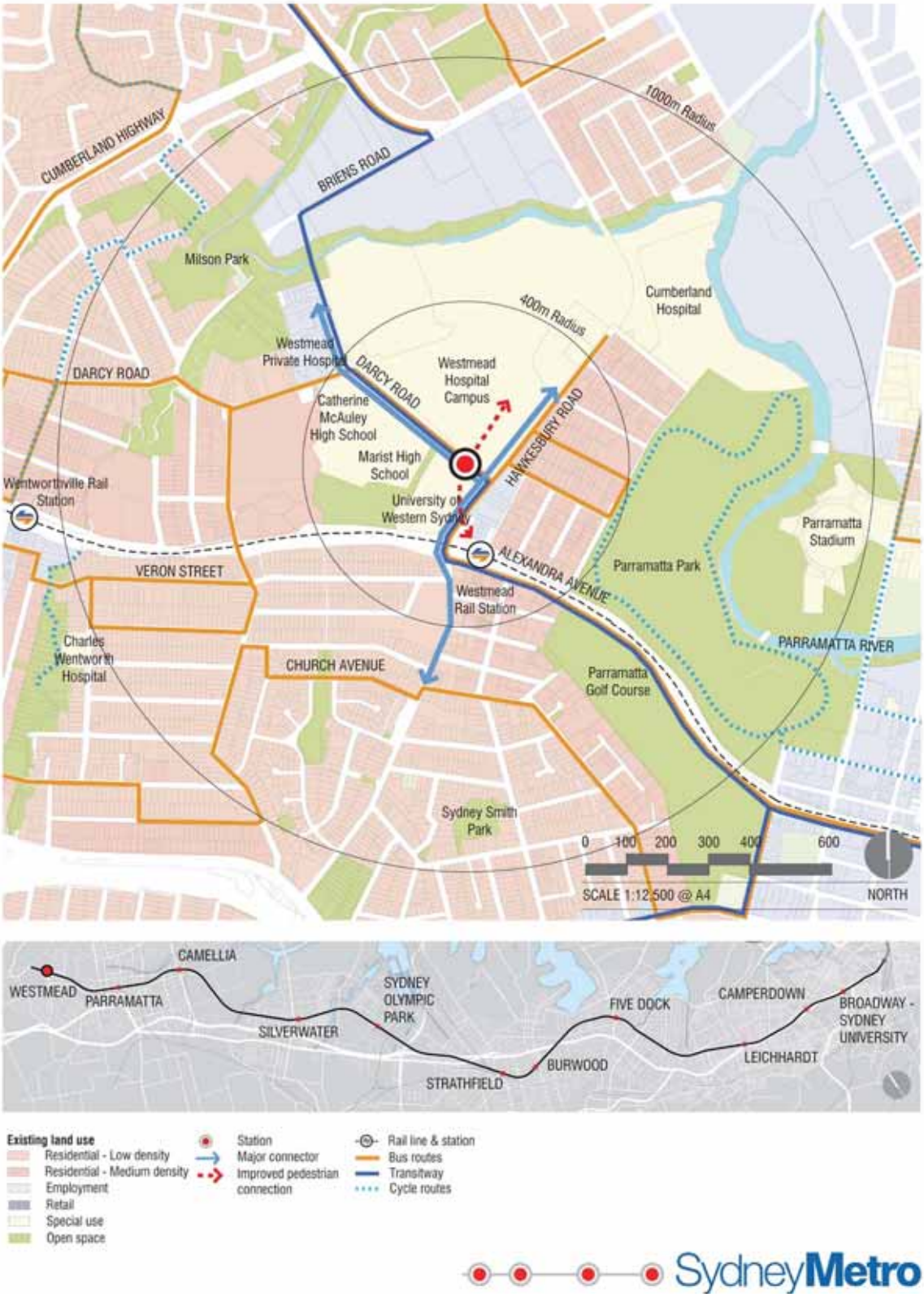


Figure 4.4 Station context plan – Westmead



4.2.3 Parramatta

The preferred location for a station at Parramatta is in the Civic Place site, a master-planned commercial and civic redevelopment, between Parramatta Transport Interchange and Macquarie Street.

Key outcomes

The preferred Parramatta station location will:

- Provide a more reliable, fast travel time to job opportunities at both current and new employment destinations for Parramatta commuters.
- Provide a rapid and frequent link for local trips between Parramatta and Westmead.
- Increase travel choice options for people of the north west who could use T-way and metro services for fast, frequent and reliable trips to a wider range of destinations than currently available.
- Improve pedestrian amenity between Parramatta Transport Interchange and Macquarie Street as part of an integrated redevelopment of Civic Place.
- Reduce bus transfer times for people coming into Parramatta from the north east, by allowing transfer from Smith Street directly to rail services.
- Enable people from other parts of Sydney to reach Parramatta conveniently and reliably for work, shopping and recreation, and to access legal, health care and education services.

Projected travel times

The preferred Parramatta station location is 22.2 kilometres from Central station. Travel times from Parramatta station to key destinations are shown in Table 4.3.

Table 4.3 Parramatta station summary

Parramatta		
Type	Regional city	
Station function(s)	• Rail/metro interchange. • Bus/metro interchange. • Employment destination.	
2031 population catchment (1000m)	46,700 (239% increase from 2006)	
2031 employment catchment (1000m)	60,000 (44% increase from 2006)	
Distance to Central	22.2 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	24 mins (2 min faster)
	Wynyard	30 mins (7 min faster)
	Parramatta	- mins

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.5 Station construction plan – Parramatta

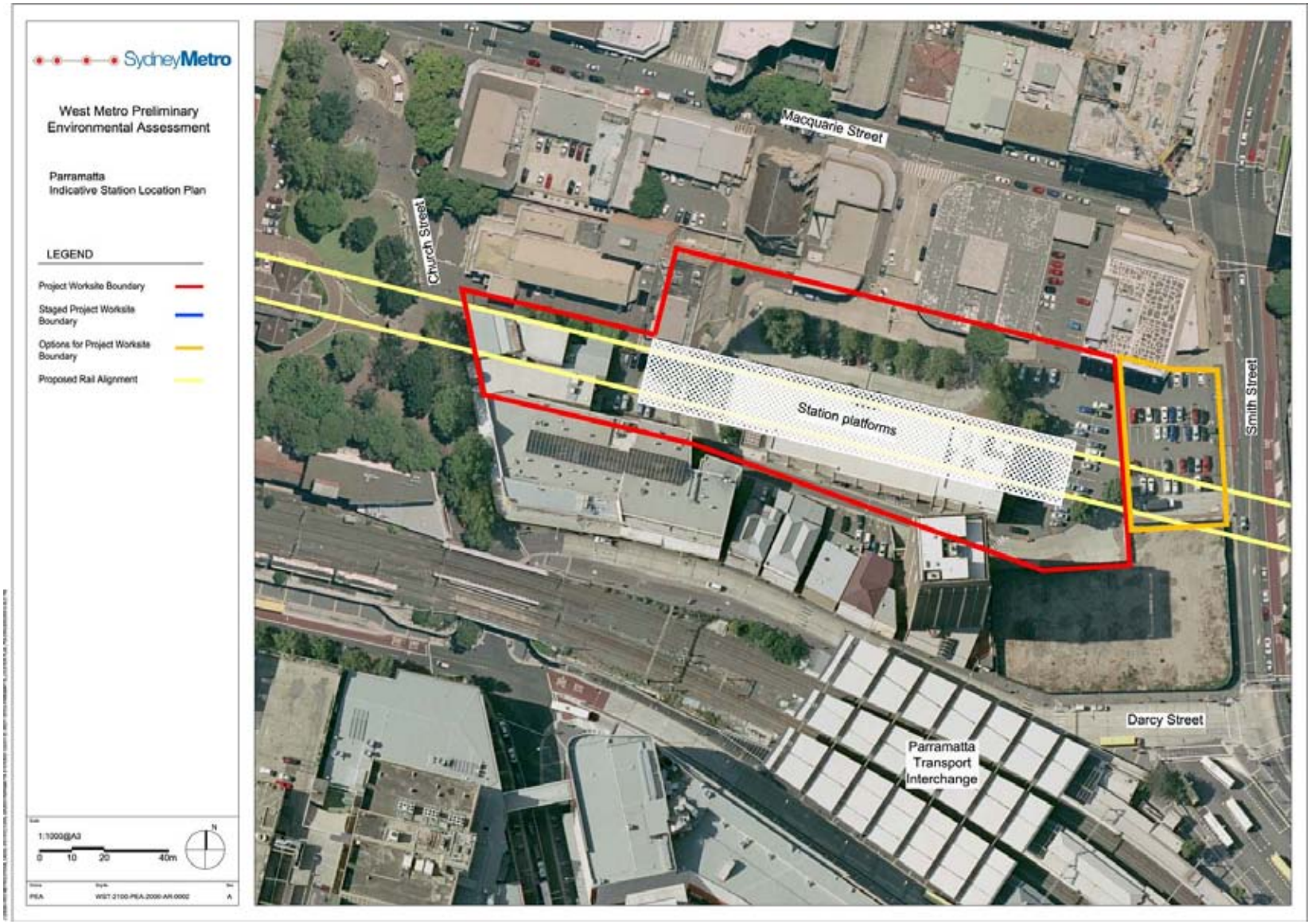


Figure 4.6 Station context plan – Parramatta

SydneyMetro

4.2.4 Camellia

The preferred location for a station at Camellia is to the north east of the intersection of Hassall Street and James Ruse Drive and to the west of the CityRail's Camellia station.

A large scale park and ride facility would be provided at Camellia station to enable people travelling from the north and northwest to transfer from their cars (or the Carlingford line connection) on to rapid and frequent rail services towards Sydney or Parramatta.

Key outcomes
The preferred Camellia station location will:

- Improve public transport access for people north of Parramatta, including those who currently use the Carlingford line.
- Improve access for students to UWS at Rydalmere, adjoining industrial estates and the Rosehill employment, residential and entertainment areas.
- Improve travel choices for workers at Camellia who are currently car-dependent for work trips.
- Provide the potential for better access for people who live or work near James Ruse Drive to cross this major road and to access frequent rail services.
- Improve public transport access to events at Rosehill racecourse.

Projected travel times
The preferred Camellia station location is 20.6 kilometres from Central station. Travel times from Camellia station to key destinations are shown in Table 4.4.

Table 4.4 Camellia station summary

Camellia		
Type	Park and ride	
Station function(s)	• Commuter car parking. • Special events. • Employment destination.	
2031 population catchment (1000m)	13,300 (185% increase from 2006)	
2031 employment catchment (1000m)	5,600 (9% increase from 2006)	
Distance to Central	20.6 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	22 mins (14 min faster)
	Wynyard	28 mins (29 min faster)
	Parramatta	1 min (21 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.7 Station construction plan – Camellia

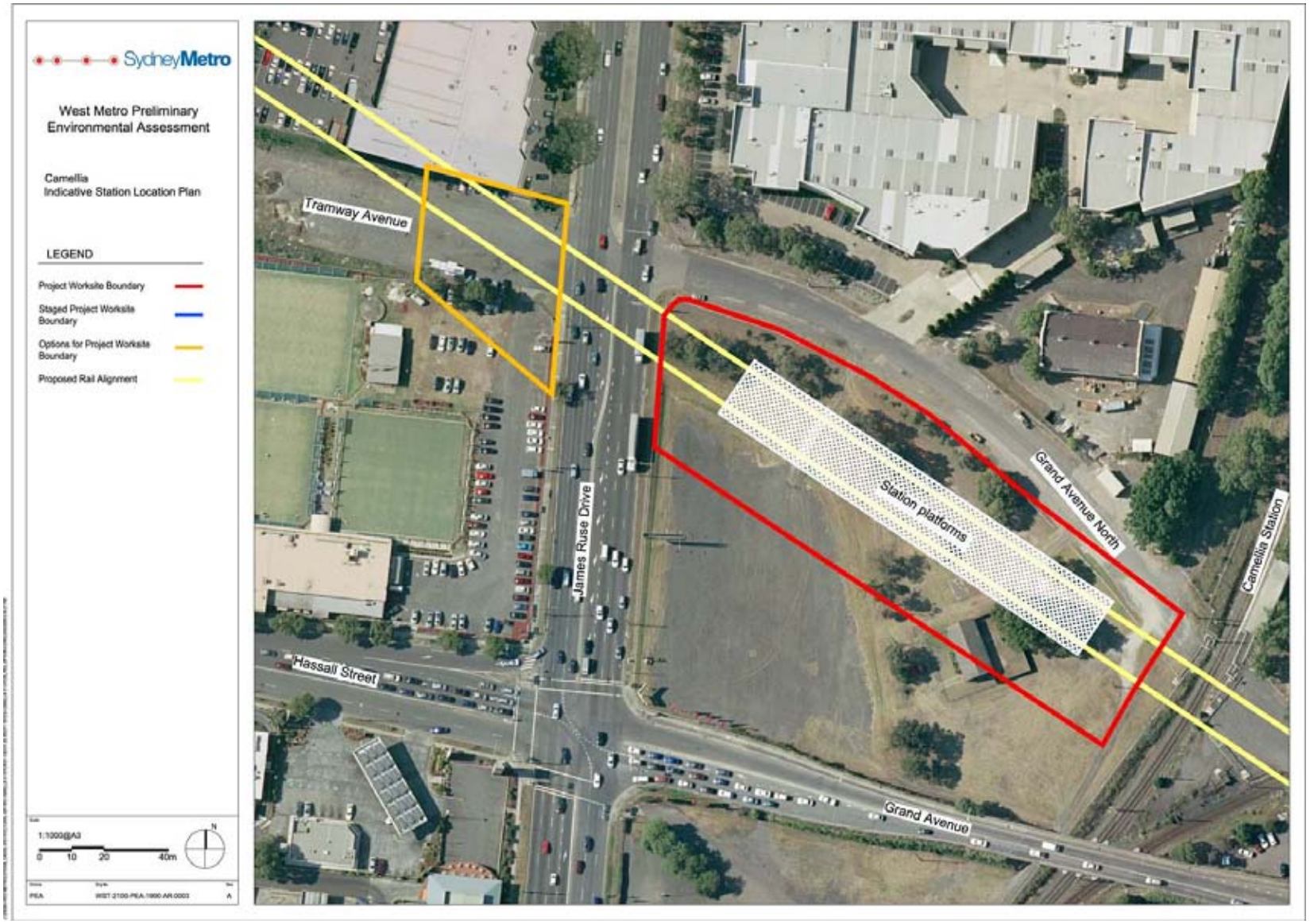
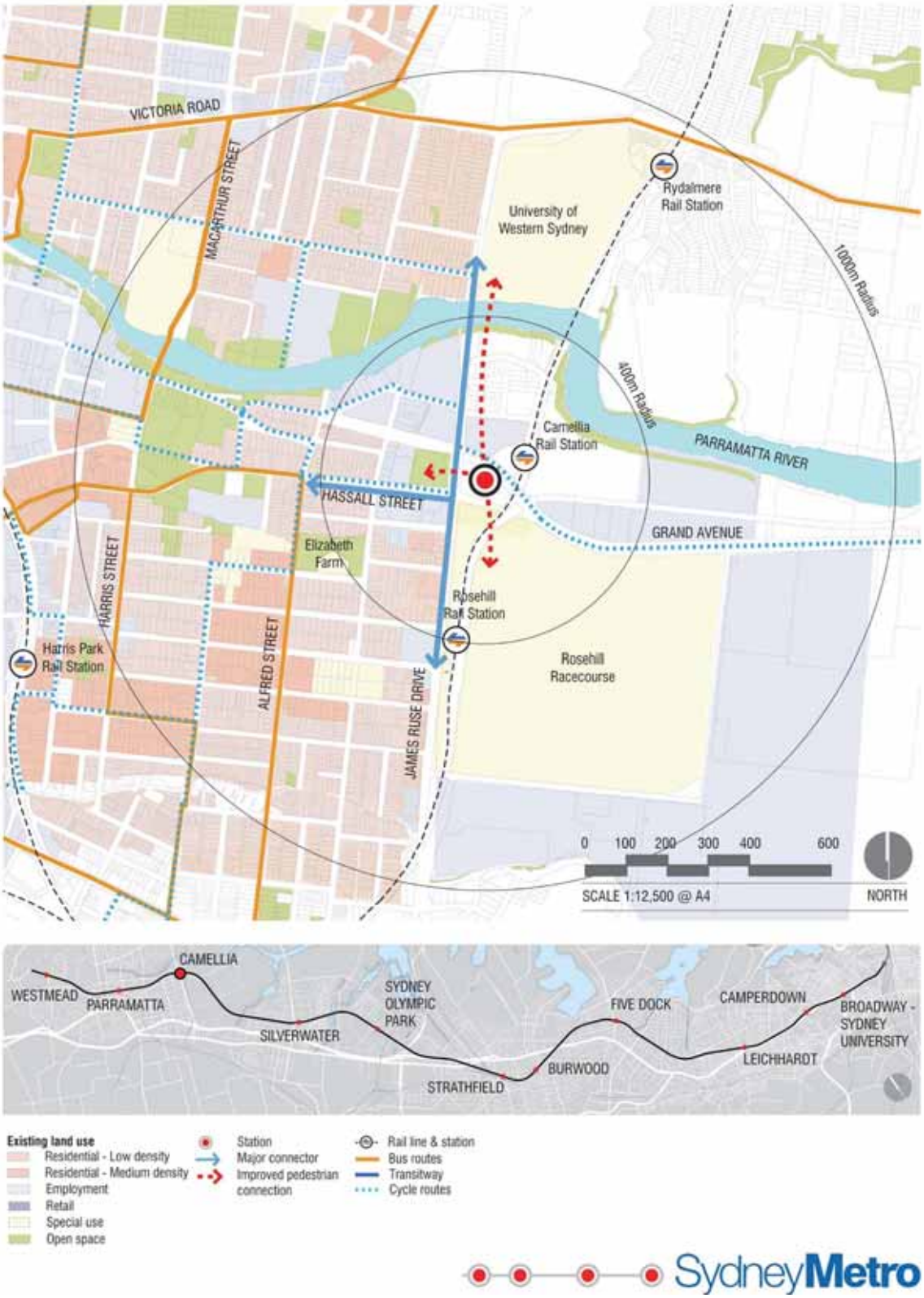


Figure 4.8 Station context plan – Camellia



4.2.5 Silverwater

The preferred location for a station at Silverwater is north of Carnarvon Street, between Silverwater Road and Wetherill Street.

Key outcomes

The preferred Silverwater station location will:

- Provide the option of parking and taking metro services for drivers on Silverwater Road and the M4.
- Improve the urban amenity and accessibility of the area through redevelopment of currently inaccessible sites or those poorly-served by public transport.
- Provide more travel choices for residents of Silverwater, North Auburn and Newington.
- Present opportunities to consolidate residential development north of the M4 Motorway and east of Silverwater Road.
- Make jobs in Silverwater more accessible from other parts of Sydney.

Projected travel times

The preferred Silverwater station location is 17.2 kilometres from Central station. Travel times from Silverwater station to key destinations are shown in Table 4.5.

Table 4.5 Silverwater station summary

Silverwater		
Type	Park and ride	
Station function(s)	• Walk-up residential catchment from Silverwater and North Auburn. • Employment destination. • Park and ride potential.	
2031 population catchment (1000m)	18,800 (139% increase from 2006)	
2031 employment catchment (1000m)	12,800 (13% increase from 2006)	
Distance to Central	17.2 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	19 mins (35 min faster)
	Wynyard	25 mins (36 min faster)
	Parramatta	5 mins (31 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.1 Station construction plan – Silverwater

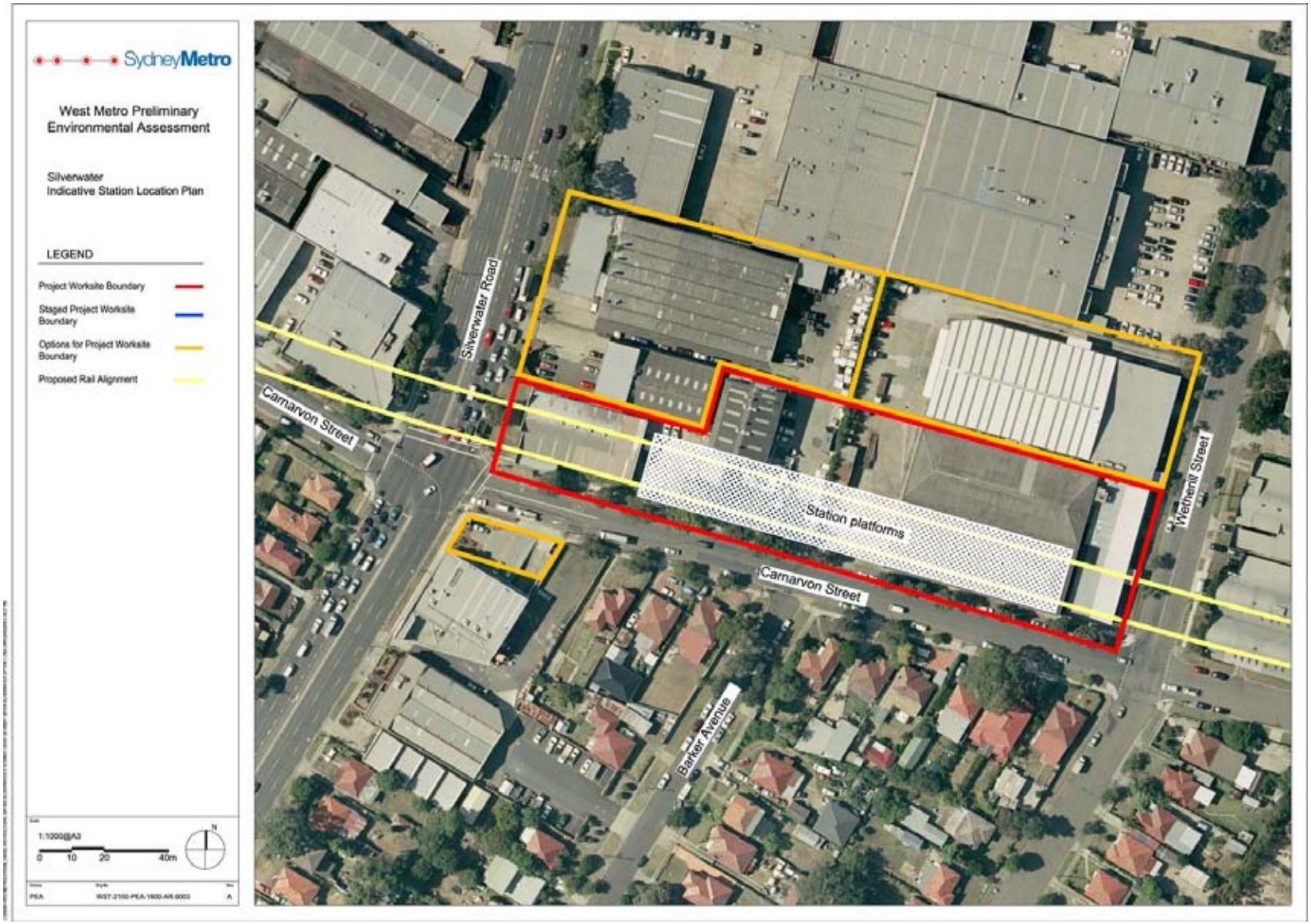
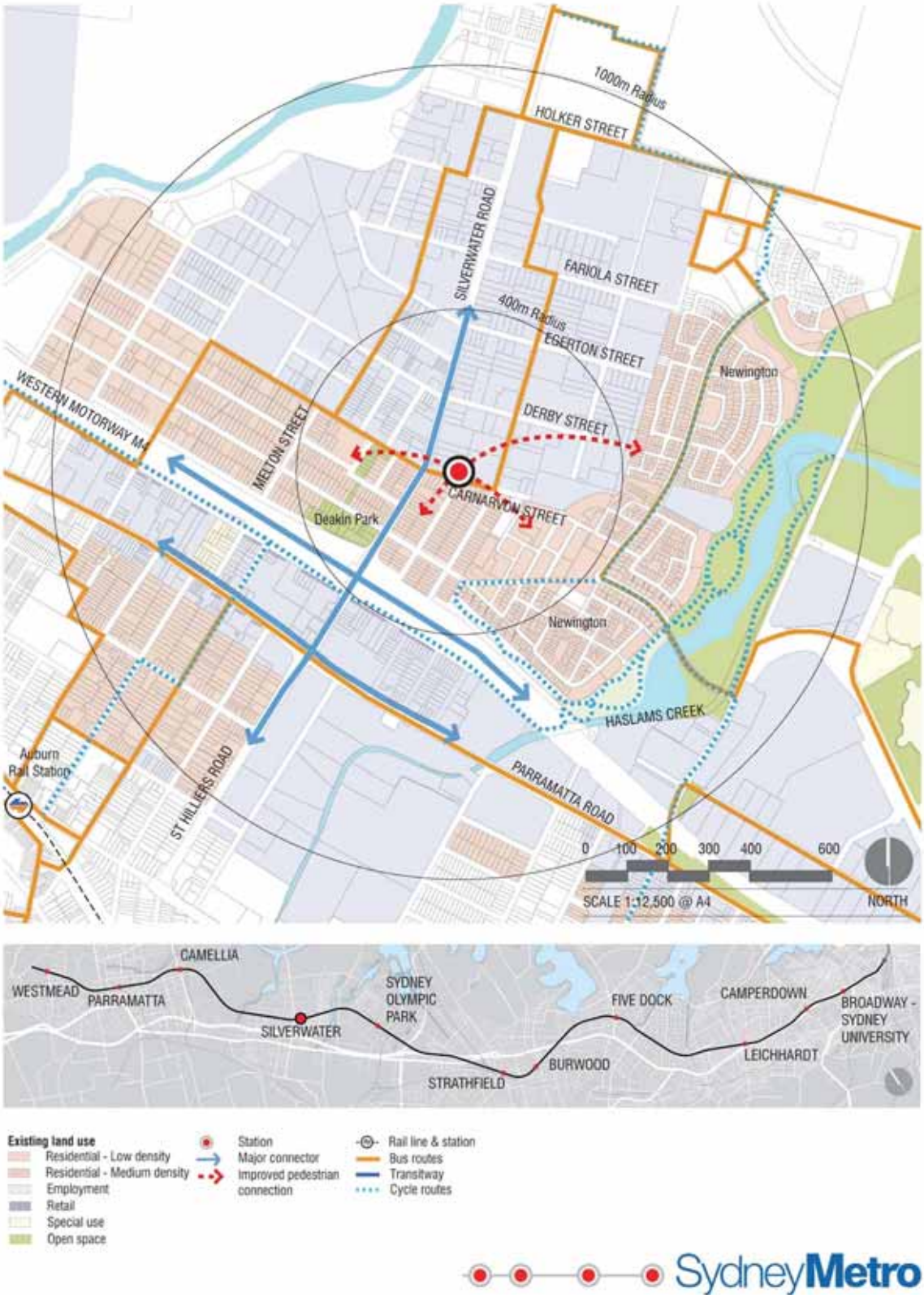


Figure 4.2 Station context plan – Silverwater



4.2.6 Sydney Olympic Park

The preferred location for a station at Sydney Olympic Park is adjacent to the Aquatic Centre on the corner of Dawn Fraser Avenue and Olympic Boulevard.

Key outcomes

The preferred Sydney Olympic Park station location will:

- Support major employment and residential growth envisaged in the Sydney Olympic Park Master Plan.
- Improve the level of public transport service for workers at Sydney Olympic Park and Carter Street, bringing more jobs within reach of the wider Sydney region.
- Provide another means of getting to and from special events, adding significant capacity.
- Provide an opportunity to review bus and rail services for travel to Sydney Olympic Park.
- Provide access to more frequent and regular public transport outside peak hours or special event times.
- Provide a direct and fast link for workers at Sydney Olympic Park to Strathfield and Burwood during the week.
- Provide a direct, fast link for workers and residents at Sydney Olympic Park to shopping and services at Parramatta, Strathfield and the inner west.

Projected travel times

The preferred Sydney Olympic Park station location is 14.9 kilometres from Central station. Travel times from Sydney Olympic Park station to key destinations are shown in Table 4.6.

Table 4.6 Sydney Olympic Park station summary

Sydney Olympic Park		
Type	Specialised centre	
Station function(s)	• Employment destination. • Special events.	
2031 population catchment (1000m)	5,200 (5,621% increase from 2006)	
2031 employment catchment (1000m)	15,500 (282% increase from 2006)	
Distance to Central	14.9 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	16 mins (8 min faster)
	Wynyard	23 mins (20 min faster)
	Parramatta	7 mins (20 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.3 Station construction plan – Sydney Olympic Park

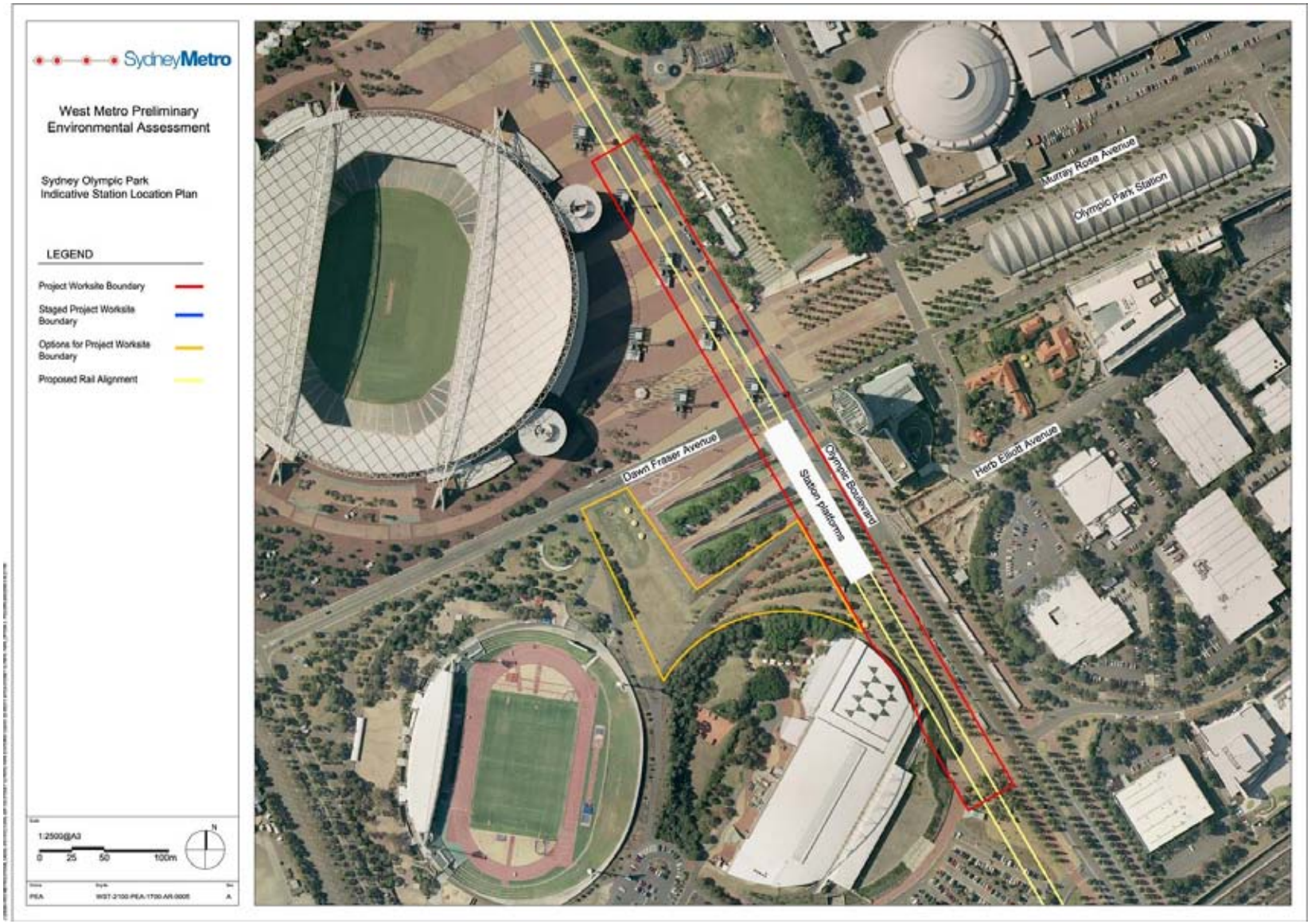
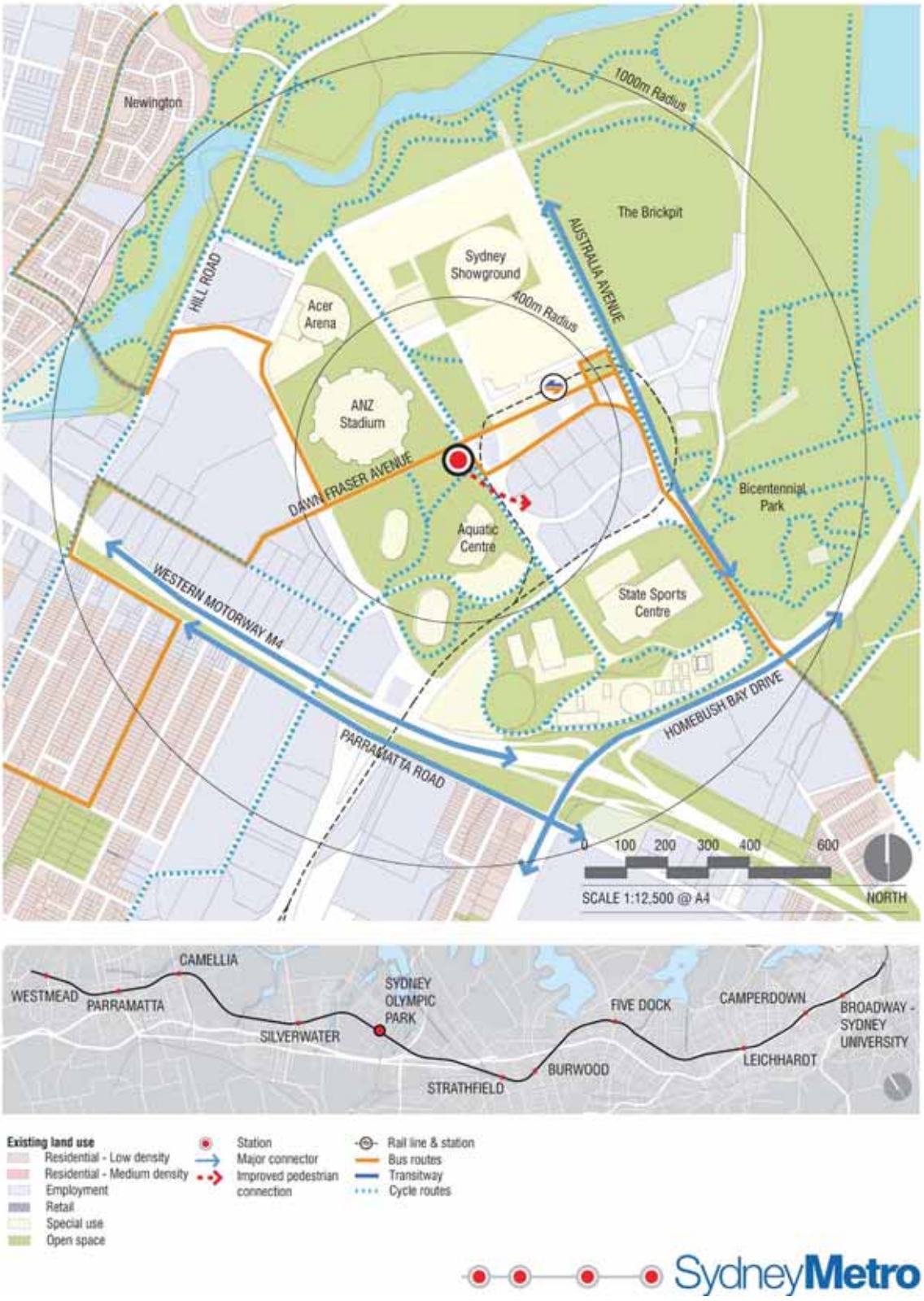


Figure 4.4 Station context plan – Sydney Olympic Park



4.2.7 Strathfield

The preferred location for a station at Strathfield is to the north of the CityRail station beneath Everton Road.

Key outcomes
The preferred Strathfield station location will:

- Enable CityRail and CountryLink passengers from other areas to gain access to a range of new destinations on the metro network, including Sydney University, and other educational or employment destinations.
- Serve areas undergoing urban renewal or redevelopment for residential uses.
- Provide access for Strathfield residents to a wider range of job opportunities.
- Stimulate the improvement of interchange facilities at Strathfield.
- Provide a direct and fast link for workers or residents of Sydney Olympic Park to the shopping and services at Strathfield throughout the week.

Projected travel times
The preferred Strathfield station location is 11.2 kilometres from Central station. Travel times from Strathfield station to key destinations are shown in Table 4.7.

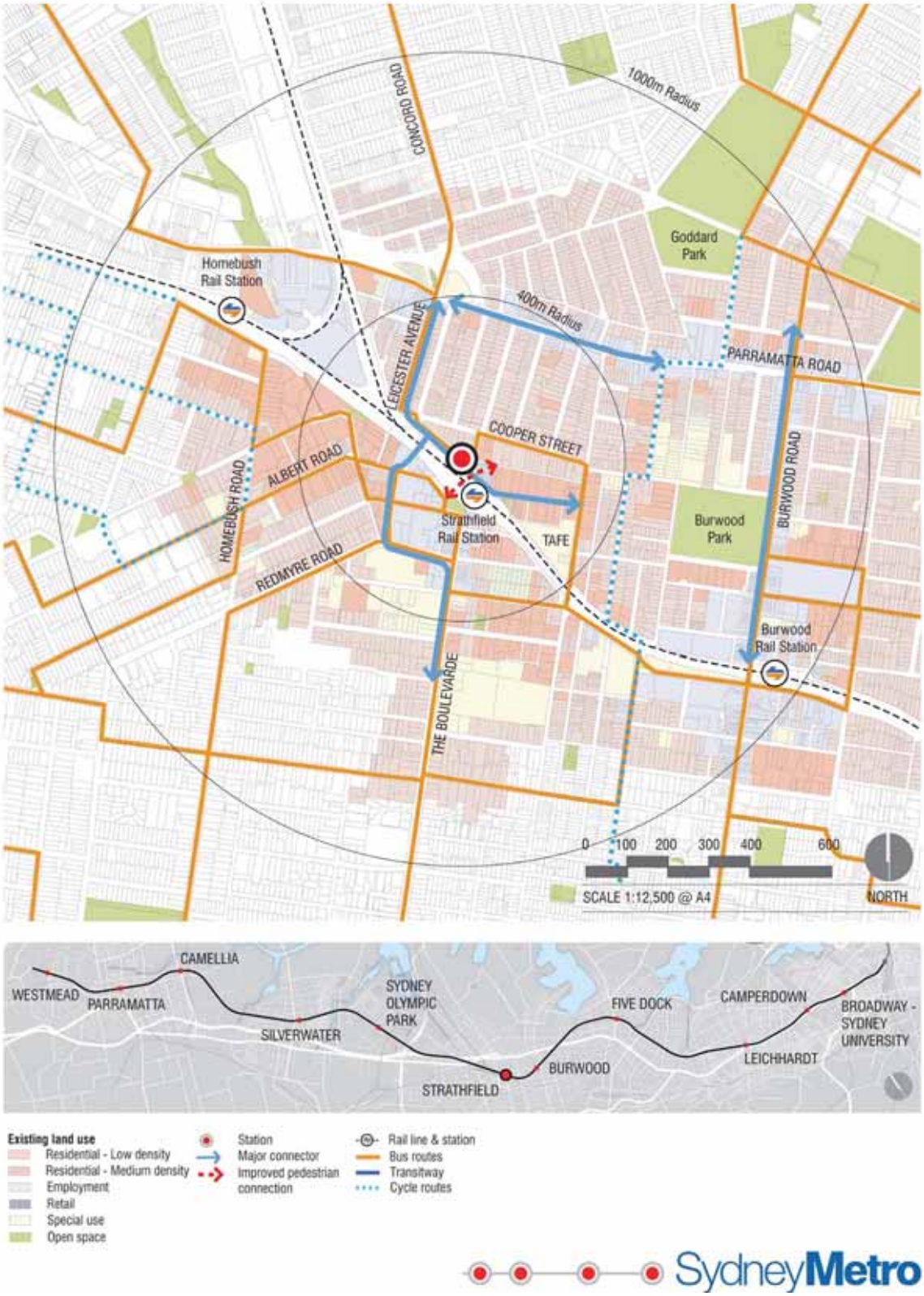
Table 4.7 Strathfield station summary

Strathfield		
Type	Interchange	
Station function(s)	• Rail/ and bus/metro interchange. • Walk-up residential catchment. • Employment destination.	
2031 population catchment (1000m)	26,100 (54% increase from 2006)	
2031 employment catchment (1000m)	12,200 (42% increase from 2006)	
Distance to Central	11.2 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	13 mins (1 min faster)
	Wynyard	19 mins (2 min faster)
	Parramatta	11 mins (0 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.5 Station construction plan – Strathfield

Figure 4.6 Station context plan – Strathfield



4.2.8 Burwood

The preferred Burwood station location is partly under the north eastern corner of Burwood Park, partly under Burwood Road, and partly under land north of Meryla Street.

Key outcomes

The preferred Burwood station location will:

- Support planned employment and residential growth in the Burwood town centre.
- Improve the opportunity for shoppers to travel to Westfield and Burwood Road by public transport rather than private car, and stimulate land use change in the northern part of Burwood between Burwood Park and Parramatta Road.
- Provide direct and frequent access for bus passengers from the north and south of Burwood centre to a range of new destinations on the metro network, including Sydney University, and other educational or employment destinations.
- Create a direct and fast link for workers or residents of Sydney Olympic Park to the shopping, restaurants and administrative services at Burwood throughout the week.
- Provide an alternative to rail services for people travelling to or from Burwood for employment purposes during peak hours.

Projected travel times

The preferred Burwood station location is 10.2 kilometres from Central station. Travel times from Burwood station to key destinations are shown in Table 4.8.

Table 4.8 Burwood station summary

Burwood		
Type	Commercial/retail focus	
Station function(s)	• Employment destination. • Bus/metro interchange. • Walk-up residential catchment.	
2031 population catchment (1000m)	20,600 (24% increase from 2006)	
2031 employment catchment (1000m)	20,800 (52% increase from 2006)	
Distance to Central	10.2 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	11 mins (2 min faster)
	Wynyard	17 mins (2 min faster)
	Parramatta	13 mins (6 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.7 Station construction plan – Burwood

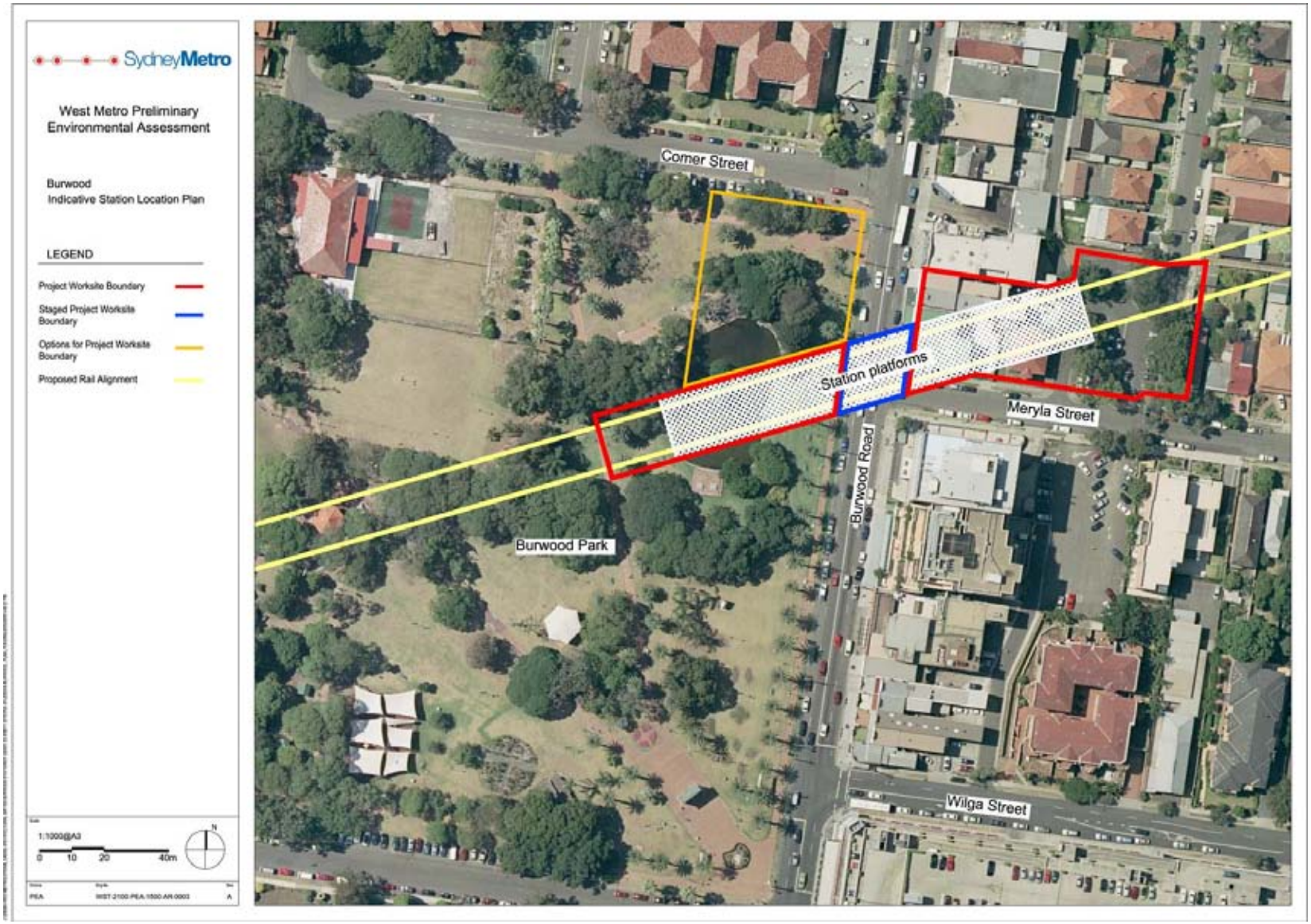
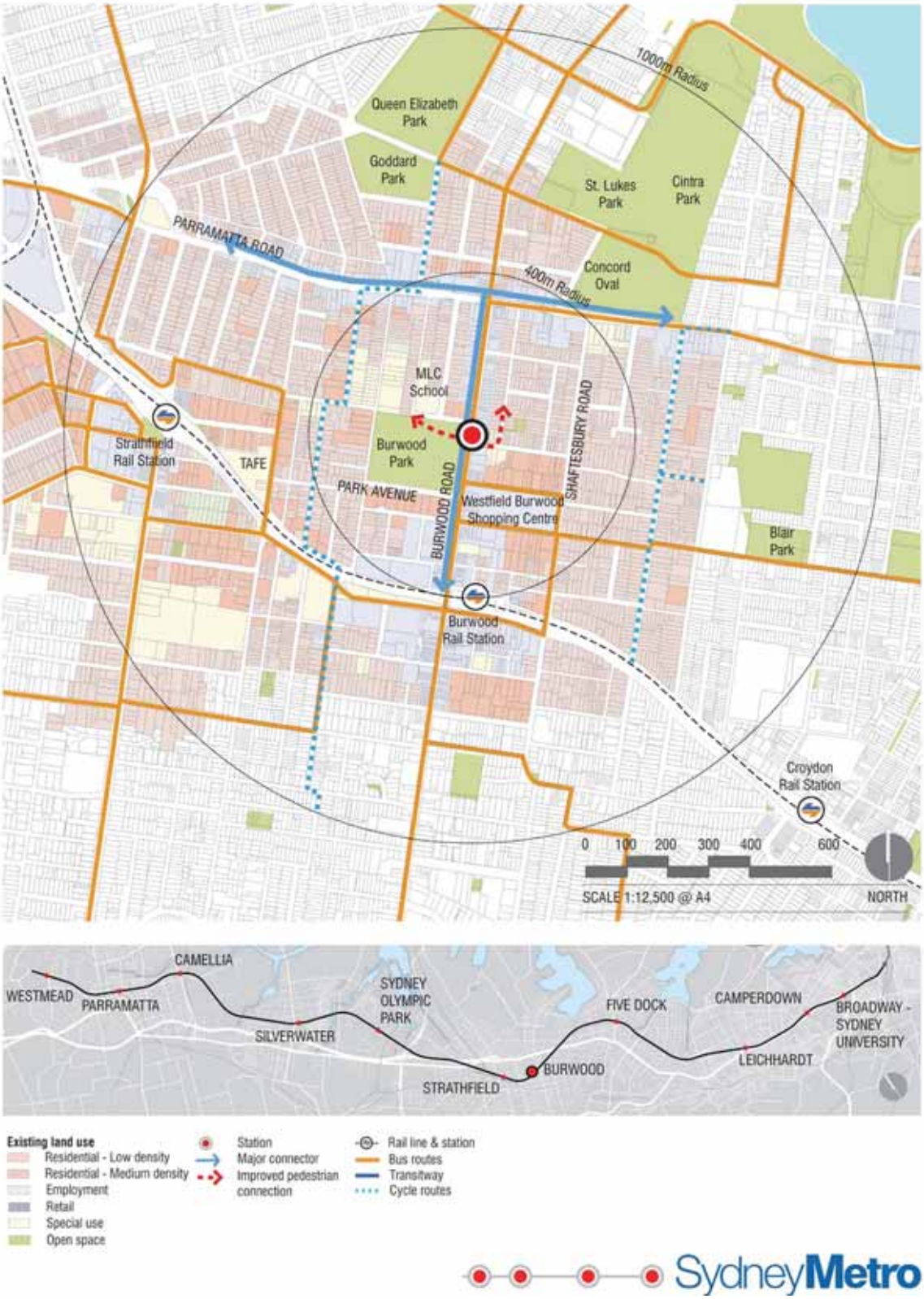


Figure 4.8 Station context plan – Burwood



4.2.9 Five Dock

The preferred location for a station at Five Dock is Ramsay Road between Great North Road and Fairlight Street.

Key outcomes

The preferred Five Dock station location will provide:

- A hub for passengers to transfer from bus to metro services.
- Direct, frequent access for people from Five Dock, Haberfield, Abbotsford, and Chiswick to travel, via metro, to a wider range of job and other opportunities.
- A much faster and more reliable alternative to bus services for people travelling to Sydney CBD for employment purposes during peak hours when services are usually most crowded.
- An opportunity for bus services to be reconfigured to relieve bus congestion locally, on Parramatta Road and in the Sydney CBD, potentially improving cross-regional bus services and giving bus passengers a more reliable and speedy journey.
- A direct and fast link to the shopping and restaurants at Five Dock.
- Improved urban amenity and regeneration in the Five Dock village centre.
- Service to the growth areas along the foreshore of the Parramatta River.

Projected travel times

The preferred Five Dock station location is 7.7 kilometres from Central station. Travel times from Five Dock station to key destinations are shown in Table 4.9.

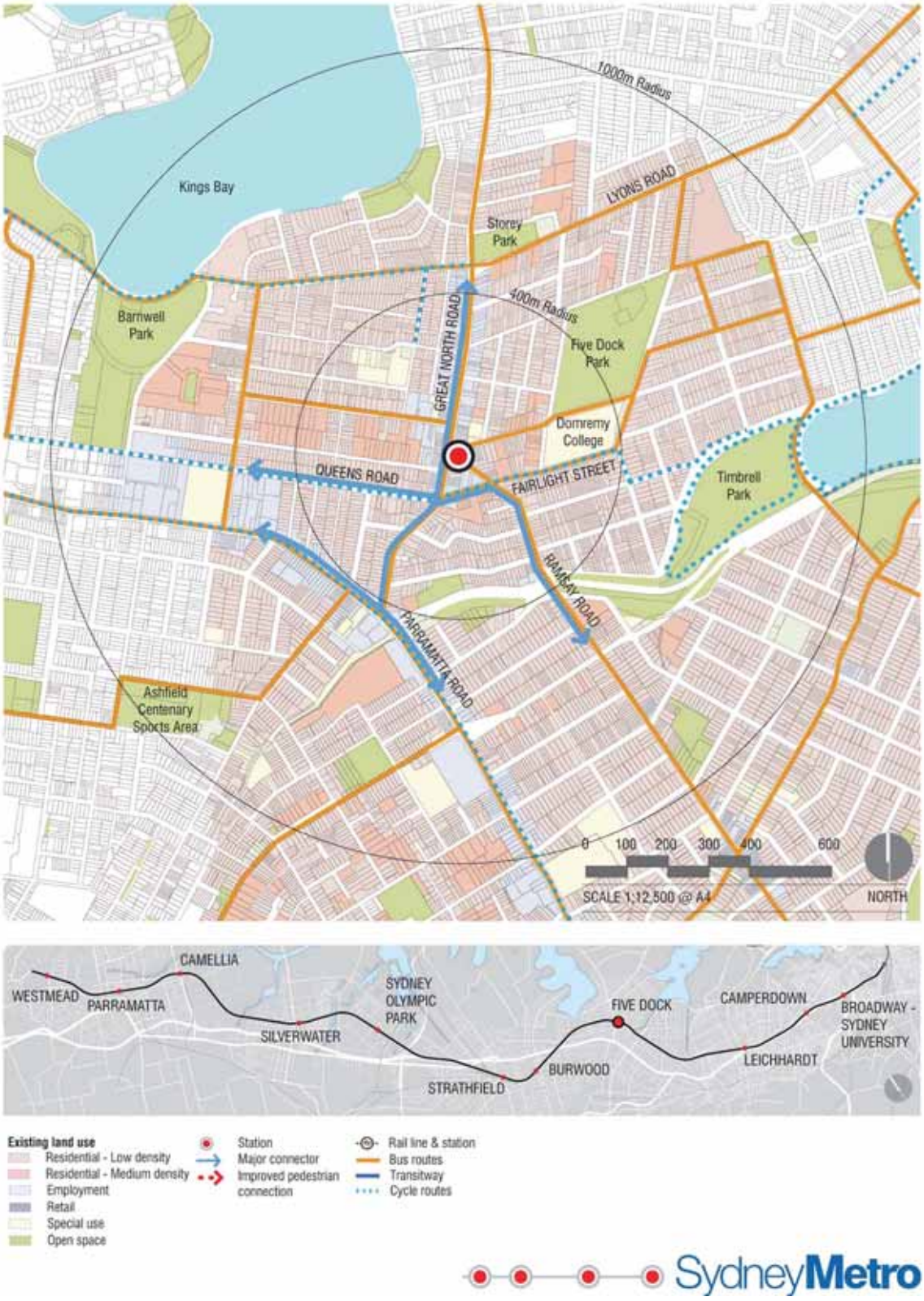
Table 4.9 Five Dock station summary

Five Dock		
Type	Village	
Station function(s)	• Bus/metro interchange. • Walk-up residential catchment.	
2031 population catchment (1000m)	12,100 (2% increase from 2006)	
2031 employment catchment (1000m)	4,000 (9% increase from 2006)	
Distance to Central	7.7 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	8 mins (22 min faster)
	Wynyard	15 mins (23 min faster)
	Parramatta	15 mins (30 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.9 Station construction plan – Five Dock

Figure 4.10 Station context plan – Five Dock



4.2.10 Leichhardt

The preferred location for a station at Leichhardt is north of Parramatta Road between Balmain Road and Catherine Street.

Key outcomes
The preferred Leichhardt station location will provide:

- Direct and frequent travel from Leichhardt to new educational or employment destinations on the metro network.
- A much faster and more reliable alternative to bus services for people travelling to Sydney CBD.
- Opportunities for residents of Petersham, Haberfield, Annandale and further afield in the inner west to travel to a wider range of job and other opportunities.
- A direct and fast link to the shops, restaurants and cultural facilities at Leichhardt, potentially easing traffic and bus congestion in Norton Street.
- Opportunity for reconfiguration of bus services to reduce bus congestion on Parramatta Road and in Sydney CBD, and improvements to cross-regional services, thus giving bus passengers a more reliable and speedy journey.
- Opportunities to stimulate urban renewal in the southern part of Leichhardt.

Projected travel times
The preferred Leichhardt station location is 4.5 kilometres from Central Station. Travel times from Leichhardt station to key destinations are shown in Table 4.10.

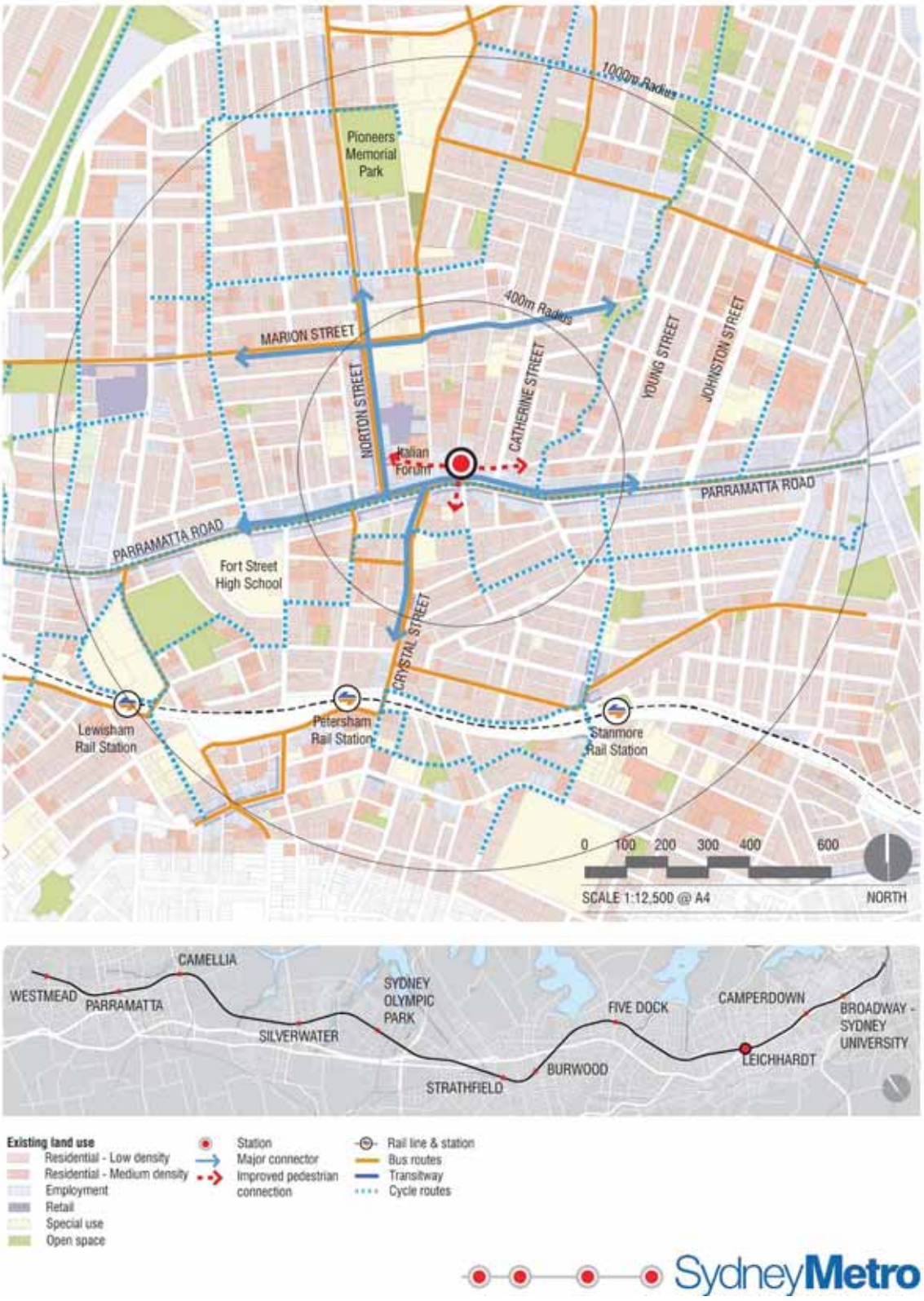
Table 4.10 Leichhardt station summary

Leichhardt		
Type	Residential focus	
Station function(s)	• Bus/metro interchange. • Walk-up residential catchment.	
2031 population catchment (1000m)	18,400 (7% increase from 2006)	
2031 employment catchment (1000m)	10,100 (17% increase from 2006)	
Distance to Central	4.5 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	5 mins (18 min faster)
	Wynyard	11 mins (18 min faster)
	Parramatta	18 mins (32 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.11 Station construction plan – Leichhardt

Figure 4.12 Station context plan – Leichhardt



4.2.11 Camperdown

The preferred location for a station at Camperdown is north of Parramatta Road and east of its intersection with Missenden Road.

Key outcomes

The preferred Camperdown station location will provide:

- Improved access for employees, clients and visitors to hospital/health complexes on Missenden Road and Carillon Avenue.
- A much faster and more reliable alternative to bus services for people travelling to Sydney CBD.
- Improved access for students and employees of Sydney University and its colleges.
- Access from Camperdown, Annandale, and Newtown to a wider range of job and other opportunities, including those to the west.
- Reduced bus congestion on Parramatta Road and in Sydney CBD.
- Support the redevelopment of disused or under-occupied sites, thereby improving urban amenity.
- Underground or overhead connections across Parramatta Road would reduce severance effect.
- Improved connections across Parramatta Road.

Projected travel times

The preferred Camperdown station location is 2.4 kilometres from Central station. Travel times from Camperdown station to key destinations are shown in Table 4.11.

Table 4.11 Camperdown station summary

Camperdown		
Type	Specialised centre	
Station function(s)	• Access to university, hospitals and health facilities. • Walk-up residential catchment.	
2031 population catchment (1000m)	31,200 (51% increase from 2006)	
2031 employment catchment (1000m)	17,900 (12% increase from 2006)	
Distance to Central	2.4 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	3 mins (13 min faster)
	Wynyard	9 mins (15 min faster)
	Parramatta	21 mins (21 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.13 Station construction plan – Camperdown

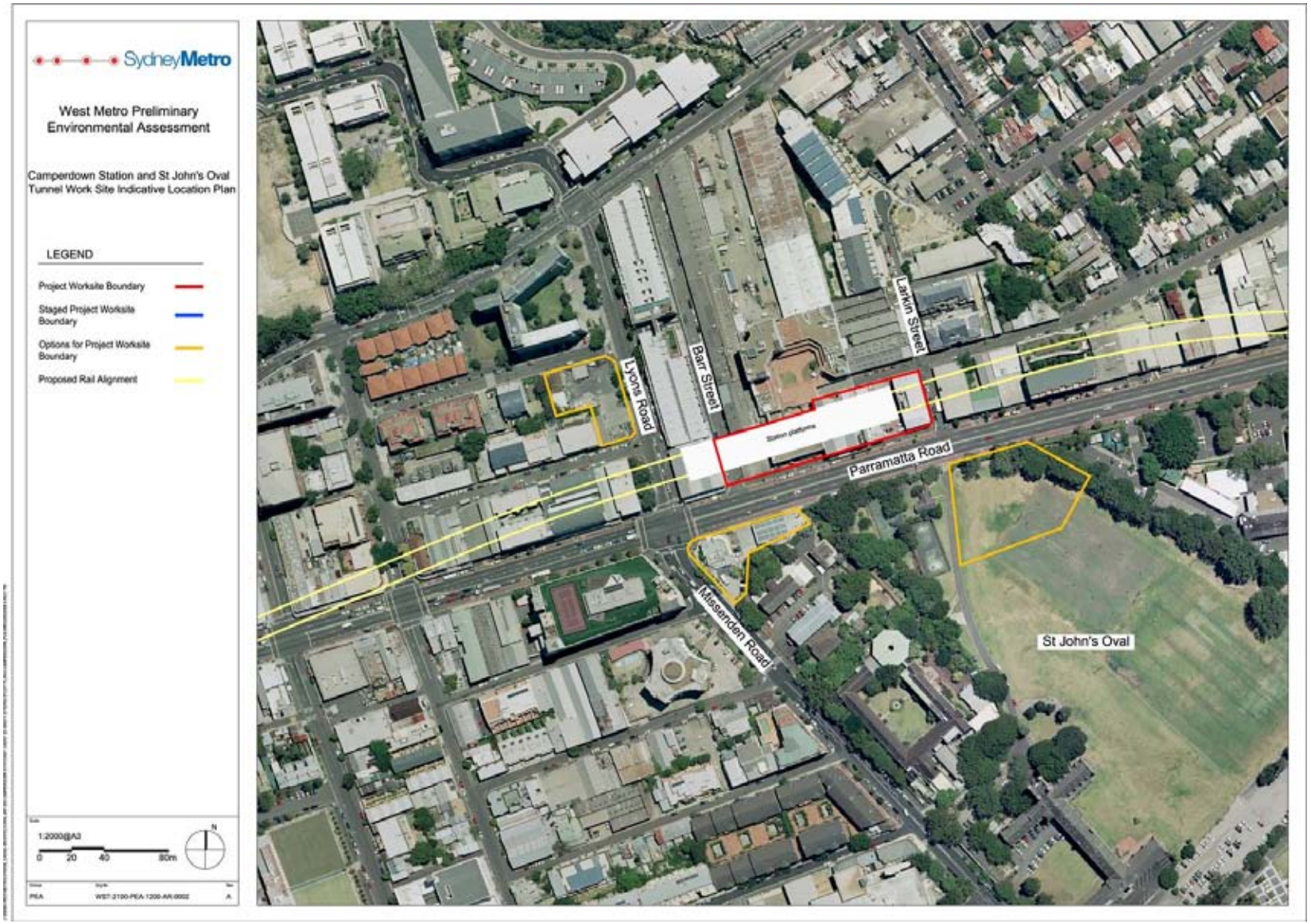
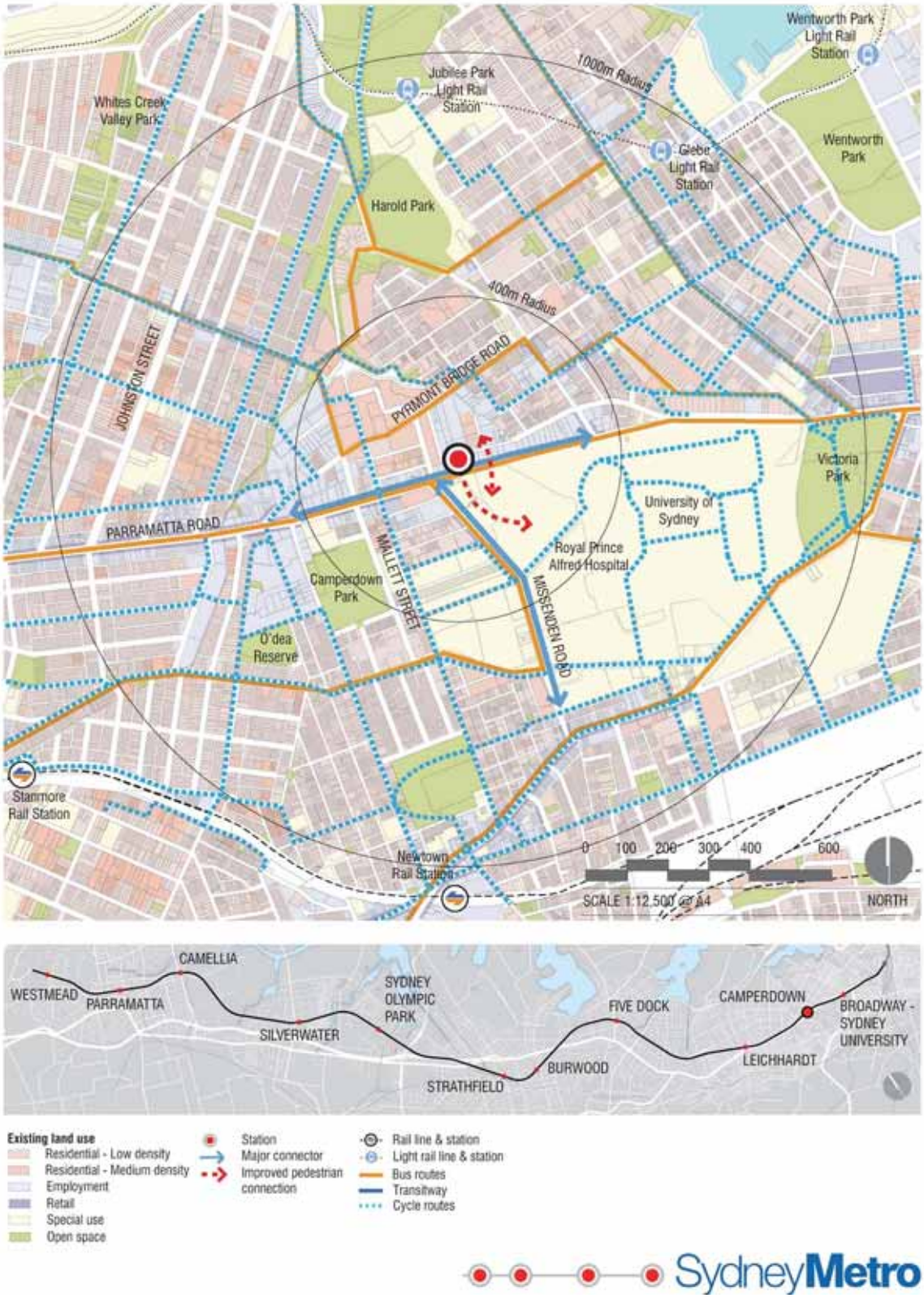


Figure 4.14 Station context plan – Camperdown



4.2.12 Broadway-Sydney University

The preferred location for a station at Broadway-Sydney University is south of Parramatta Road, in Victoria Park.

Key outcomes

The preferred Broadway-Sydney University station location will provide:

- A much faster and more reliable alternative to bus services for people travelling during peak hours.
- Improved access for students and employees of Sydney University.
- Access for Glebe, Darlington and Chippendale residents to job opportunities in the CBD and the west.
- Reduced bus congestion on Parramatta Road and in Sydney CBD.
- Underground or overhead connections across Parramatta Road to reduce its severance effect.
- Improved community access to the recreational facilities of Victoria Park.
- A link for Broadway Shopping Centre to fast and frequent public transport.

Projected travel times

The preferred Broadway-Sydney University station location is 1.3 kilometres from Central Station. Travel times from Broadway-Sydney University station to key destinations are shown in Table 4.12.

Table 4.12 Broadway-Sydney University station summary

Broadway – Sydney University		
Type	Specialised centre	
Station function(s)	• University. • Walk-up residential catchment.	
2031 population catchment (1000m)	31,700 (51% increase from 2006)	
2031 employment catchment (1000m)	35,000 (43% increase from 2006)	
Distance to Central	1.3 km	
Projected travel times and estimated travel time saving* (compared to current fastest public transport option)	Central	1 min (10 min faster)
	Wynyard	8 mins (12 min faster)
	Parramatta	22 mins (17 min faster)

* Travel time savings based on regularly timetabled public transport services arriving by 9am weekdays. Actual savings may be greater in some cases.

Figure 4.15 Station construction plan – Broadway-Sydney University

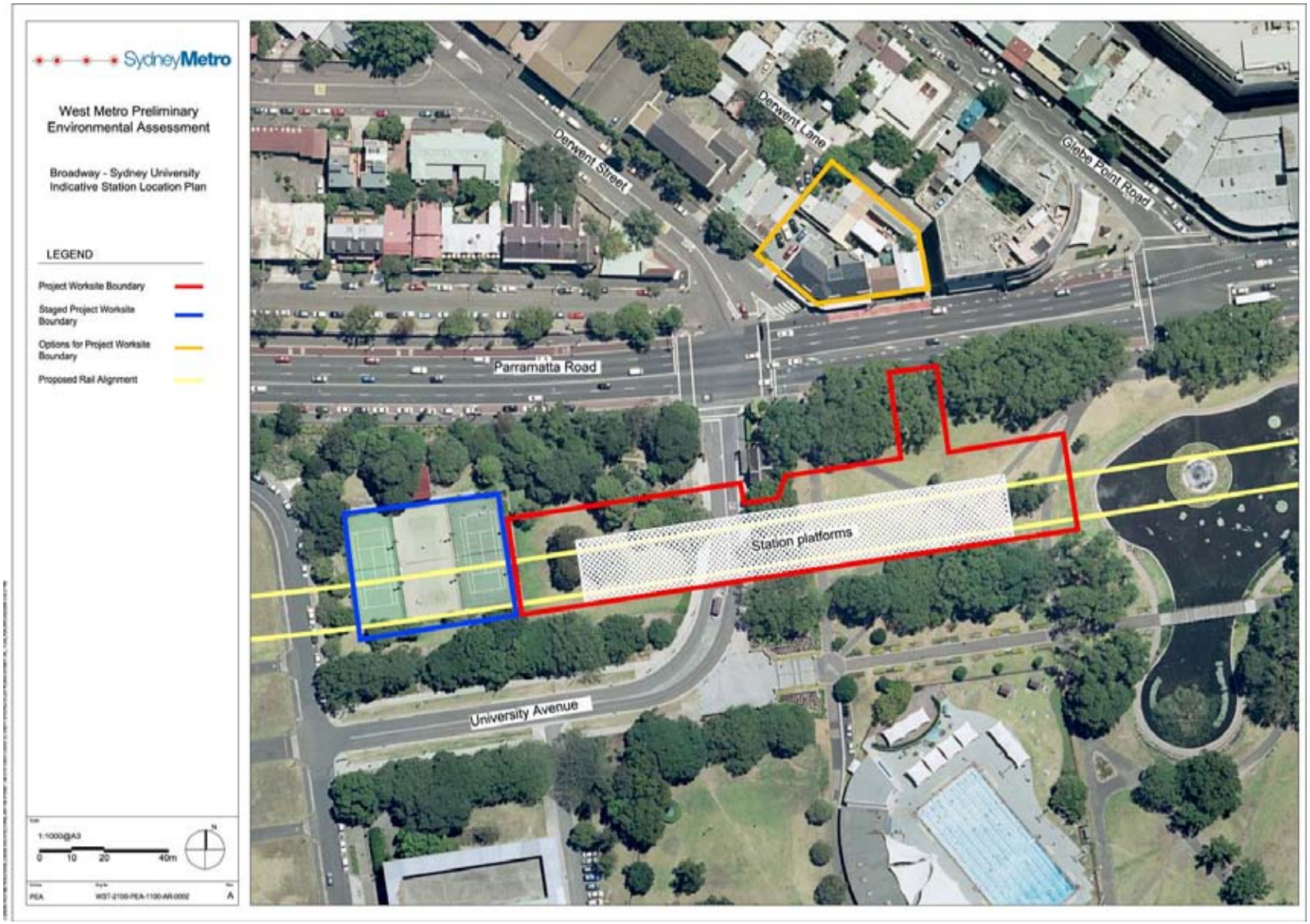
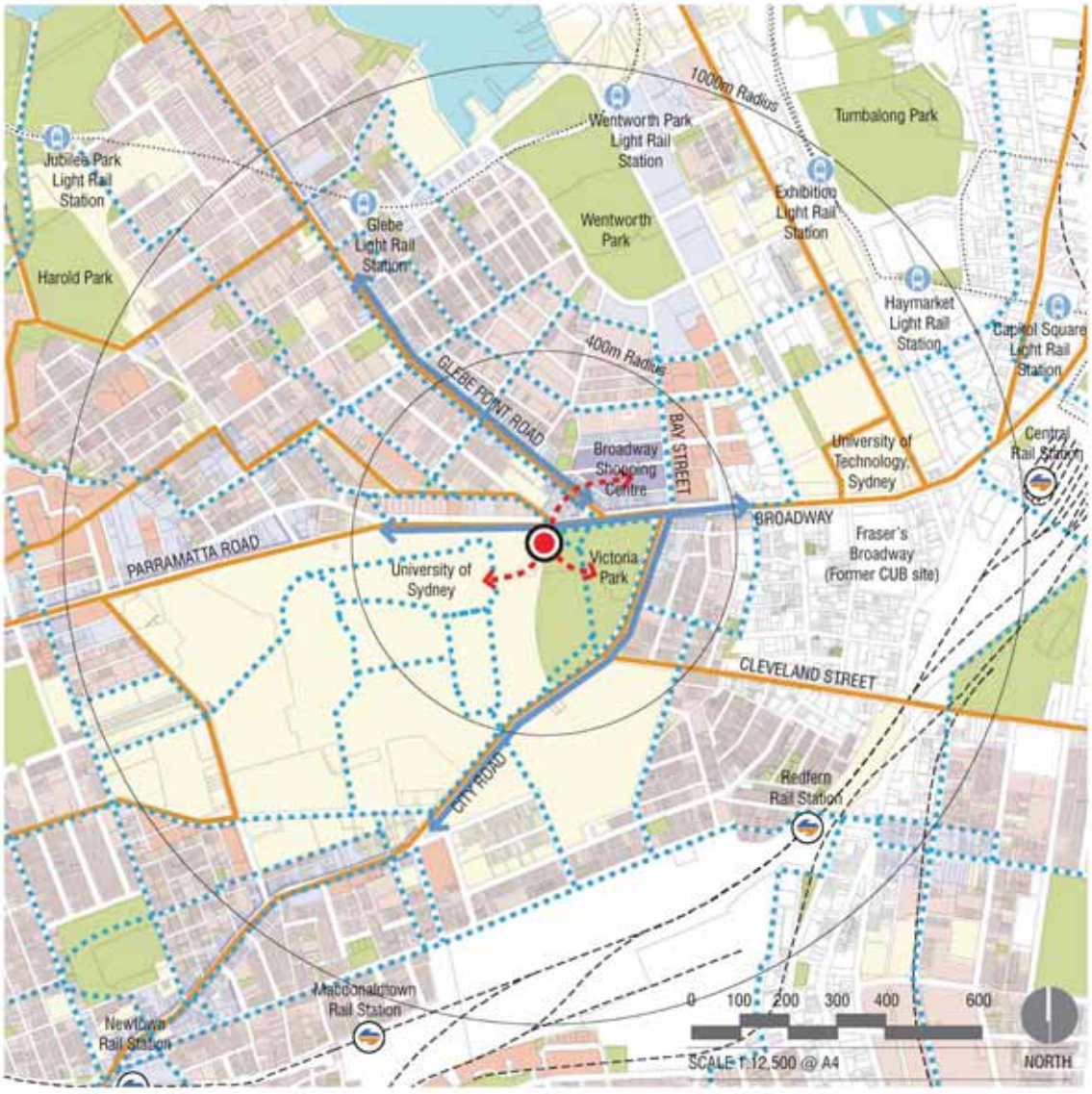


Figure 4.16 Station context plan – Broadway-Sydney University



Existing land use
- Residential - Low density
- Residential - Medium density
- Employment
- Retail
- Special use
- Open space

- Station
- Major connector
- Improved pedestrian connection

- Rail line & station
- Light rail line & station
- Bus routes
- Transitway
- Cycle routes

SydneyMetro

4.3 Alignment

The project comprises a 24.1 kilometre railway in twin tunnels (See Appendix A). The alignment shown in this PEA is preliminary and subject to further development and environmental assessment. Some modifications may occur as new information is obtained during the reference design phase and the preferred alignment is confirmed. The station localities identified in Section 4.2 may also require subsequent modification to allow for alignment changes. The alignment and station locations will be confirmed in the EA.

Starting at the CBD Metro Central station, the alignment heads west following Broadway and Parramatta Road, with slight curves to accommodate Broadway-Sydney University and Camperdown stations. To the west of Camperdown station the alignment curves slightly to the north from Parramatta Road to pass through Leichhardt station located at the southern end of Balmain Road and Catherine Street.

The alignment then heads to the north west, passing under Hawthorne Canal and Iron Cove Creek to Five Dock station, located near the junction of Great North Road and Ramsay Road. The alignment then crosses to the southern side of Parramatta Road to pass through Burwood station and runs in close proximity to the CityRail western line to Strathfield station. The alignment crosses to the north of Parramatta Road, runs under Powells Creek and under CityRail's Olympic Park loop to pass through the Sydney Olympic Park station.

The alignment then curves slightly to the south and passes under Haslams Creek to align with Carnarvon Street to the north of the M4 Motorway at Silverwater station. At the end of Carnarvon Street the alignment curves slightly to the north and crosses under Duck River and passes through Camellia station. The alignment passes under Clay Cliff Creek and then follows Macquarie Street to Parramatta station. Finally the alignment curves slightly to the north at O'Connell Street to Westmead station on the corner of Darcy Road and Hawkesbury Road with space for train storage provided just beyond Westmead station.

The following key constraints have been considered in developing the alignment to date and will require further consideration in developing the reference design:

- Major sewer mains and sub mains including the Bondi Ocean Outfall Sewer, main branches connecting to the South West Ocean Outfall Sewer and the Northern Suburbs Outfall Sewer.
- The Olympic Park CityRail loop.
- Northern Sydney Freight Corridor.
- Broad scale contamination known to underlay the industrial areas around Camellia and the Homebush Bay reclamation areas.
- Deep alluvial deposits in and around Parramatta and a number of alluvial channels associated with tributaries to Parramatta River such as A'Beckett Creek, Clay Cliff Creek, Subiaco Creek, Duck Creek, Duck River, Haslams Creek, Powells Creek, Iron Cove Creek, Blackwattle Creek and Hawthorne Canal and the palaeochannels of Canada Bay and Kings Bay.
- Hazards and risks associated with facilities such as Shell Oil Refinery and oil pipelines.
- Heritage items around Parramatta.

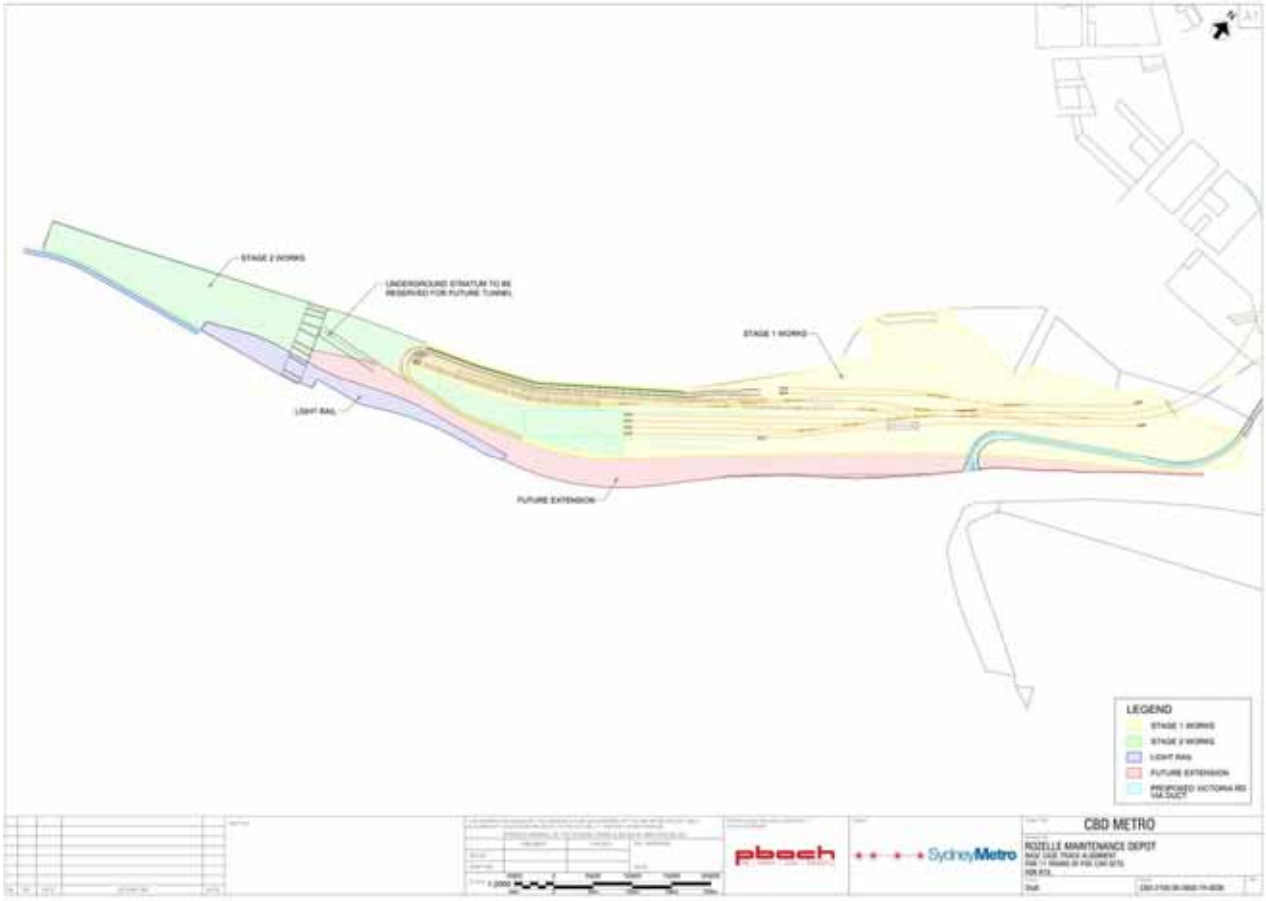
4.4 Rail corridor protection

The State Environmental Planning Policy – Infrastructure 2007 (the 'Infrastructure SEPP') was introduced to assist in the effective delivery of public infrastructure throughout the State of NSW. Amendments to the Infrastructure SEPP are proposed to add the West Metro corridor to the corridors protected, including provisions requiring concurrence by Sydney Metro for proposed development.

4.5 Stabling facilities, maintenance depots and control centre

The West Metro will utilise the stabling and maintenance facilities to be constructed within the former Rozelle Marshalling Yard as part of the CBD Metro, with additional overnight storage at Westmead and Sydney Olympic Park. The proposed stabling layout at Rozelle is shown in Figure 4.17.

Figure 4.17 Stabling



Details of the required expansion to the Rozelle stabling and maintenance depot and other facilities to accommodate the West Metro will be included in the EA.

4.6 Ancillary facilities

The West Metro also includes a number of ancillary facilities critical to the operation of the project, as outlined in the following sections.

4.6.1 Crossovers and turnbacks

Crossovers and turnbacks are required for the reliable operation of the metro network, in order to provide for train storage and contingency for the removal of failed trains. Indicative locations are shown on the alignment drawings. These will be finalised during preparation of the EA.

4.6.2 Power supply

The West Metro will require electrical power during construction and operation.

The operational power system comprises various components:

- Bulk supply point (BSP): The BSP is the electrical supply point from Energy Australia and Integral Energy. These in turn feed the metro's high voltage reticulation system, which in turn feeds the traction supply, station and depot supply systems. The West Metro project will be likely to require several BSPs.
- High voltage reticulation: The high voltage reticulation system transfers and controls the supply of power throughout the West Metro infrastructure. The preferred system will be a 33kV ring network for traction supply and an 11kV ring network for building supplies.
- Traction supplies: Traction supply substations will be used to provide electrical power to the overhead conductor contact system. The traction supply substations are proposed to be located within certain station plant rooms and within the maintenance depot.
- Station supplies: Station supply substations are used to provide electrical power to the station and depot buildings. These substations will be contained within station buildings.

During detailed design, opportunities will be investigated to use Green Power and other renewable energy sources.

4.6.3 Water management

The tunnels will be concrete-lined, and it is expected that there will be some groundwater inflows. If required, permanent water treatment facilities will be provided for normal operations within the tunnels. Stormwater management will be required at stations.

4.7 Constructability

4.7.1 Construction staging and timing

Construction of the CBD Metro is planned to commence in 2010, with the line being operational by 2015.

West Metro is currently proposed to be built in a single stage, with construction works anticipated to commence in 2011 and trains operating on the line by the end of 2017. Depending on funding availability, it is possible that the project will be delivered in several stages.

4.7.2 Construction methodology

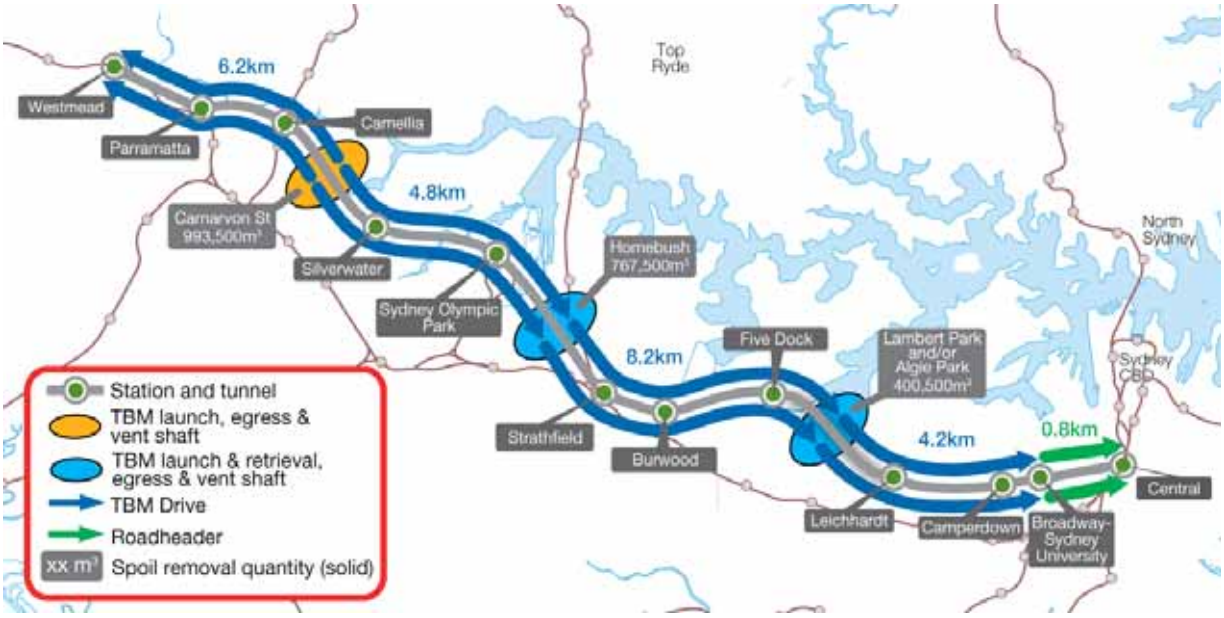
The 24.1km tunnels from Central to Westmead will be constructed using tunnel boring machines (TBM) which will be launched from TBM launch and retrieval sites and operate concurrently.

Road headers, rock breakers and conventional excavation methods will be required for other underground construction activities such as station excavation, TBM access and retrieval shafts, take-off chambers and dives, services and ventilation shafts, crossovers and cross passages.

Road headers will also be used for tunnel construction at some locations. Precast rings will be erected behind the excavation to provide a continuous pre-cast concrete lining.

Figure 4.18 illustrates a possible tunnel construction sequence.

Figure 4.18 Indicative tunnel construction sequence for West Metro



4.7.3 Construction worksites, compounds and ancillary facilities

A number of construction sites are proposed as part of the project, including three major TBM operations sites, TBM retrieval sites and station sites. Table 4.13 details the construction activities that will occur at each of these sites.

Location plans of these indicative sites can be found in Appendix C.

Table 4.13 Construction activities

Sites	Construction activity
Westmead station	Station construction; TBM retrieval
Parramatta station	Station construction
Camellia station	Station construction
Carnarvon Street, Silverwater	TBM launch; roadheader access for cross passage construction; spoil removal; ventilation and egress shaft

Sites	Construction activity
Silverwater station	Station construction; spoil removal
Sydney Olympic Park station	Station construction
Homebush Bay Drive Site Bressington Park/ Mason Park	TBM launch and retrieval; roadheader access for cross passage construction, spoil removal; ventilation and egress shafts
Strathfield station	Station construction
Burwood station	Station construction
Five Dock station	Station construction
Lambert Park (Alternative/Support Sites: Algie Park, Haberfield; Cintra Park-Hockey Field, Concord)	Egress and ventilation shaft; TBM launch; roadheader access for cross passage construction; spoil removal
Leichhardt station	Station construction
Camperdown station	Station construction
Broadway-Sydney University station	Station construction; TBM retrieval; roadheader access for drive to Central; spoil removal

The Carnarvon Street, Homebush and Lambert Park sites provide an opportunity to establish major construction sites to support tunnel construction (TBM launch and major spoil removal sites) and rail systems installation.

A description of the indicative major construction sites and proposed site access for heavy vehicles is provided in Table 4.14.

The work activities on major construction sites would generally include:

- Enabling works that would include temporary construction of high voltage power supply and substation for TBM usage; services relocation; demolition works; vegetation clearing and grubbing.
- Establishment of a site compound including site offices, parking area, amenities, workshops, materials/plant storage areas, and truck wheel wash facility.
- Excavation of launch shafts.
- Tunnel construction water treatment plant and water tanks.
- Tunnel air ventilation and extraction plant.
- Assembly and launching of TBMs.
- Spoil storage area and disposal.
- Tunnel precast segmental lining delivery and storage; electrical and mechanical lay down areas.
- Tunnel grout or concrete batching plant.
- Tunnel rail systems including track work, and electrical and mechanical related installation works.

Table 4.14 Major construction worksites

Sites	Approximate Area (m^2)	Access
Carnarvon Street	54,000	Carnarvon Street/Newton Street North
Homebush Bay Drive/Bressington Park/Mason Park	27,500	Homebush Bay Drive
Lambert Park (Leichhardt)	10,000	Marion Street
Algie Park (Haberfield) (Alternative/support site for Lambert Park)	7,000	Ramsay Street
Cintra Park hockey field (Concord) (Alternative/support site for Lambert Park)	17,000	Gipps Street
St Johns Oval/alternative TBM site	27,000	Parramatta Road

Other ancillary construction sites or facilities such as batching plants (for the production of pre-cast segments, concrete or grout) will be required.

The locations of these facilities and their associated impacts will be assessed in detail in the EA.

4.7.4 Station construction

There are a range of potential methods by which stations can be constructed. Each has its own profile of cost, risk and difficulty. Figure 4.19 illustrates the full range of *typical* station box construction methods. The actual methods to be used on West Metro will be refined and confirmed during the EA preparation, in light of community consultation, further design, and impact assessment.

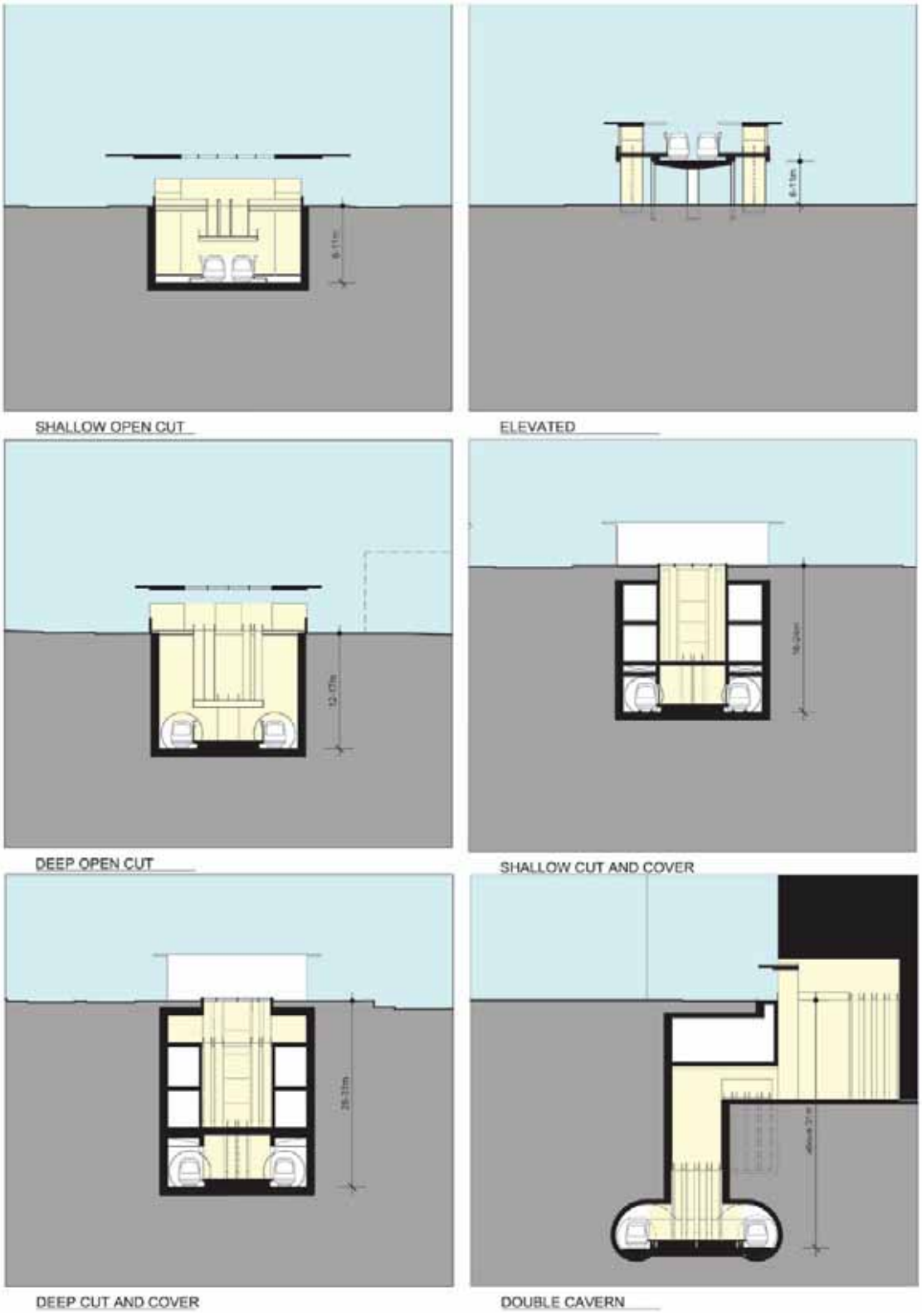
It is likely that cut and cover methods will be used to construct to Westmead, Parramatta, Camellia, Silverwater and Strathfield station boxes.

The open cut method is likely to be used to excavate the Sydney Olympic Park station box.

For Burwood, Leichhardt and Camperdown station boxes, construction is likely be partially open cut.

For Five Dock and Broadway-Sydney University, station box construction will be likely to involve a combination of cut and cover and cavern methodology.

Figure 4.19 Typical station box construction methods



4.7.5 Spoil management

The West Metro will produce spoil from the following activities:

- Excavation of tunnels, rail crossovers, cross passages and stub tunnels.
- Excavation of underground station box structures.
- Excavation of station access, ventilation shafts, underground stabling facilities and TBM launch shafts.

Approximately 3,576,000m^3 of bulk spoil has been estimated for the project. Estimated bulk spoil volumes from each site are provided in Table 4.15.

Spoil will include sandstone and shale and is also likely to include some waste and contaminated material. Spoil will be recycled or reused in preference to disposal at landfill sites where possible.

An assessment of suitable reuse options and recycling sites will be undertaken during the preparation of the EA. Spoil removal by rail or barge will also be investigated.

It should, however, be noted that the final spoil re-use location(s) will be ultimately selected by the construction contractor. Spoil management is discussed further in Section 7.2.

Table 4.15 Estimated bulk spoil volumes from each site

Location	Bulk volume tunnels by TBM or roadheader (m^3)	Bulk volume stations (m^3)	Material
Broadway-Sydney University station	79,000	117,000	Residual soil (15%), Ashfield Shale (30%), Mittagong Formation (15%), Hawkesbury Sandstone (40%)
Camperdown station		110,500	Residual soil (20%), Ashfield Shale (5%), Mittagong Formation (10%), Hawkesbury Sandstone (65%)
Leichhardt station		108,000	Residual soil (20%), Ashfield Shale (35%), Mittagong Formation (10%), Hawkesbury Sandstone (35%)
Lambert Park (and/or support site/s) (Vent and Egress Shaft)	400,500	25,000	Residual soil (5%), Hawkesbury Sandstone (95%)

Location	Bulk volume tunnels by TBM or roadheader (m^3)	Bulk volume stations (m^3)	Material
Five Dock station		132,500	Residual Sandstone (20%), Ashfield Shale (30%), Mittagong Formation (10%), Hawkesbury Sandstone (40%)
Burwood station		99,500	Residual soil (20%), Ashfield Shale (80%)
Strathfield station		117,000	Residual soil (10%), Ashfield Shale (90%)
Homebush Site	767,500	48,500	Residual soil (45%), Ashfield Shale (55%)
Sydney Olympic Park station		137,000	Residual soil (25%), Alluvium (15%), Ashfield Shale (60%)
Silverwater station		82,000	Residual soil (25%), Ashfield Shale (75%)
Carnarvon Street	993,500	34,000	Residual soil (25%), Alluvium (35%), Ashfield Shale (40%), possible contaminated spoil
Camellia station		101,500	Alluvium (40%), Ashfield Shale (10%), Mittagong Formation (10%), Hawkesbury Sandstone (40%), possible contaminated spoil
Parramatta station		98,000	Alluvium (60%), Ashfield Shale (20%), Buried Shale Ridgeline (20%)
Westmead station		124,500	Deep residual soil (30%), Ashfield Shale (70%)
Total	**2,240,500**	**1,335,000**	

4.7.6 Construction hours and activities

Below ground activities are proposed to occur up to 24 hours per day, seven days per week, along with certain above ground sites that support tunnelling and fit out activities. However, at above ground locations where sensitive noise receivers are close to the proposed construction works, specific noisy activities are likely to be more restricted during evening and night-time periods.

Depending on road network conditions and the locality, spoil removal by truck may need to be restricted to occur outside of peak hours and special events. In addition, surface works which require lane or road closures may also need to be undertaken at night.

Construction of the project will involve three key phases of activity as described below:

- Phase one – establishment and pre-construction activities:
  - Precondition surveys of structures along the tunnel alignment.
  - Approval applications and discussions with regulatory authorities and services authorities.
  - Commencement of detailed design.
  - Enabling works including: temporary construction of high voltage power supply and substation; services relocation; demolition works; vegetation clearing and grubbing.
  - Establishment of site compounds including: site offices; parking area; amenities; workshops; materials/plant storage areas; truck wheel wash facilities where required; construction water treatment plant(s); and construction tunnel air ventilation and extraction plant.
  - Establishment of ancillary facilities including concrete batch plants.
- Phase two – construction:
  - Tunnel and station box excavation.
  - Station construction including platforms and concourses.
  - Construction of trackform and installation of track.
  - Electrical and mechanical fit-out including power, communications and other equipment.
  - Implementation of permanent traffic and access arrangements and landscaping.
  - Decommissioning of plant and equipment, including TBMs.
- Phase three – commissioning and testing:
  - Testing and commissioning of metro services and systems.
  - Restoration of worksites.

Full details of construction methods, timing and management will be provided in the EA.

4.8 Operation

4.8.1 Service requirements

West Metro will provide a service between Central and Westmead with a travel time of approximately 27 minutes. The West Metro is currently proposed to operate from 5.30am to 12.00 midnight Sunday to Thursday, and from 5.30am to 1.00am (Friday and Saturday). These operating hours can be adjusted to cater for special events, and the system will be capable of 24-hour operation (subject to maintenance requirements).

Generally all track maintenance activities will be undertaken at night time when trains are not operating.

4.8.2 Train operations

Trains are proposed to operate under Automatic Train Operation (ATO) with driverless capability. There will be provision for an on-board train attendant with defined duties to assist with customer service.

Train operational control functions will be centralised at the Operations Control Centre (OCC), located at the maintenance depot. Station systems will be controlled from a number of control rooms located at stations.

In the event of a breakdown or emergency the system is designed to continue to operate using Automatic Train Protection (ATP).

The exit path for train evacuation in a tunnel in the event of a breakdown or emergency will likely be via the front or rear train door directly onto the track centre towards the designated station(s) or emergency exit.

4.8.3 Station operations

Stations will be designed to provide easy access for all passengers with a range of different needs. Platform screen doors will be utilised at all stations. These will effectively separate the station from the tunnel/surface rail line, resulting in fewer service disruptions, less littering and trackside cleaning, improved safety and reduce the need for mechanical ventilation.

4.8.4 Stabling and maintenance operations

The Rozelle stabling and maintenance depot will operate 24 hours a day to provide for the control and management of the metro railway network, maintenance, repair, refurbishing, upgrading, stabling, cleaning, despatch and retrieval activities on the operating passenger train fleet and a base for infrastructure maintenance activities.

The types of activities will vary considerably throughout the day. For example, trains will depart the depot from about 5.30am to 6.30am. About half of the train fleet will return to the stabling area after the morning peak (about 9.00am). These trains will depart again for the afternoon peak and return to the depot at about 7.00pm. The remaining trains will return to stabling around midnight, when the Infrastructure Maintenance Operations Period will commence. Infrastructure maintenance trains will leave the depot around midnight and return around 5.00am.

Rolling stock maintenance will occur during the day and after the evening peak. It will not normally be undertaken on a weekend. There will be a wheel lathe, in an appropriately sound-proofed building. Wheel turning will occur infrequently.

Trains will proceed through the automated train washing plant when they return to the depot after the morning and afternoon peaks but this will not be a noisy activity. Brake-testing will occur within the rolling stock maintenance building. As the trains will be driverless and controlled by an ATO system it is not intended that horns be fitted to the rolling stock. The Operations Plan for the metro system will be prepared to manage and minimise impacts on any adjacent residential premises.

4.8.5 Rolling stock

The rolling stock will be procured through a high level performance and functional requirement specification to ensure proven ‘off the shelf’ type rolling stock technologies can be supplied. The rolling stock will be standard single deck metro-type trains in a 5-car set with overhead traction power. Ultimate train capacity allows for a 6-car set.

Subject to detailed design, the trains will be nominally 110m long with a body width of approximately 3.2m. Each car will have three bi-parting doors per side, two-by-two transverse seating, a wide centre aisle, wheelchair spaces and an open full-width passageway (between cars) to assist passenger movement and provide a clean open environment.

The trains will be equipped with modern passenger surveillance and communication systems and have disability access provisions.

The Operations Plan for the metro system will be prepared to manage and minimise impacts on any adjacent residential premises.

5 Planning framework and statutory requirements

5.1 Planning approval requirements

Part 3A of the EP&A Act establishes an assessment and approval regime for major projects. Projects to which Part 3A applies are declared to be a Part 3A project by either a State Environmental Planning Policy or Ministerial Order.

On 10 July 2009, the order declaring the West Metro a project to which Part 3A applies was gazetted. A copy of the declaration is included in Appendix D. The declaration states that the following development is of State and regional environmental planning significance:

Development for the purposes of the West Metro ('the Project') generally involving construction and operation of a new electrified passenger metro railway between Central station and Westmead. The Project includes development for all associated or ancillary works, activities, uses, structures or facilities including (but not limited to):

1. *Construction (including demolition works), and operation (excluding maintenance) of the project;*
2. *Any winning, obtaining or disposal of extractive material as part of the construction work of the project including transport of material and any associated access roads/rail tracks and sidings, conveyors, loading facilities and wharf facilities constructed for this purpose;*
3. *Temporary batch plants, concrete casting yards, excavated material reprocessing facilities associated with construction activities;*
4. *Access for construction, maintenance or operation of the project, including roads, access for pedestrians, cyclists, public transport and vehicles, and emergency egress/access facilities;*
5. *Metro stations, including car parks, and associated transport interchanges (i.e. bus, rail, light rail, taxi, coach, ferry, bicycle and kiss and ride facilities) and public amenities;*
6. *Retail premises, business premises, or community facilities in a metro station complex, including areas in the complex that customers use to gain access to station platforms;*
7. *Train stabling, maintenance, administration and control facilities;*
8. *Utilities/service installations or diversions, including power supply and protection of existing assets;*
9. *Landscaping and public domain improvements; and,*
10. *Advertising structures.*

The Project does not include activities comprising:

(a) Surveys;

(b) Test drilling;

(c) Test excavations;

(d) Preliminary geotechnical investigations;

or the like, associated with the design and environmental assessments required for the development of the Project prior to the commencement of construction.

The West Metro is therefore considered to be a project to which Part 3A applies.

5.1.1 Critical infrastructure declaration

Section 75C of the EP&A Act provides that the Minister for Planning may declare a project to be a critical infrastructure project because it is, in the opinion of the Minister, essential for the State for economic, environmental or social reasons.

The critical infrastructure provisions of the EP&A Act:

- Ensure the timely and efficient delivery of essential infrastructure projects.
- Allow the Government and the planning system to rapidly and readily respond to the changing needs of the State.
- Provide certainty in the delivery of these projects.
- Provide for rigorous scrutiny to ensure environmental outcomes are appropriate.
- Focus on delivering outcomes essential to the NSW community.

On 2 May 2008, the Minister for Planning's declaration that *"development for the purpose of a metro rail line to contribute to a metro rail network providing high speed, high frequency mass-transit capacity within the Greater Metropolitan Region"* would be a critical infrastructure project under Section 75C of the EP&A Act was gazetted.

The West Metro is therefore considered to be critical infrastructure.

5.2 The proponent

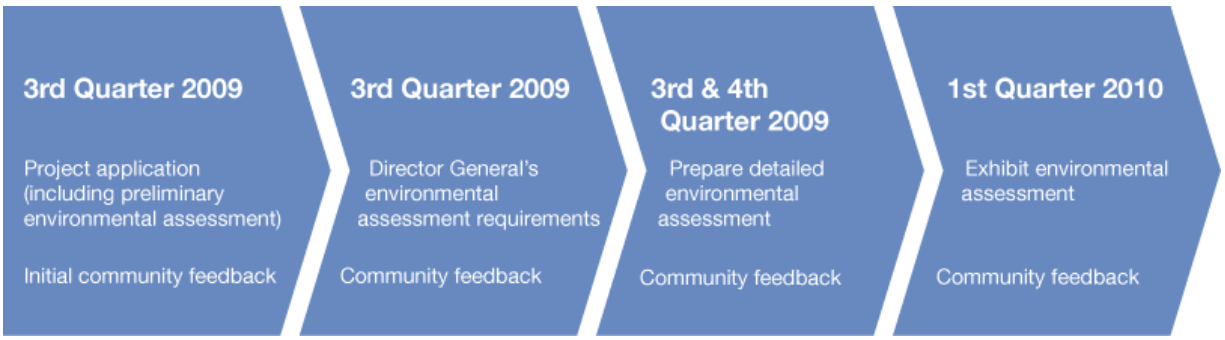
Sydney Metro is the NSW Government agency constituted under the *Transport Administration Act 1988* as amended by the *Transport Administration Amendment (Metro Rail) Act 2008* to develop a metro railway system, including procuring the West Metro.

The principal function of Sydney Metro is to develop safe and reliable metro railway systems for Sydney. It will be the governing body responsible for the development and delivery of the West Metro and the proponent for the purposes of the EP&A Act.

5.3 Environmental assessment and planning approval process

Sydney Metro, as project proponent, now seeks a Project Approval under Part 3A of the EP&A Act for the West Metro. This PEA has been prepared to support the Project Application. A summary of the planning approval and environmental assessment process and indicative key milestones is illustrated in Figure 5.1.

Figure 5.1 Indicative planning approvals and environmental assessment process



5.4 Environmental planning instruments

5.4.1 State Environmental Planning Policies

Section 75R(2) of the EP&A Act states that State Environmental Planning Policies (SEPPs) apply to:

"(a) the declaration of a project as a project to which this Part applies or as a critical infrastructure project, and

(b) the carrying out of a project, but (in the case of a critical infrastructure project) only to the extent that the provisions of such a policy expressly provide that they apply to and in respect of the particular project."

The West Metro has been declared to be a critical infrastructure project. To date there are no SEPPs that *"expressly provide that they apply to and in respect of"* the West Metro project.

By reason of the operation of Sections 75J and 75R of the EP&A Act, and the critical infrastructure declaration, the project may be approved notwithstanding a prohibition contained in an environmental planning instrument, including a SEPP, unless that SEPP specifically states that it applies to the critical infrastructure project.

State Environmental Planning Policy (Infrastructure) 2007 contains statutory provisions that permit the construction and operation of the project without the need for development consent under Part 4 of the EP&A Act.

Other SEPPs that may provide useful guidance, as opposed to statutory requirements, regarding potential issues and synergies to be addressed within the EA include *State Environmental Planning Policy No. 55 – Remediation of Land and State Environmental Planning Policy No.33 – Hazardous and Offensive Development.*

5.4.2 Regional Environmental Plans and Local Environmental Plans

Section 75R(2) of the EP&A Act states that *"environmental planning instruments (other than State environmental planning policies) do not apply to or in respect of an approved project".* Further, Section 75J(3) states:

"In deciding whether or not to approve the carrying out of a project, the Minister may (but is not required to) take into account the provisions of any environmental planning instrument that would not (because of section 75R) apply to the project if approved."

As the project is critical infrastructure, Regional Environmental Plans (REPs) and Local Environmental Plans (LEPs) do not apply to the project. The Minister may, but need not, consider these plans when determining the application.

The *Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005* may apply to the land on which the project will be located, and will be reviewed where relevant as part of the EA.

The following local environmental planning instruments apply to the land on which the project will be located, and will be reviewed where relevant as part of the EA:

- Sydney Local Environmental Plan 2005.
- Leichhardt Local Environmental Plan 2000.
- Ashfield Local Environmental Plan 1985.
- Canada Bay Local Environmental Plan 2008.
- Burwood Planning Scheme Ordinance 1979.
- Strathfield Planning Scheme Ordinance 1969.
- Auburn Local Environmental Plan 2000.
- Parramatta Local Environmental Plan 2001.

While Sydney Olympic Park is unzoned, applicable land uses are identified in the Sydney Olympic Park Master Plan 2002 and Draft Master Plan 2030.

5.5 Other regulatory licences and approvals that may be required

Section 75U(1) of the EP&A Act specifies certain authorisations that are not required for an 'approved project' under Part 3A, namely:

"(a) the concurrence under Part 3 of the Coastal Protection Act 1979 of the Minister administering that Part of the Act,

(b) a permit under section 201, 205 or 219 of the Fisheries Management Act 1994,

(c) an approval under Part 4, or an excavation permit under section 139, of the Heritage Act 1977,

(d) a permit under section 87 or a consent under section 90 of the National Parks and Wildlife Act 1974,

(e) an authorisation referred to in section 12 of the Native Vegetation Act 2003 (or under any Act to be repealed by that Act) to clear native vegetation,

(f) a permit under Part 3A of the Rivers and Foreshores Improvement Act 1948,

(g) a bush fire safety authority under section 100B of the Rural Fires Act 1997,

(h) a water use approval under section 89, a water management work approval under section 90 or an activity approval under section 91 of the Water Management Act 2000."

Section 75A defines 'approved project' as *"a project to the extent that it is approved by the Minister under this Part, but does not include a project for which only approval for a concept plan has been given"*. Consequently, any approvals that will otherwise be needed will not be required following project approval to carry out the project under Part 3A.

Under Section 75V(1) of the EP&A Act, the following relevant authorisations cannot be refused if necessary for the carrying out of an 'approved project' and are to be substantially consistent with an approval to carry out the project given under Part 3A:

- An Environment Protection Licence under Chapter 3 of the *Protection of the Environment Operations Act 1997*.
- A consent under s138 of the *Roads Act 1993*.

In addition, with respect to a critical infrastructure project, Section 75U(3) provides that the following orders or notices cannot be made or given so as to prevent or interfere with the carrying out of an approved critical infrastructure project:

"(a) an interim protection order (within the meaning of the National Parks and Wildlife Act 1974 or the Threatened Species Conservation Act 1995),

(b) an order under Division 1 (Stop work orders) of Part 6A of the National Parks and Wildlife Act 1974, Division 1 (Stop work orders) of Part 7 of the Threatened Species Conservation Act 1995 or Division 7 (Stop work orders) of Part 7A of the Fisheries Management Act 1994,

(c) an environment protection notice under Chapter 4 of the Protection of the Environment Operations Act 1997,

(d) an order under section 124 of the Local Government Act 1993."

5.5.1 Protection of the Environment Operations Act 1997

Activities for which a licence is required under the *Protection of the Environment Operations Act 1997* (POEO Act) are detailed in Schedule 1 of the Act.

Clause 33 of Schedule 1 relates to 'railway systems activities', which are defined as:

"(a) the installation, on site repair, on site maintenance or on site upgrading of track, including the construction or significant alteration of any ancillary works, or

(b) the operation of rolling stock on track."

In Clause 33, track means *"railway track that forms part of, or consists of, a network of more than 30 kilometres of track, other than railway track that is used solely by railway vehicles that are themselves used solely for heritage purposes".*

The project involves the construction and operation of 24.1km of railway track as the first extension of the 7 kilometre CBD Metro and will therefore result in a network of more than 30 kilometres of track. The metro network will therefore require an Environment Protection Licence under the POEO Act.

5.5.2 Roads Act 1993

Section 138(1) of the Roads Act 1993 (Roads Act) states:

"A person must not:

(a) erect a structure or carry out a work in, on or over a public road, or

(b) dig up or disturb the surface of a public road, or

(c) remove or interfere with a structure, work or tree on a public road, or

(d) pump water into a public road from any land adjoining the road, or

(e) connect a road (whether public or private) to a classified road,

otherwise than with the consent of the appropriate roads authority."

The project is expected to involve erecting structures in, on or over some public roads, as well as temporarily occupying or disturbing the surface of some public roads. Consent from the appropriate roads authority, being the Roads and Traffic Authority or the local council as relevant, will be required in accordance with section 138 of the Roads Act in respect of work carried out by a *"public authority"* on a classified road.

5.6 Commonwealth legislation – Environment Protection and Biodiversity Conservation Act 1999

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas and species, populations and communities and heritage items.

The approval of the Commonwealth Minister for the Environment is required for:

- An action which has, will have or is likely to have a significant impact on *"matters of National Environmental Significance"* (NES matters). The current NES matters include:
  - The world heritage values of a declared World Heritage property.
  - The National Heritage values of a listed National Heritage place.
  - The ecological character of a declared Ramsar wetland.
  - Listed threatened species and ecological communities.
  - Listed migratory species.
  - The Commonwealth marine environment.
  - Nuclear actions.
- An action by the Commonwealth or a Commonwealth agency which has, will have or is likely to have a significant impact on the environment.

- An action on Commonwealth land which has, will have or is likely to have a significant impact on the environment.
- An action which has will have or is likely to have a significant impact on the environment on Commonwealth land, no matter where it is to be carried out.

NES matters are assessed through a referral process to the Commonwealth Department of the Environment, Water, Heritage and the Arts (DEWHA). If the Commonwealth Minister for the Environment, Heritage and the Arts determines that a project is likely to have a significant impact on a NES matter then the project becomes a controlled action and approval of the Commonwealth Minister for the Environment, Heritage and the Arts will be required before construction could commence.

A preliminary consideration of the project against these triggers has been undertaken. Based on investigations completed to date, a number of ecological communities listed under the EPBC Act are located near Homebush Bay in close proximity to the project.

The EPBC Act may also be triggered if the proposal impacts upon Commonwealth land or heritage items listed within the Australian Heritage Database. The preferred Parramatta station site is located near Linden House and Lancer Barracks, which are listed on the Register of National Estate. In addition to having local and RNE heritage listings, Linden House and the Lancer Barracks are also identified as a Commonwealth Heritage Place, which is located on Commonwealth land.

At this early stage of assessment, it is considered that approval for the proposal is not required under the EPBC Act and therefore, referral to the Commonwealth Minister for the Environment, Water, Heritage and the Arts is not required. However, this would be considered further during the preparation of the EA when detailed property, flora and fauna and heritage investigations are undertaken.

If the West Metro was likely to result in a ‘significant’ impact, direct or indirect, upon these NES matters, concurrent Commonwealth approval under the EPBC Act would be required.

5.7 Station masterplanning

The locations for the West Metro stations have been selected because of their relationship to existing land use and transport networks, and their potential to serve or stimulate anticipated urban growth and change, reflecting current and future regional and local strategic directions.

In most cases, the stations are proposed within or adjacent to well-established urban areas, with their own local communities, social networks, businesses, movement patterns, and ways of life. Improved access by metro rail will inevitably raise a host of issues and opportunities for centres along the West Metro route. But it has the potential to improve the quality of life for local residents significantly, as well as offering broader benefits for the region’s economy and its transport networks.

The successful introduction of metro requires a co-ordinated response from all levels of government. Sydney Metro will work with local councils, the Department of Planning, and other key agencies and stakeholders to manage the direct impacts arising from construction and operation of the stations.

Moreover, in order to ensure that the benefits of metro access can be enjoyed fully, while recognising the local context, Sydney Metro will work closely with these parties at each centre along the route to prepare masterplans for the station precinct, so as to identify any potential for land use change and improved amenity which may be presented by metro.

This will be achieved through:

- Providing the general managers of all councils along the route, and the Chief Executive Officer of the Sydney Olympic Park Authority (SOPA), with a briefing on the project at the time of submitting this Project Application and PEA, and inviting their active participation in future planning and design work for the project.
- Providing briefings to all relevant State Government agencies to ensure an integrated approach across government.
- Working jointly with councils and the Department of Planning to:
  - Identify strategic direction for local economies and property markets.
  - Assess land use zonings and redevelopment potential.
  - Confirm station locations and configurations.
  - Refine concept designs, including the finalisation of transport and access arrangements for the proposed stations.
  - Assess construction and operational traffic impacts, and develop appropriate mitigation measures.
  - Understand and accommodate community preferences.
- Preparing detailed masterplans for all station precincts, outlining the transport land use context for the stations, together with recommended ways to:
  - Optimise station design, including access, public domain, and landscaping.
  - Provide adequately for passenger access and pedestrian flows.
  - Provide for cycle storage.
  - Ensure effective interchange with other transport modes.
  - Optimise the relationship of the station and the surrounding urban environment in terms of built form, urban design, landscaping, and land use integration.
- Co-operating with the Department of Planning, SOPA and councils to re-assess current regional, draft sub-regional, and local planning strategies to incorporate the potential of metro rail and to create supportive land use contexts for the stations.
- Co-operating with NSW Transport and Infrastructure, the Roads and Traffic Authority, and transport operators, as appropriate, to re-assess and adapt transport networks and services to optimise the transport performance of the station locations.

6 Preliminary environmental risk analysis

Environmental risk analysis enables the identification of potentially significant environmental effects associated with projects. It is an important part of the Part 3A environmental assessment process. Evaluation of the environmental baseline and the construction and operating characteristics of projects assists in deriving important information on potential issues and further assessment needs.

The study area for the West Metro consists of a corridor between Westmead and Sydney's CBD. Where relevant, existing assessments in the study area provide useful background information that aids the environmental risk analysis process. Building on the review and reconfirmation of these existing key risk issues, the West Metro environmental risk analysis has adopted an iterative evaluation process. This enables environmental risk issues to be incorporated into the project design. The results of this preliminary environmental risk analysis have identified those issues considered to be key issues for the EA. Identified key issues are:

- Operational transport impacts and interactions.
- Spoil management (including contamination).
- Construction traffic.
- Operational noise and vibration.
- Construction noise and vibration.
- Land use and socio-economic implications.
- Non-indigenous heritage.

The majority of these issues are expected to arise from surface related construction activities and will be concentrated around station locations and key construction sites.

It is recognised that the proposed station locations are generally within sensitive locations including, but not limited to, parks, roads, shopping centres and civic spaces. The complexities of constructing within such sensitive locations will be carefully considered during the design and planning for the West Metro project.

These key issues are discussed, and anticipated requirements for further assessment have been identified, in Section 7.

A number of other environmental aspects that could largely be addressed using management measures have also been identified and are discussed in Section 8.

Environmental risk analysis of potential environmental impacts associated with the project, proposed mitigation measures and any potentially significant residual impacts after the application of proposed mitigation measures will be undertaken during the preparation of the EA. Should any additional key issues be identified, an appropriately detailed impact assessment will be included in the EA.

In addition, consideration of the principles of ecologically sustainable development and potential cumulative impacts will be documented in the EA.

7 Key environmental issues

7.1 Operational transport impacts and implications

7.1.1 Background

The study area contains a variety of road and rail infrastructure. Transport infrastructure in the CBD to Westmead corridor plays a key role in the metropolitan transport system, serving both local and regional travel demands. Total daily travel across all modes in this corridor amounts to 9.26 million passenger kilometres per day, making it the most travelled corridor in Sydney (Urban Transport Statement, 2006). Major transport routes in the western corridor forming the “western spine” include the Main Western rail line, the M4 Motorway, Parramatta Road and Parramatta River. Rail lines include the dedicated freight lines between Strathfield and Parramatta and six CityRail passenger rail lines (the Western Line, Carlingford Line, South Line, Northern Line, Inner West Line, and the Bankstown Line). CityRail stations near the West Metro alignment are located at Central, Redfern, Macdonaldtown, Newtown, Stanmore, Petersham, Lewisham, Summer Hill, Ashfield, Croydon, Burwood, Strathfield, North Strathfield, Homebush, Flemington, Sydney Olympic Park, Lidcombe, Auburn, Clyde, Rosehill, Camellia, Granville, Harris Park, Parramatta and Westmead. In addition, the Sydney Light Rail connects fourteen stops between Central and Lilyfield via a combination of on-street and dedicated above ground tracks.

As outlined in Section 3, both the road and rail networks are operating at or near capacity in the week day morning and evening peak periods. Heavy road traffic flows are increasingly extending into business hours and weekends as demand for personal, business and freight related travel increases. Traffic congestion impacts on the travel time and travel time reliability of bus services. Current congestion on the main western rail corridor is the highest on the Sydney network, with an AM peak hour average loading of 130 per cent (where a loading of 100 per cent means all passengers have a seat). A significant number of services exceed ‘crush capacity’ of 135 per cent, with loads often up to 180 per cent (Transport Data Centre, 2008).

CityRail stations at Parramatta, Strathfield, Burwood and Ashfield are the most patronised stations in the corridor. Pedestrian and cyclist infrastructure is generally focused around CityRail stations. However, the extent of linkages provided varies. Local bus services link residential areas, commercial precincts and railway stations in Sydney’s west. While no large scale car parking is provided at CityRail stations within the study area, street parking and some limited at grade parking facilities are available. The car parking around these CityRail stations is generally time limited and some parking is metered.

7.1.2 Potential issues

The West Metro linking the CBD Metro with Parramatta and Westmead will:

- Provide a new, world-class rail line with high frequency, rapid and accessible train services.
- Significantly improve public transport travel times and reliability, especially for travellers from areas currently serviced by buses.
- Relieve congestion in the western corridor and the broader rail network.
- Deliver strategically located stations, directly accessible to employment, residential and other key destinations.

- Strengthen Parramatta's role as Sydney's second CBD.
- Enable strategic interchange opportunities with other transport networks.
- Provide significant support for transit oriented development and urban regeneration within the corridor.
- Deliver services to new rail markets, in areas which are currently not well served by public transport.
- Stimulate employment and residential growth in Australia's most significant urban corridor, thereby driving national productivity and competitiveness.

Of the eleven proposed West Metro stations, interchange with the CityRail network would be provided at Parramatta, Camellia and Strathfield. Interchange with existing bus services will be provided at Westmead (which is located adjacent to the T-way station on Darcy Road), Parramatta (including the local 'Loop' bus service and cross-regional bus services), Strathfield, Burwood, Five Dock Leichhardt, Camperdown and Broadway-Sydney University.

The development of metro stations is likely to alter travel patterns within the station locality, redistributing vehicular traffic and impacting pedestrian and cyclist movements and may require alterations and/or additions to existing bus services. Effective interchange with all transport modes will be integral to the patronage of the West Metro and a fundamental input to station design and broader station area planning.

As West Metro is the first extension of the CBD Metro, consideration will be given to the implications for future expansion of the network and associated impacts on existing and proposed infrastructure and corridors.

7.1.3 Scope of further studies

Operational transport studies will include:

- An analysis of likely transport impacts including:
  - Collection of traffic and transport data on key road and rail routes within the corridor and around proposed station localities to provide an adequate baseline model.
  - Forecasting of likely project patronage and changes in utilisation of key road and rail routes within the corridor.
  - Analysis of traffic and transport implications within proposed station localities.
- Station precincts will be designed to ensure integration with existing and proposed transport and infrastructure and to provide a high degree of accessibility to all transport modes, consistent with the objectives of *Integrated Land Use and Transport* (DUAP, 2001). Appropriate access arrangements at each new station will give consideration to (but not necessarily be limited to) the following matters:
  - Road access arrangements.
  - Bus access arrangements.
  - Interchange with CityRail services where relevant.

- Provision for kiss and ride and taxis.
- Pedestrian and cyclist linkages.

The EA will indicate how the project will be designed and implemented to facilitate a potential expansion of the metro system.

7.2 Spoil management

7.2.1 Potential issues

All material generated by excavation is defined as spoil. Spoil will be generated from site preparation activities, the excavation of tunnels and station boxes, and cut and fill activities. A considerable volume of spoil is likely to be generated during construction of the project. Spoil will be removed from major tunnelling sites and from each of the station construction sites.

Spoil management encompasses transport off-site and reuse, recycling or disposal of spoil. The majority of this spoil is likely to be Virgin Excavated Natural Material (VENM), clean natural material (such as clay, gravel, sand, soil and rock) that is not mixed with any other type of waste and has been excavated from areas of land that are not contaminated. However, some large pockets of fill, contaminated soil and potentially acid sulphate soils will be encountered during excavation works. The potential for acid sulphate soils generally increases with proximity to tributaries and foreshore areas. Registered contaminated sites within the study area are predominately service stations and industrial landfills. Contaminants may vary depending on the former use of the site. However, hydrocarbons, heavy metals, including lead, and asbestos are likely to be encountered.

The local impacts of spoil removal will require further assessment, particularly in relation to truck movements and routes, traffic noise, water quality management and dust management. While major construction sites are located adjacent to the arterial road network some sites may need to be accessed from the local road network. Removal of spoil by truck is expected to be the most suitable form of transport from most major construction sites and station construction sites.

Spoil will be reused or recycled in preference to disposal at licensed landfill sites. Spoil will be tested on site to determine appropriate uses including:

- Onsite reuse of VENM as engineering fill in construction of embankments and pavement construction.
- VENM recycling including use as engineering fill for approved developments and processing off site for use in other construction projects.
- Shale recycling where material is of an appropriate quality for use in brick manufacturing.

Final spoil reuse and recycling location(s) will be determined by the construction contractor. Contaminated spoil will be managed in accordance with Managing Contaminated Land: Planning Guidelines (DUAP and EPA, 1998).

7.2.2 Scope of further studies

Spoil management studies will include:

- Investigation of spoil removal by rail or barge.
- Investigation of spoil re-use and recycling opportunities.
- Further investigation and confirmation of an appropriate management approach for contaminated material and acid sulphate soils.

7.3 Construction traffic

7.3.1 Potential issues

Construction of the West Metro is likely to result in noticeable increases in heavy vehicle movements in the immediate vicinity of construction sites for the period of construction. In addition, some road and/or lane closures will be necessary during surface works, including around station construction sites. Pedestrian and cyclist access will require diversion and some loss of parking may be required to facilitate some construction works. As the West Metro will be entirely separate from the existing CityRail network, the project is not expected to result in any direct impacts on the CityRail network. However, some passengers may be slightly inconvenienced due to the proximity of the Parramatta, Camellia, and Strathfield station sites to existing CityRail stations.

Construction traffic impacts will be carefully considered in planning construction activities with a particular focus on:

- Minimising impacts during peak travel periods to avoid potential traffic safety and congestion impacts.
- Avoiding impacts on bus infrastructure and routes where practicable.
- Minimising the potential for cumulative impacts across the road networks.
- Ensuring that alternative pedestrian and cyclist access is provided where practicable.

Traffic management measures will be employed to minimise the potential for traffic delays during construction, including Traffic Management Plans for construction traffic to be submitted with the EA.

7.3.2 Scope of further studies

Construction traffic studies will include:

- Identification of potential impacts on arterial and local roads, bus infrastructure and routes and pedestrian and cyclist access associated with each construction site including the volume of heavy vehicle movements.
- Management frameworks to minimise impacts, focusing on major construction sites, spoil transportation and activities which are likely to result in the disruption to traffic.
- The EA will present a strategy for monitoring and mitigating traffic impacts with a focus on activities identified as having the greatest potential for traffic flow and safety.

7.4 Operational noise and vibration

7.4.1 Background

While background noise is variable across the study area, it is largely characterised by proximity to roads and the existing CityRail and Sydney Light Rail corridors.

Noise-sensitive land uses in the study area include residences, schools, hospitals, child care facilities and recreational facilities such as parks. Industrial and commercial properties are not considered to be as sensitive to impacts as residential receivers.

7.4.2 Potential issues

Rail traffic in the tunnel will generate some ground-borne noise and vibration. The key parameters influencing the level of ground-borne noise are train speed, wheel condition, rail condition, track features and design, tunnel design, rolling stock design, receiver distance, ground conditions, depth of the tunnel and building design.

The required assessment process and applicable criteria are documented in the Department of Environment and Climate Change's *Interim Guidelines for the Assessment of Noise from Rail Infrastructure Projects* (2007) (IGANRIP) and *Assessing Vibration: A Technical Guideline* (2006). These guidelines reference non-mandatory noise trigger levels for various land uses, which if exceeded, require the consideration of all feasible and reasonable mitigation measures in order to reduce the potential noise impacts.

Rail noise modelling will be an integral input to the design development process. Catchments where trigger levels are likely to be exceeded, will be identified as early as possible and mitigation strategies developed.

In addition, the station ventilation systems will also generate some noise. Further assessment will be undertaken in accordance with the Environment Protection Authority's Industrial Noise Policy (2000) which sets out assessment requirements and criteria for stationary plant and equipment. These facilities will be designed to minimise noise impacts.

7.4.3 Scope of further studies

Operational noise and vibration studies will include:

- Defining the existing noise environment through monitoring at representative locations.
- Establishing applicable noise criteria for the project in accordance with the IGANRIP.
- Prediction of likely noise and vibration levels for identified noise catchment areas utilising maximum rail traffic predictions for representative years.
- An outline of mitigation strategies for each noise catchment area for further consideration during design development.
- Noise predictions for all surface buildings and plant will also be conducted in accordance with the *Industrial Noise Policy* and these facilities will be designed to minimise noise impacts.

The EA will address the criteria documented in the IGANRIP.

7.5 Construction noise and vibration

7.5.1 Potential issues

Noise and vibration impacts will be generated for the duration of construction, which is predicted to take around six years. The extent of construction noise and vibration impact associated with the project will depend on the construction sequencing adopted, plant and equipment utilised and the distance to receivers. Significant construction noise impacts are likely to be intermittent and relatively short term in duration. The areas of highest impact will be around the major tunnelling and station sites. Additional construction noise impacts will also occur where surface works including roadworks are proposed.

Standard construction noise mitigation has the potential to reduce construction impacts, including:

- A considered approach to scheduling construction works having regard to the nature of construction activity.
- Providing advance notification of the time and duration of the construction activity.
- Considering likely noise impacts in determining construction site layouts.
- Operating plant and equipment quietly and efficiently manner and ensuring plant and equipment is regularly maintained.
- Consideration of the use of alternative broadband reversing alarms.
- Incorporating noise barriers where practicable.
- Providing respite periods where practicable.

Tunnel excavation and required surface support activities will occur 24 hours a day. Tunnel and station box excavation (using TBMs and roadheaders) may result in ground-borne noise (regenerated noise) impacts at residential receivers located above the tunnels at night. These potential impacts will be influenced by the tunnelling machinery utilised, the depth of tunnelling works, ground conditions and the materials used to construct the subject residences. Regenerated noise impacts will be short term in duration (approximately 2-3 weeks) and may be managed through comprehensive and proactive community consultation and a reactive management approach.

The EA will present a strategy for maintaining and integrating construction noise and vibration with a focus on activities having the greatest potential for adverse effects from noise and vibration.

7.5.2 Scope of further studies

Construction noise and vibration studies will include:

- Construction noise assessment focusing on major construction sites, ground-borne noise and vibration from tunnelling and activities likely to require significant night works.
- Identification of a suite of possible mitigation measures for consideration during construction planning.

7.6 Land use and socio-economic implications

7.6.1 Background

The West Metro will be located in an established urban corridor. Much of the corridor has residential zonings comprising single and multiple dwellings, with typical lot size decreasing toward the Sydney CBD. However, a variety of other land use zonings are located within the study area including commercial, industrial, open space, special use and mixed use. Between Sydney CBD and Sydney Olympic Park, commercial zonings are generally located adjacent to arterial road corridors such as Parramatta Road, elsewhere, they are clustered around existing rail stations including Burwood, and Strathfield. Outside the Sydney CBD commercial and industrial land use zonings within the study area are also generally located adjacent to transport corridors such as Parramatta Road and Victoria Road. Industrial zones intensify within Auburn Local Government Area and to the west as far as Camellia, while within Parramatta city centre the zoning is commercial and generally surrounded by mixed use.

Land use zoning is an indicator of development potential and the planned urban structure. Some precincts within the corridor, in particular Camellia and Silverwater, are currently under-utilised, meaning that existing development is not consistent with allowable uses and densities.

Based on 2006 Census of Population and Housing statistics, the major demographic characteristics of the western corridor relative to the Sydney Statistical Division average are:

- Higher than average proportion of medium and high density housing.
- Higher than average proportion of people born overseas.
- Slightly younger than average age profile.
- Slightly higher than average rates of unemployment.
- Higher than average proportion of rented dwellings.
- Higher than average household size.
- Slightly lower than average household incomes.

7.6.2 Potential issues

The main potential adverse socio-economic impact associated with the project will be the potential for temporary disruption during construction. Increased noise, traffic and dust levels, access impacts and reduction in visual amenity during construction activities could temporarily adversely affect local residents, businesses and other sensitive land uses. Some property and business acquisitions will also be required (see Section 8). In addition to direct impacts, businesses located outside the construction precincts may experience disruption to business activities, including temporary customer inconvenience.

A range of major positive social and economic impacts are expected as part of the project, including significant improvements to transport services, increased economic activity and employment opportunities during construction and operation. Wider economic benefits are derived from reducing the perceived distance between localities. Wider economic benefits associated with rail projects include:

- Facilitation of new residential and employment areas through enhanced capacity and connectivity.
- Greater mobility and community linkages within the subregions.

- Increased urban density and unlocking the development potential of brownfield sites.
- Enhanced agglomeration benefits.
- Greater competition in labour markets.
- Impacts on property prices for existing residential and commercial areas.
- Increased reliability of deliveries for businesses with improved productivity from reduced travel times.
- Reduced costs of goods and services.
- Greater access to services such as educational facilities and hospitals.
- Greater economic efficiency.
- Improved access to employment opportunities, leading to increased labour mobility.
- Rejuvenation and stimulus of currently run down urban areas.

Station Plans will be prepared in accordance with Sydney Metro legislation in order to ensure that potential social and economic benefits, and land use development opportunities of the project are captured to the greatest extent possible. The integration of each station with surrounding land uses and the promotion of development in the vicinity will be a key focus of these plans.

7.6.3 Scope of further studies

Social, economic and land use studies will include:

- Consideration of local community (services, access and amenity) related changes during construction and proposed measures to minimise these impacts. A social and economic impact assessment will be carried out as part of the EA.
- Analysis of potential sustainable long term socio-economic and land use changes to input to the concurrent station planning process.

7.7 Non-indigenous heritage

7.7.1 Background

The study area contains some of the earliest suburbs of Sydney including locations of early colonial settlement. A preliminary analysis of statutory heritage listings has been undertaken including the Australia Heritage Database (which includes the Register of National Estate, Commonwealth Heritage List, National Heritage List and World Heritage List), NSW State Heritage Inventory and State Heritage Register, Section 170 Heritage and Conservation listings of NSW State agencies and relevant local environmental planning instruments. Key listed non-Indigenous heritage items within or in close proximity to station localities identified through this preliminary review are outlined in Table 7.1.

Table 7.1 Non-indigenous heritage – site specific issues

Station	Listed items near station localities
Westmead	• Cumberland Hospital and grounds. • Some University of Western Sydney buildings.
Parramatta	• CityRail Parramatta station. • Arthur Phillip High School. • Commercial Hotel. • Parramatta Town Hall. • Former Fire Station (Church Street). • Leigh Memorial Uniting Church. • Linden House. • Lancer Barracks. • Parramatta Regional Park.
Camellia	• Madgee Grave. • Sewage Pumping Station 67.
Strathfield	• CityRail Strathfield station.
Burwood	• CityRail Burwood station. • Ilfracombe Conservation area. • 90-98 Burwood Road. • Bath Arms Hotel.
Leichhardt	• Bald Faced Stag Hotel. • Numerous locally listed houses. • Adjacent to heritage conservation area.
Camperdown	• Royal Prince Alfred Hospital. • University of Sydney. • Adjacent to heritage conservation area.
Broadway –Sydney University	• Victoria Park. • University of Sydney. • Adjacent to heritage conservation area.

No heritage listings are located within the Five Dock, Sydney Olympic Park or Silverwater station localities.

7.7.2 Potential issues

The project will not directly impact on the majority of non-indigenous heritage items identified.

Broadway-Sydney University station will be located in Victoria Park and directly adjacent to the grounds from the University of Sydney both of which are listed on the Register of National Estate. In addition, this station site is also directly adjacent to Glebe local heritage conservation area.

Leichhardt station site is located adjacent to a heritage conservation area identified under the *Leichhardt Local Environmental Plan 2000*.

A high density of heritage items is located within the Parramatta CBD and large precincts are identified as heritage conservation areas. The preferred Parramatta station site is located near the locally listed Leigh Memorial Uniting Church and Linden House and Lancer Barracks, which are listed on the

Register of National Estate, are located nearby. In addition to having local and RNE heritage listings, Linden House and the Lancer Barracks are also identified as a Commonwealth Heritage Place, which is located on Commonwealth land.

Any potential impacts on heritage items at the preferred Broadway-Sydney University, Leichhardt and Parramatta station sites will be assessed fully in the EA, and measures adopted to mitigate any adverse effects.

The potential impacts of stations on non-indigenous heritage items will need to be assessed in parallel with the development of the reference design. In addition, where tunnelling has the potential to result in vibration impacts on heritage structures during construction, these impacts will also need to be investigated. Heritage significance will also be an important consideration in assessing visual impacts and urban design. These issues are discussed further in Section 8.

7.7.3 Scope of further studies

Non-indigenous heritage studies will include:

- Identification of items of heritage significance (including items both above and below ground) in and around the project that may be directly or indirectly affected during construction or operation.
- Consideration of the potential impacts to the heritage value, settings and integrity of heritage areas and items located in the vicinity of the project.

The EA will include a Heritage Impact Statement addressing areas relating to items of heritage significance.

8 Other environmental issues

The environmental risk analysis process indicated that the following issues could be addressed by standard mitigation and management measures, and subsequently are not considered to be key environmental issues for the purpose of the EA.

Table 8.1 Other environmental issues

Environmental aspect	Potential issues	Preliminary management strategy*
Indigenous heritage	• Based on a search of the Aboriginal Heritage Information Management System, a number of Aboriginal heritage items and sites have been identified in the study area, with a particular concentration of sites in the Parramatta CBD and in Broadway in proximity to the preferred Broadway-Sydney University station site.	• Conduct studies to confirm the presence of any Aboriginal heritage sites potentially affected by the project. • Consider identified sites during reference design development and avoid any direct impacts if practicable. • Stop work during construction if any previously unidentified relics are identified and consult an Aboriginal heritage specialist. Work in the affected areas will not resume until any required approvals have been received.
Ecology	• Small pockets of remnant native vegetation occur in recreational areas, fragmented bushland and adjacent to watercourses within the study area including Duck Creek and Subiaco Creek. Parramatta Regional Park is a noteworthy area of biodiversity value which supports the endangered ecological communities of Shale/Sandstone Transition Forest and Cumberland Plain Woodland. • Data from the Department of Environment and Climate Change indicates that eighteen threatened species may potentially inhabit the study area including the Green and Golden Bell Frog, a threatened species which is found within the preferred Sydney Olympic Park station locality. • As the West Metro will be largely in tunnel, surface impacts will be restricted to station sites and construction sites.	• Minimise the extent of clearing required. • Where clearing of vegetation is required, assess the extent of potential impact and identify appropriate mitigation strategies.

Environmental aspect	Potential issues	Preliminary management strategy*
	• Burwood and Broadway-Sydney University stations may impact on mature trees which are identified for preservation under local environmental planning instruments. There may also potential for some impact on the transplanted fig trees within the Olympic Park precinct and on mature trees within Victoria Park.	
Visual impact, urban design and landscaping	• As the project is mainly in tunnel, the potential for visual impacts is limited to station sites. • During construction the project construction sites may have a short term visual impact on surrounding land uses.	• The West Metro will be designed to integrate with the existing environment at the proposed station locations so as to minimise potential visual impacts. • Consideration will be given to existing relevant urban design guidelines and stations will be designed to the highest contemporary urban design criteria. • An independent Design Review Panel will be established to review design proposals for overall consistency with the project design objectives, and with State and local government master planning.
Geotechnical considerations and groundwater management	• The study area generally consists of undulating rises and broad flats. A number of soil types along the corridor are erosive. Underlying geology varies, but is characterised by Hawkesbury Sandstone, shales and alluvial deposits in the vicinity of waterways. • Aquifers are known to be shallow in some areas of the study area, particularly around the Parramatta CBD. • Contamination and the potential for encountering acid sulphate soils are discussed in Section 7.2 of this Report.	• Undertake geotechnical investigation as part of design development and implement appropriate mitigation strategies. • Assess the effects of any groundwater drawdown associated with the construction of the project and any likely settlement impacts, including the potential for damage to buildings and structures and measures to minimise, monitor and offset potential impacts. • Groundwater inflows captured during the construction of the project will be treated prior to discharge.
Hydrology and flooding	• The proposal passes under Hawthorne Canal, Iron Cove Creek, Powells Creek, Haslams Creek, Duck River, Clay Cliff Creek, A'Beckett Creek and runs in close proximity to Parramatta River.	• Consider potential flooding impacts during design development and avoid any adverse impacts, if practicable. • Ensure that tunnel portals are designed to avoid inflows during a probable maximum flood event.

Environmental aspect	Potential issues	Preliminary management strategy*
	• Areas that are flood prone include low-lying land adjacent to Parramatta River. • It is anticipated that the proposal is unlikely to have a significant impact on hydrology and flooding given that the works are primarily in tunnel.	
Construction water management	• Due to the highly urbanised nature of the study area, water quality is likely to be influenced by pollutants from various point and diffuse sources, such as stormwater runoff. • During construction the disturbance of soils at construction sites will create the potential for the mobilisation of sediment.	• Measures to minimise impacts on water quality will be identified during design development and construction planning in accordance with the guideline Soils and Construction, Managing Urban Stormwater (Landcom, 2004).
Operational air quality	• The project will use electric trains which will emit very small quantities of brake dust at locations where they were required to slow or stop. • Each underground station will require a ventilation system and outlet. Depending on the distances between stations, intermediate ventilation outlets may also be required. Air flow from these ventilation outlets will not result in any adverse impacts on surrounding receptors. • Emissions from motor vehicles are a major contributor to urban air pollution. As the project will result in a mode shift away from private car usage this will have a net positive benefit on roadside air quality.	• Assess the extent of mode shift away from private car usage resulting from the project.
Construction air quality	• There is the potential for dust generation from above ground construction sites and during tunnel excavation. Construction vehicles and plant and equipment will also generate some emissions.	• Standard mitigation measures will be employed to reduce dust emissions. • Plant and equipment will not be left idling when not in use. • A construction ventilation system will be implemented at tunnelling sites.

Environmental aspect	Potential issues	Preliminary management strategy*
Energy and greenhouse	• As outlined above the operation of the project will have a net positive benefit on air quality including a reduction in greenhouse gas emissions; however, the construction of tunnels requires significant resource inputs including concrete (which also contributes significantly to greenhouse gas emissions) and generates large volumes of waste and spoil.	• A number of measures to minimise greenhouse gas emissions will be considered during design development including: – Minimisation of spoil generation and required materials inputs. – Use of recycled materials during construction. – Protecting and maintaining biodiversity values during construction. – Reuse and recycling of spoil. – Capture of water for reuse during construction. – Better use of the natural environment in design including passive systems (natural ventilation and natural light) where practicable. – Minimisation of operational electricity usage (through minimising vertical tunnel gradients and selection of energy efficient rolling stock).
Property impacts	• Construction of the project in tunnel will limit property impacts to within the vicinity of station sites and construction sites. • The perceived impact of infrastructure and, in particular, tunnels on property values is also a noted community concern. Based on experience following the opening of other rail and road tunnel projects, property values in the vicinity of such projects tend to appreciate in the longer term due to greater accessibility and improved urban amenity.	• Minimise impacts on property and the need for property acquisition during design development. • Undertake any property acquisition in accordance with the NSW Land Acquisition (Just Terms Compensation) Act, 1991. • Where partial acquisition is required any reasonable property adjustments will be carried out at no cost to the owner. • Any damage to property resulting from the proposal will be rectified at no cost to the owner.
Utilities and services	• Detailed investigations have yet to be undertaken, but considering the highly urbanised nature of the corridor it is inevitable that construction of the project will impact on some utilities.	• Identify utilities that may be impacted by the project and, in consultation with the owner, develop appropriate management strategies including consideration of the need for protection or relocation.

Environmental aspect	Potential issues	Preliminary management strategy*
Resource and waste management	• The project will generate waste from a number of streams including building materials, green waste and office waste. Spoil management is discussed in Section 7.2 of this Report.	• Measures to minimise use of resources will be considered as part of design development, procurement and construction planning. • Waste management will be undertaken in accordance with the resources management hierarchy outlined by the NSW Waste Avoidance and Recovery Act, 2002 and other relevant polices and guidelines.

* Mitigation strategies will need to be confirmed as part of the detailed EA.

9 Conclusion

9.1 Overview

Sydney Metro is seeking Project Approval under Part 3A of the EP&A Act for the West Metro, a twin-track passenger metro railway, 24.1 km in length extending from Westmead to the CBD Metro station at Central and featuring eleven stations.

This PEA for the West Metro identifies a number of potential environmental impacts during the construction and operational phases that will require further detailed investigation as part of the detailed EA.

In addition, a number of relatively minor impacts associated with the project have been identified that could be effectively managed and/or adequately mitigated through the design process and application of standard and/or tailored mitigation measures.

9.2 Proposed scope of the detailed EA

In accordance with the PEA undertaken for the project, Table 9.1 summarises the proposed scope of the detailed EA, having regard to the issues identified throughout this report.

Table 9.1 Proposed scope of the EA

Issue	Scope of the EA
General	• Strategic justification including consideration of mode alternatives. • Project justification including consideration of alternative alignment and station locations. • Description of the project. • Consideration of planning and statutory requirements (NSW and Commonwealth). • Consideration of the principles of ecologically sustainable development in the context of the project. • Consideration of any potential cumulative impacts.
Stakeholder consultation	• Description of consultation activities conducted during the EA. • Outline of consultation and community strategy.
Operational transport impacts and implications	• An analysis of possible transport impacts including: – Collection of traffic and transport data on key road and rail routes within the corridor and around proposed station localities to provide an adequate baseline model. – Forecasting of likely project patronage and changes in utilisation of key road and rail routes within the corridor. – Analysis of traffic and transport implications within proposed station localities.

Issue	Scope of the EA
	• Station precincts will be designed to provide a high degree of accessibility to all transport modes, consistent with the objectives of Integrated *Land Use and Transport* (DUAP, 2001). Appropriate access arrangements at each new station will give consideration to (but not necessarily be limited to) the following matters: – Road access arrangements. – Bus access arrangements. – Interchange with CityRail services where relevant. – Provision for kiss and ride and taxis. – Pedestrian and cyclist linkages.
Spoil management	• Investigation of spoil removal by rail or barge. • Investigation of spoil reuse and recycling opportunities. • Further investigation and confirmation of an appropriate management approach for contaminated material and acid sulphate soils.
Construction traffic and transport	• Identification of potential impacts on arterial and local roads, bus infrastructure and routes and pedestrian and cyclist access associated with each construction site including volume of heavy vehicle movements. • Management frameworks to minimise impacts focusing on major construction sites, spoil transportation and activities which are likely to result in disruption to traffic.
Operational noise and vibration	• Defining the existing noise environment through monitoring at representative locations. • Establishing applicable noise criteria for the project in accordance with the IGANRIP. • Prediction of likely noise and vibration levels for identified noise catchment areas utilising worst case rail traffic predictions for representative years. • An outline of mitigation strategies for each noise catchment area for further consideration during design development. • Noise predictions for all surface buildings and plant will also be conducted in accordance with the Industrial Noise Policy and these facilities will be designed to minimise noise impacts.
Construction noise and vibration	• Construction noise assessment focusing on major construction sites, ground-borne noise and vibration from tunnelling and activities likely to require significant night works. • Identification of a suite of possible mitigation measures for consideration during construction planning.
Land use and socio-economic implications	• Consideration of local community (services, access and amenity) related changes during construction and proposed measures to minimise these impacts. • Analysis of potential sustainable long term socio-economic and land use changes to input to the concurrent station planning process.
Non-indigenous heritage	• Identification of items of heritage significance (including items both above and below ground) in and around the project that may be directly or indirectly affected during construction or operation. • Consideration of the potential impacts to the heritage value, settings and integrity of heritage areas and items located in the vicinity of the project.

Issue	Scope of the EA
Other environmental issues	• Undertake investigations to determine potential impacts and develop mitigation measures for the following issues: – Indigenous heritage. – Ecology. – Visual character, urban design and landscaping. – Geotechnical considerations and groundwater management. – Hydrology and flooding. – Construction water management. – Operational air quality. – Construction air quality. – Energy and greenhouse gas emissions. – Property. – Utilities and services. – Resources and waste management.
Environmental risk analysis	• Identification of potential environmental impacts associated with the project, proposed mitigation measures and any potentially significant residual impacts after the application of proposed mitigation measures. • Should any additional key issues be identified, an appropriately detailed impact assessment will be included in the EA.
Draft Statement of Commitments	• A draft list of the measures to avoid, minimise, manage, mitigate, offset and/or monitor impacts.

9.3 Next steps

A Project Application, supported by this PEA, is the first key step in the planning approvals and environmental assessment process for a West Metro. It identifies the benefits and potential impacts of the West Metro and outlines the scope of the required further studies. As Sydney Metro moves ahead in developing a metro system for Sydney, more information regarding this initiative will become available. The Project Application and a copy of this document have been lodged with the Department of Planning.

A toll-free information line has been established (1800 636 910) to receive and respond to all public enquiries and the Sydney Metro website (www.sydneymetro.nsw.gov.au) includes information on the project.

In response to the Project Application and PEA, the Director-General of the Department of Planning will issue requirements which outline the key issues that the proponent must address in its detailed EA. These requirements are prepared in consultation with relevant agencies and other key parties.

Following receipt of the Director-General's requirements, the EA will be prepared, supported by specialist studies to address the key issues identified.

The detailed EA will be exhibited in early 2010 for a minimum of 30 days and public comment will be invited. Advertisements will be placed in appropriate newspapers, and relevant State agencies and local councils will be notified, as well as affected and adjacent landowners.

The EA will be exhibited at the Department of Planning's head office, relevant regional offices, local council offices and on the Department's website. During the exhibition period any person is able to make a written submission to the Director-General regarding the project.

Submissions received by the Director-General are provided to the proponent and any relevant public authorities. The proponent may be required to prepare and submit:

- A submissions report, providing a response to the issues raised in the submissions; and/or
- A preferred project report, outlining any proposed changes to the project; and/or
- A revised statement of commitments.

The Director-General will then prepare a report to the Minister for Planning on the EA, for the purposes of the Minister's consideration of the application for approval to carry out the project.

The Minister for Planning will determine whether to approve or refuse the project. A project may be approved with such modifications of the project or on such conditions as may be determined by the Minister.

10 References

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