NSW GOVERNMENT | Planning & Environment

STATE SIGNIFICANT INFRASTRUCTURE ASSESSMENT:
WestConnex New M5
SSI 6788

Environmental Assessment Report under
Section 115ZA of the
Environmental Planning and Assessment Act 1979

April 2016

Cover Photograph: Photomontage of St Peters Interchange (source: SMC, April 2016)

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ABBREVIATIONS

ANZECC	Australian and New Zealand Environment Conservation Council
ADT	Average Daily Traffic
ARI	Average Recurrence Interval
AWT	Average Weekday Traffic
CBD	Central Business District
CEEC	Critical Endangered Ecological Community
CNVMP	Construction Noise and Vibration Management Plan
CSSI	Critical State Significant Infrastructure
Department	Department of Planning and Environment
DoE	Commonwealth Department of the Environment
DPI (Water)	Department of Primary Industries – Water
EEC	Endangered Ecological Community
EIS	Environmental Impact Assessment
EPA	Environment Protection Authority
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
ESA	Environmental Site Assessment
ESD	Ecologically Sustainable Development
GDE	Groundwater Dependent Ecosystem
GRAL	Graz Lagrangian model (air dispersal modelling system)
GRAMM	Graz Mesoscale Model (the meteorological (wind) model for GRAL)
HCV	Heavy Commercial Vehicle
ICNG	Interim Construction Noise Guideline
INP	NSW Industrial Noise Policy
LGA	Local Government Area
LoS	Level of Service
M4–M5 Link	Stage 3 of WestConnex
M4 East	Stage 1(b) of WestConnex
M4 Widening	Stage 1(a) of WestConnex
MOC	Motorway Operations Complex
Minister	Minister for Planning
NCA	Noise Catchment Areas
New M5	Stage 2 of WestConnex
NML	Noise Management Level
NSW Health	NSW Ministry of Health
OEH	NSW Office of Environment and Heritage
PMF	Probable Maximum Flood
Proponent	Roads and Maritime Services
RMS	Roads and Maritime Services
RNP	NSW Road Noise Policy
RWR	Residential, workplace and recreational receptors
SEARs	Secretary's Environmental Assessment Requirements
Secretary	Secretary of the Department of Planning and Environment
SSI	State Significant Infrastructure
TSC Act	Threatened Species Act 1995
WRTM	WestConnex Road Traffic Model

EXECUTIVE SUMMARY

The Proposal

Roads and Maritime Services (the Proponent), proposes to construct a project known as the New M5, as part of the WestConnex program of works.

WestConnex comprises a 33 kilometre motorway designed to improve connections between industrial, commercial and residential areas in Sydney's west, east and south-west, by creating road network links between the Sydney Central Business District (CBD), Sydney Airport, Port Botany and the Parramatta CBD.

WestConnex is expected to deliver broad economic benefits to NSW. The *WestConnex Updated Strategic Business Case* (NSW Government, 2015) estimated a $24.3 billion benefit to the State economy realised through better access to a more reliable motorway network. This results in more efficient freight movements, quicker trips to work and better access to businesses and services.

The component stages and projects of the WestConnex program of works are summarised in the table below.

WestConnex Stages	Projects	Current Status
Stage 1	M4 Widening (Parramatta to Homebush)	Approved and under construction.
	M4 East	Approved and under construction.
Stage 2	**The New M5**	**The subject of this report.**
	King Georges Road Interchange Upgrade	Approved and under construction.
Stage 3	M4-M5 Link	Secretary's Environmental Assessment Requirements issued.

The Sydney Motorway Corporation will deliver WestConnex, on behalf of RMS, with construction by the private sector.

The New M5 project (the project) involves building a twin-tunnel nine kilometre motorway connecting the existing M5 East Motorway, east of King Georges Road at Beverly Hills, and St Peters. It would include a new multi-level interchange at St Peters on the site of the previous Alexandria Landfill, bounded by the Princes Highway, Campbell Road, Canal Road and Burrows Road. The interchange would provide road connections from the tunnels to Campbell Road and Euston Road.

Two bridges connecting Gardeners Road and Campbell Road to the interchange site would be built over the Alexandra Canal. On- and off- ramps would be constructed as part of the project to provide future connections to the M4-M5 Link, Southern extension and Sydney Gateway projects.

Five motorway operation centres would be established including:

- three ventilation facilities located adjacent to the M5 East Motorway at Beverly Grove Park, Kingsgrove, near the intersection of Marsh Street and the M5 East Motorway at Arncliffe and at the St Peters Interchange near the corner of Canal Road and the Princes Highway;
- a motorway control centre near the intersection of Burrows Road and Campbell Street at St Peters; and

- an emergency smoke extraction facility near the intersection of Bexley Road and the M5 East Motorway.

Need and Justification

Sydney's road and motorway network support economic growth across NSW by connecting people to jobs, facilitating trade between businesses and providing infrastructure to support freight movements. As Sydney's population and economy continue to grow, efficient transport systems become increasingly important in servicing future growth.

The *NSW Long Term Transport Management Plan* (Transport for NSW, 2012), notes that road congestion costs the NSW economy approximately $5.1 billion each year. This is largely due to time delays, which is forecast to increase to approximately $8.8 billion by 2020 if no improvements are made.

The M5 East Motorway is the main road corridor providing passenger, commercial and freight connections between south-west Sydney, the CBD, Sydney Airport, Port Botany and Sydney's eastern suburbs. The corridor also links with Sydney's orbital road network and the wider southern and south-western Sydney road network including King Georges Road, the Cumberland Highway, the Hume Motorway and M7 Motorway. The M5 East Motorway carries about 100,000 vehicles per day, including about 10,000 heavy vehicles, well in excess of its design capacity. The high volume of traffic results in heavy congestion, slow speeds and unreliable travel times.

Traffic modelling suggests that the New M5, when compared to the M5 East Motorway would improve traffic safety with modelling indicating the project would result in a 14 per cent reduction in average annual crash costs in 2021. The modelling also suggests a reduction in average travel times by around a half and double average travel speeds during the morning and afternoon peaks would be experienced.

The Department considers the New M5 project is justified as it would provide immediate and long-term operational benefits in relieving congestion along the M5 East Motorway. It would also increase the efficiency of the road network by providing an alternative to the M5 East Motorway. Furthermore, the project is strategically justified and consistent with the government's key priorities and transport planning framework.

Assessment and Approvals Process

The proposal is State Significant Infrastructure (SSI) and has also been declared Critical State Significant Infrastructure (CSSI) because it is deemed essential for the State. The Minister for Planning is the approval authority.

The Environmental Impact Statement (EIS) was publicly exhibited from Friday 27 November 2015 until Friday 29 January 2016 (64 days). A total of 10,195 submissions were received from approximately 8,044 individual submitters. Of the 8,045 individual submitters, 8,029 were identified as members of the public and special interest groups. Eight submissions were received from State government authorities, and seven submissions from local councils. One additional submission was received outside of the exhibition period.

Key issues raised in the submissions included:

- traffic and transport impacts;
- noise and vibration;
- air quality and human health impacts;
- biodiversity impacts;
- groundwater, soil and surface water impacts;
- contamination;
- urban design and visual amenity; and

- social and economic impacts.

Following the exhibition period, the Department of Planning and Environment directed the Proponent to prepare a response to the submissions. The Proponent provided a Response to Submissions Report which included a Preferred Infrastructure Report that was published on the Department's website.

Key Assessment Issues

Traffic and Transport

The Department has considered traffic and transport impacts during the construction and operational stages which included advice and recommendations from an independent traffic and transport consultant.

The Department's assessment concludes that impacts associated with construction traffic are unavoidable but that these impacts can be appropriately managed. The Department has recommended the Proponent prepare a suite of traffic management controls, to be set out in a Construction Traffic and Access Management Plan, Spoil Management Plan, and Ancillary Facilities Management Plan. These plans would ensure that traffic and access management measures are implemented to minimise impacts on the surrounding road network; ensure that spoil haulage occurs along approved routes; facilitate the safe movement of construction traffic to and from compound sites; and facilitate safe pedestrian and cyclist access around construction sites.

In terms of operational impacts, concern was raised in relation to increased traffic volumes and congestion along key roads and at intersections, particularly in Sydney's inner-west. Traffic volumes along King Street, Newtown and Euston Road, Alexandria are to be investigated further in a Road Network Performance Review Plan. The Plan requires the implementation of mitigation measures should traffic performance deficiencies be identified. The plan is to be prepared in consultation with the relevant local councils.

The Department also recognises the potential for rat-running through local streets to avoid tolls and congested intersections. The Department is satisfied that the Proponent's traffic modelling adequately accounted for the impacts of toll avoidance and effectively assessed the performance of arterial roads within and adjacent to the project area.

Noise and Vibration

Noise and vibration impacts are expected to occur throughout the construction phase of the project with surface road and interchange works likely to have the greatest noise impacts. In response, the Department has recommended a number of conditions to manage the impact of construction noise and vibration including the preparation and implementation of a Construction Noise and Vibration Management Plan.

To manage noise impacts once the project is operational, a combination of project controls and property treatments are proposed. These measures are supported by the Department and the Department requires the implementation of these measures as early as possible during construction to minimise construction noise impacts. The Department has also recommended the implementation of an Operational Noise Management Plan and Operational Noise and Vibration Review to ensure that noise and vibration levels generated by the project would comply with project specific noise criteria.

Air Quality

While air quality remains at good levels across broader Sydney, levels of atmospheric pollutants can be heavily influenced at a localised level by road traffic. Based on the outcomes of the air quality assessment, the operational air quality outcomes for the project (both in-tunnel and adjacent to the ventilation facilities) are considered acceptable.

The Department is satisfied that the changes in health risk associated with the project across the local area will be acceptable and will include improvements in some areas, including when measured against a no project scenario.

The Department has recommended limits on in-tunnel and ventilation outlet concentrations of key pollutants to ensure acceptable air quality outcomes. The Department has recommended monitoring and reporting requirements to determine compliance with the air quality and emissions goals and criteria. The Department has also recommended an Air Quality Community Consultative Committee be established comprising representative from the community and local councils. The Committee would have a consultative role on the air quality management plans and the siting of monitoring locations.

Biodiversity

The project was referred to the Commonwealth Department of the Environment who determined it to be a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* due to the potential impact on listed threatened species and communities. These species include the critically endangered Cooks River/Castlereagh Ironbark Forest and the endangered Green and Golden Bell Frog.

The Proponent has developed an offset strategy for the Cooks River/Castlereagh Ironbark Forest consistent with the *NSW Biodiversity Offsets Policy for Major Projects.*

To ensure the sustainability of the identified Green and Golden Bell Frog population, the Proponent has prepared a Plan of Management and a Habitat Creation and Captive Breeding Plan which have been endorsed by the Commonwealth Department of the Environment.

The Department acknowledges the unavoidable impacts on area of biodiversity value. However, it is considered that the proposed alignment of the project has avoided other areas of considerable biodiversity significance including endangered vegetation within the Wolli Creek Valley, a Grey-headed Flying Fox camp and habitat at Turrella and areas of coastal reedland and mangroves at the confluence of Wolli Creek and the Cooks River.

Groundwater

The project alignment is located in an area of complex geological composition and aquifers and would likely result in impacts to the existing groundwater conditions. The project may impact on groundwater conditions through contamination, drawdown and diminished groundwater quality as a result of saline intrusion. The Department engaged an independent groundwater consultant to provide recommendations in managing the likely impacts of the project.

The Department has recommended the Proponent undertake further groundwater modelling and monitoring and produce a Groundwater Modelling Report prior to finalising the design of the project to further verify groundwater drawdown, tunnel inflows and saline water migration. The Department has also recommended the Proponent implement a Water Quality Plan and Monitoring Program which requires monitoring of groundwater levels, pollutant and groundwater quality monitoring, verification of bore-users and 'make good' provisions for any impacted bores during construction and operation.

Soils and Surface Water Hydrology

Construction of the project may result in erosion, sedimentation and surface water impacts from site clearing, excavation works, and demolition, tunnelling and piling activities. There is also the potential for acid sulfate soils disturbance particularly around the former Alexandria Landfill site, the Alexandra Canal and at the Arncliffe construction compound. In response, the Department has recommended a Construction Soil and Water Management Plan be prepared to manage surface and groundwater impacts.

Water quality baseline data is continuing to be collected. The Department has recommended that this recently collected baseline data be used to determine Water Quality trigger criteria for discharging water.

Flooding and Drainage

Modelling indicates that construction works and ancillary facilities may increase 100 year ARI and PMF levels and alter flooding behaviours across the project corridor in the vicinity of the surface works. The Department has recommended a Flood Mitigation Strategy be prepared to ensure the project is designed in a manner which does not worsen existing flooding characteristics during construction and operation of the project. To verify the flooding impacts and predictions the Department has recommended a Flood Review Report be prepared after flood events to validate the flood prediction or include additional mitigation measures.

Contamination

The Department acknowledges the public health and safety concerns with regards to the removal and disposal of asbestos wastes and other contaminated material from the Alexandria Landfill. A draft Landfill Closure Management Plan has been provided as part of the application and the Department has recommended that the plan be finalised prior to any construction works commencing at the landfill site. The Department has also recommended a Soil Contamination Report be prepared prior to any excavation activities to determine whether land remediation is required.

The Department is satisfied the recommended conditions and the Proponent's environmental management measures would adequately reduce the risk of adverse environmental and human health impacts from exposure to contaminated materials during both construction and operation of the project.

Urban Design and Visual Amenity

The Department acknowledges that the surface elements of the project would have an impact on visual amenity, including the eastern and western ventilation facilities, motorways operation complex and surface interchanges.

The Department has recommended the preparation of an Urban Design and Landscape Plan to ensure that the final design is sympathetic with the surrounding urban context and built form, and that opportunities to enhance visual amenity have been incorporated into the design. Individual sub-plans are also required for the enhancement of Sydney Park, the M5 Linear Park, and the Alexandra Canal. The Department has also recommended the Proponent establish an enhanced Urban Design Review Panel to provide advice and guidance during the detailed design of the project.

Land Use, Social and Economic

Construction and operation of the project will require acquisitions of residential and commercial properties, as well as open space. Impacts to amenity and community identity are also expected adjacent to construction sites, operational surface infrastructure and adjacent to roads which will intensify in use. The Department has recommended the Proponent prepare and implement a Community and Social Management Plan, which includes a Community Cohesion Program, and a Residual Land Management Plan. The integration of the project with the King Street Gateway project to ensure mutual delivery of both projects has also been recommended.

Historic Heritage

A total of 53 locally and four State listed items were identified in the vicinity of the project. Construction would directly impact eight of the 57 identified heritage items, with three being demolished, three requiring modifications, and two requiring acquisition. Whilst it is acknowledged that the direct impacts of the project cannot be wholly offset or mitigated, the Department considers such impacts to be acceptable when considered in context of the

broader project benefits and the constrained nature of developing major linear infrastructure in a highly urbanised location.

The Department's recommendation includes the implementation of a Construction Heritage Management Plan, heritage interpretation plans, comprehensive salvaging of materials and items (particularly from the Rudders Bond Store), detailed photographic and drawn archival recording and stringent archaeological excavation, recovery and interpretation measures.

Other Issues

The assessment concludes that relevant impacts of other issues such as fire and hazard risks, greenhouse gas emissions and Aboriginal heritage can be appropriately managed through the implementation of mitigation measures and safeguards, as proposed in the Environmental Impact Statement and as recommended by the Department.

Conclusions and Recommendations

The project is a critical component to achieving the Government's transport policy and objectives and would provide an efficient link in the Sydney orbital motorway network and in the national freight network. The project is also justified by providing safer, faster and more reliable travel for motorists, while providing an alternative route for heavy vehicles.

The potential environmental impacts associated with the construction and operation would be acceptable subject to the implementation of appropriate mitigation measures. The project would comply with the objects of the *Environmental Planning and Assessment Act (1979)* and with the principles of Ecologically Sustainable Development.

On balance, the project's benefits outweigh its potential impacts and that any residual impacts can be managed and would not result in any long-term adverse or irreversible effects, subject to the conditions that have been recommended. It is therefore in the public interest that the project proceeds.

1. BACKGROUND

This section outlines the background to the New M5 project including what is proposed, how it fits within the broader WestConnex project and the main land uses along the proposed route.

The M5 Motorway corridor (comprising the M5 East Motorway and M5 West Motorway) is the major passenger, commercial and freight road connection between south-west Sydney, Sydney's south-eastern suburbs, Sydney Airport and Port Botany. The M5 East Motorway experiences heavy traffic congestion resulting in slow speeds and unreliable travels times for motorists, buses, commercial and freight vehicles.

To improve access and reduce congestion the Proponent has proposed a new motorway between St Peters and the existing M5 East Motorway in Kingsgrove. The new motorway link involves construction of twin tunnels of approximately nine kilometres in length including associated surface works to connect to the existing road network. The project route is shown in **Figure 1**.

The project spans six Local Government Areas (LGAs) and 13 suburbs. The LGAs are Botany Bay, Canterbury, Hurstville, Marrickville, Rockdale and City of Sydney. The suburbs are Alexandria, Arncliffe, Bardwell Park, Bardwell Valley, Beverly Hills, Bexley North, Earlwood, Kingsgrove, Mascot, St Peters, Sydenham, Tempe and Wolli Creek.

The project is a component of the WestConnex program of works (refer **Figure 2**). WestConnex involves a 33 kilometre long motorway linking Sydney's west and south-west with Sydney Airport and the Port Botany precinct and includes:

- widening of the M4 between Parramatta and Homebush (currently under construction);
- construction of the new M4 East twin tunnels between Homebush and Haberfield (currently under construction);
- the New M5 (the subject of this report);
- upgrade of the King Georges Road Interchange with the M5 Motorway (currently under construction); and
- the M4–M5 Link from Haberfield to St Peters (Secretary's Environmental Assessment Requirements issued).

Land uses vary along the route of the New M5 project including:

- residential, recreational and light industrial between the western portal location near Kooemba Street at Beverly Hills to Kingsgrove Road at Kingsgrove;
- predominantly residential developments with some open space between Kingsgrove Road and Arncliffe;
- residential, recreational, commercial and light industrial land uses between Arncliffe and Tempe;
- predominantly light industrial land uses between Tempe and Campbell Road at St Peters, with residential areas on the northern side of the Princes Highway;
- former landfill site (Alexandria Landfill) at the location of the proposed St Peters Interchange; and
- predominantly light industrial and commercial land uses, with recreational areas and interspersed residences adjoining the landfill St Peters.

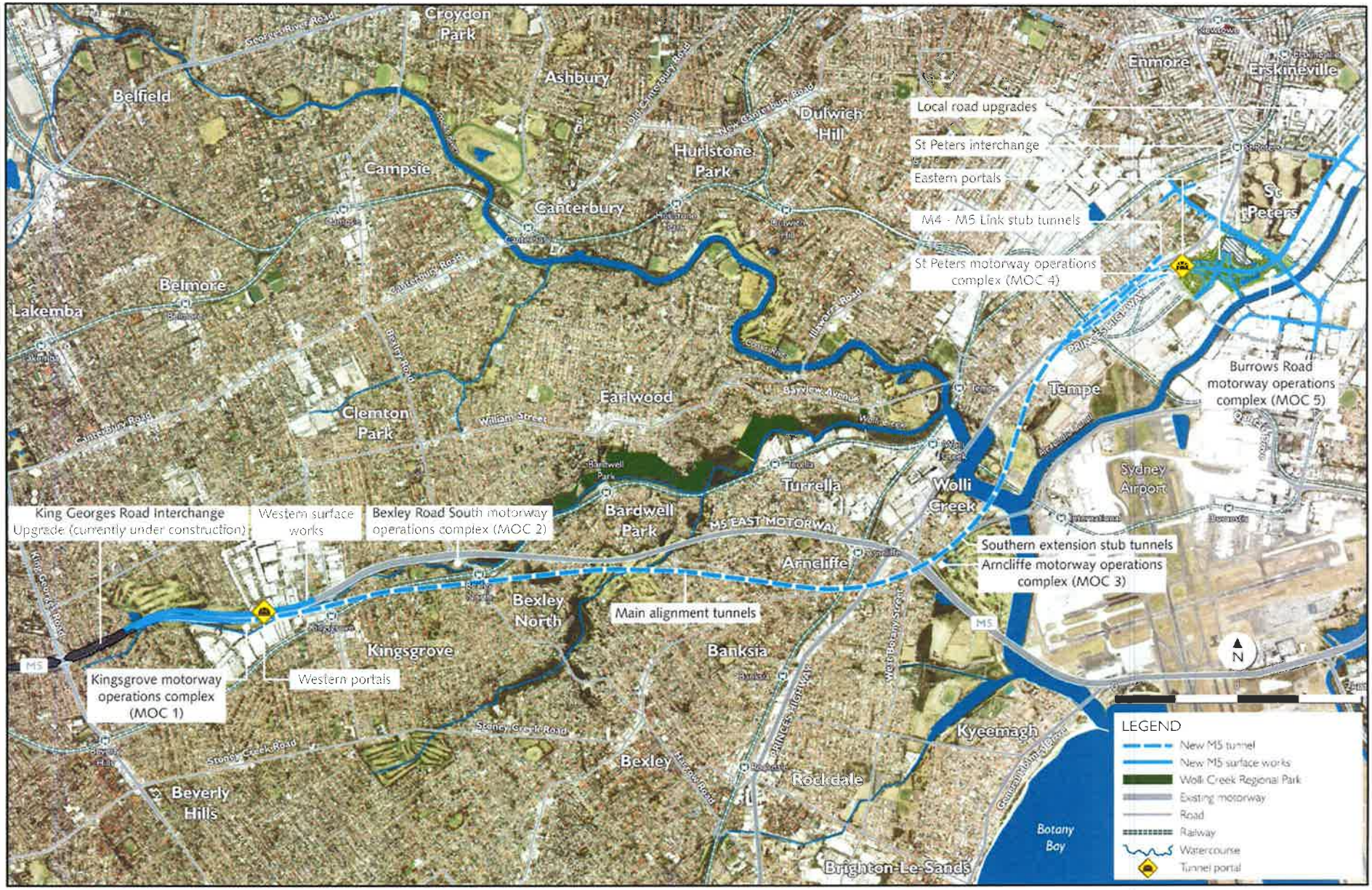

Figure 1: Project Location (Source: EIS)

Figure 2: WestConnex Motorway Proposal (Source: WestConnex Updated Strategic Business Case)

Significant land uses within or near the surface elements of the project area include, but are not limited to, Sydney Airport, Sydney Park at St Peters, Kogarah Golf Course, Canterbury Golf Course, Tempe Reserve, Wolli Creek, Alexandra Canal and the M5 Linear Park at Kingsgrove.

2. PROPOSED PROJECT

This section outlines the details of the project including the key components and operational features, how the construction program is proposed to be carried out, the major benefits it would provide and the strategic context in which it has been assessed. It also outlines the alternative project options that were part of the assessment, including alternative designs within the project.

2.1. Project Description

The New M5 project involves the construction of twin tunnels of approximately nine kilometres in length. One tunnel would run eastbound from the M5 East Motorway (between King Georges Road and Bexley Road) to St Peters. The other tunnel would run in the reverse direction. The western tunnel portals would be located at Kingsgrove.

The tunnels would be built to three lanes wide but marked for only two lanes between the western portals and Arncliffe and five lanes wide but marked for two lanes between Arncliffe and St Peters. The additional traffic lanes will be used to cater for future demand, when required. The tunnels include two vehicle cross passages at Bexley and Arncliffe to allow for emergency traffic switching. The mainline tunnels would vary between 32 and 78 metres below the ground surface. **Figure 3a to 3g** illustrate the operational footprint for the project.

Figure 3a: Indicative Project Footprint: Map 1 (Source: EIS)

Figure 3b: Indicative Project Footprint: Map 2 (Source: EIS)

Figure 3c: Indicative Project Footprint: Map 3 (Source: EIS)

Figure 3d: Indicative Project Footprint: Map 4 (Source: EIS)

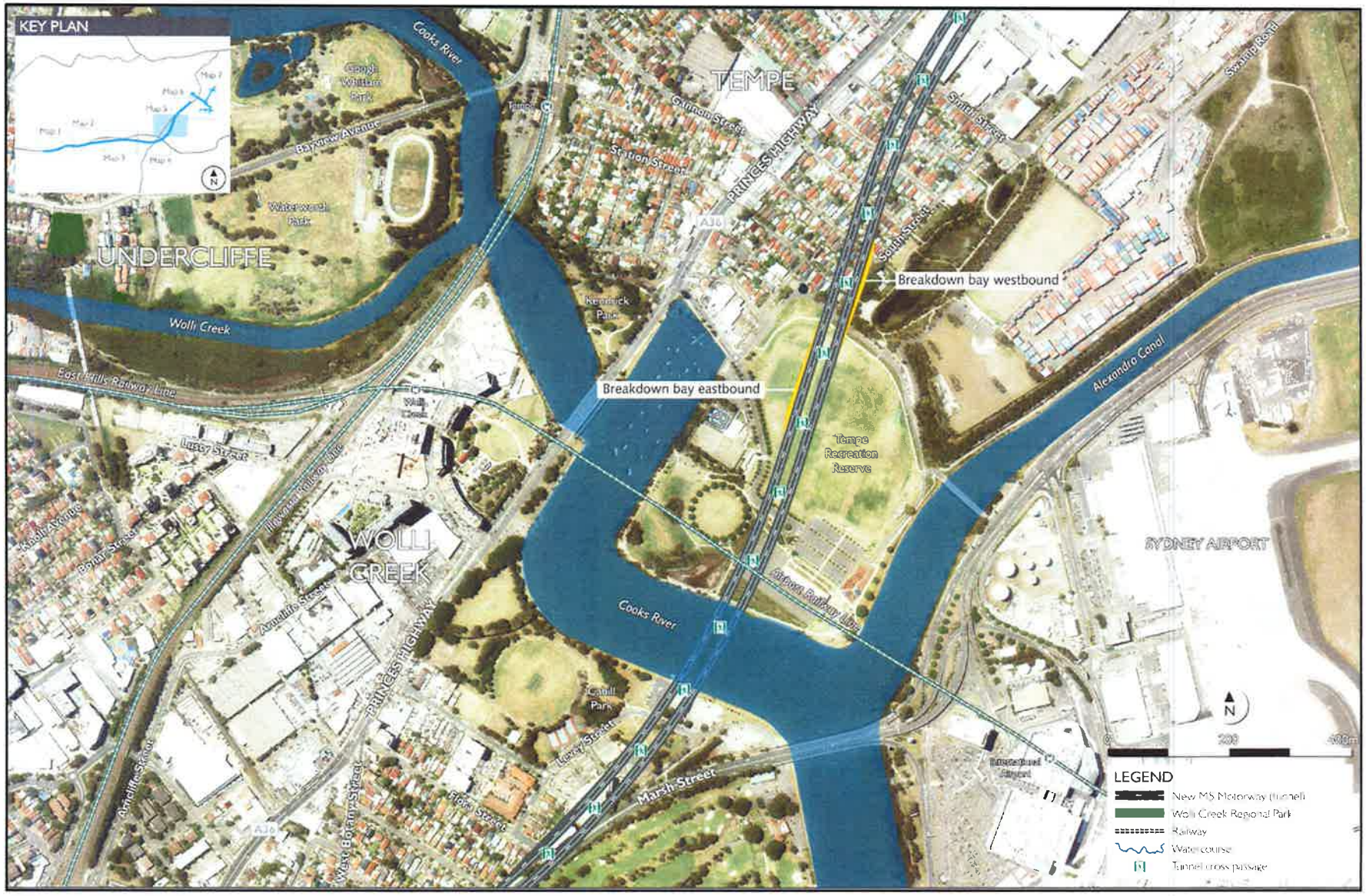

Figure 3e: Indicative Project Footprint: Map 5 (Source: EIS)

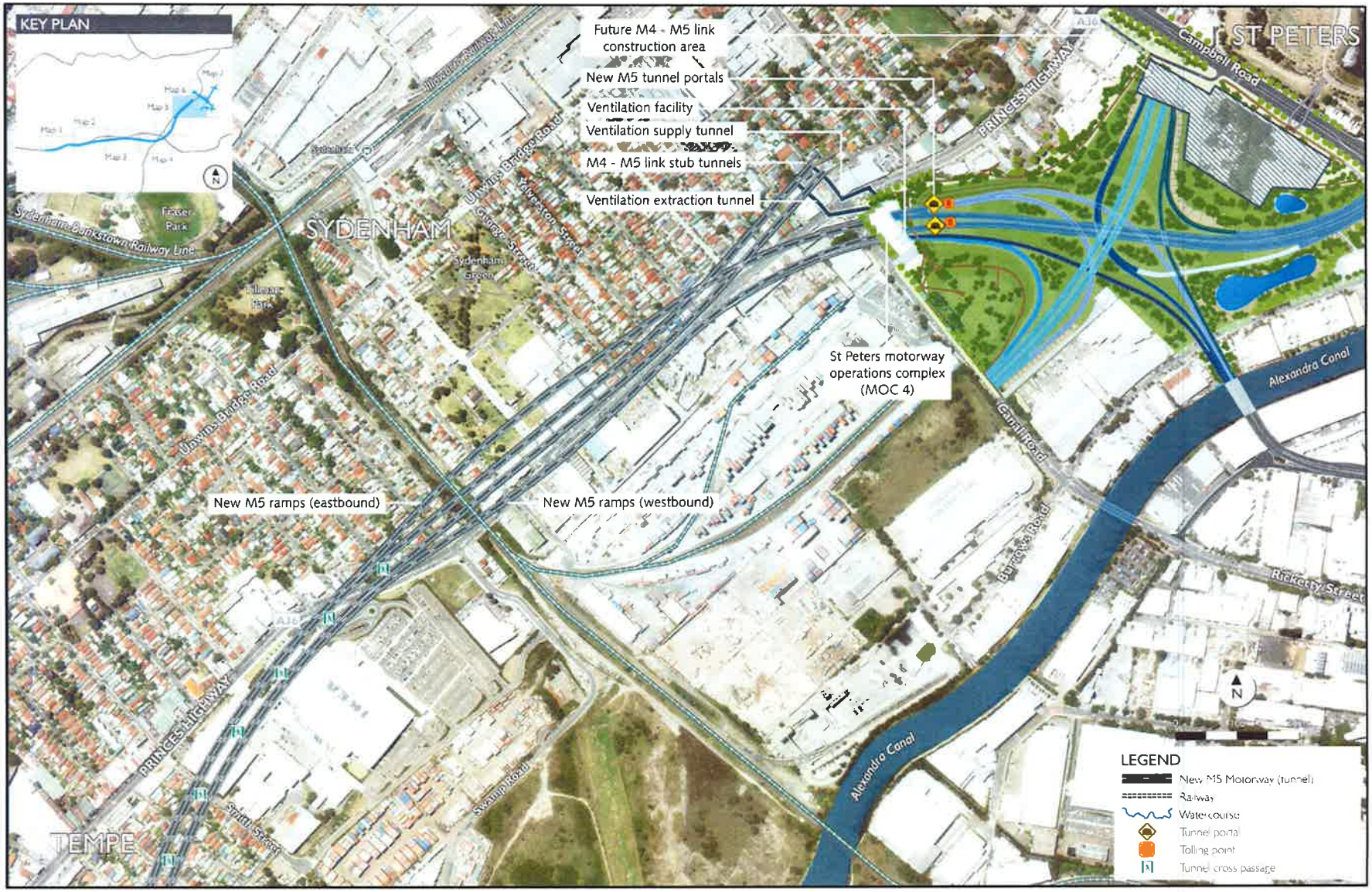

Figure 3f: Indicative Project Footprint: Map 6 (Source: EIS)

Figure 3g: Indicative Project Footprint: Map 7 (Source: EIS)

Stub tunnels at the eastern end of the main tunnels near the intersection of Canal Road and Bakers Lane at St Peters would allow for future connection to the proposed M4-M5 Link. Stub tunnels at Arncliffe near the Kogarah Golf Course would provide for future connection to southern Sydney.

A new multi-level interchange at St Peters would connect the New M5 with the future proposed M4-M5 Link, Euston Road, Gardeners Road, Sydney Airport and Port Botany via a new road, the Sydney Gateway. The interchange would comprise seven bridges over three levels (refer **Figure 4**).

Key components and operational features of the project are described in **Table 1**.

Table 1: Key Project Components – WestConnex New M5

Aspect	***Description***
Project Summary	• Eastbound and westbound tunnels extending from the M5 East Motorway (east of King Georges Road) to St Peters. • Multi-level interchange at St Peters. • Tunnel ventilation facilities at Kingsgrove, Arncliffe and St Peters. • Widening the M5 East between Canterbury Golf Course to the western portals at Kingsgrove. • Motorway operations complexes at Beverley Grove Park (Kingsgrove), Bexley Road (North Bexley), Kogarah Golf Course (Arncliffe), St Peters Interchange (St Peters) and Burrows Road (St Peters). • Emergency smoke extraction facilities at Bexley and Arncliffe. • Upgrading of the existing surface road network at St Peters, Alexandria and Mascot. • New pedestrian and cyclist bridge between Sydney Park at St Peters and the Bourke Road cycle path at Mascot.
Tunnels	• Approximately nine kilometres in length between King Georges Road at Kingsgrove and St Peters. • Stub tunnels at St Peters to enable connection to the future M4–M5 Link and Sydney Gateway and at Arncliffe to provide future connection to southern Sydney. • Tunnels vary in depth between 32 and 78 metres.
Interchange	• New multi-level interchange at St Peters connecting the New M5, future M4-M5 Link and future Sydney Gateway with Euston Road and Gardeners Road.
Ventilation	• A western ventilation facility located within the Kingsgrove motorway operations complex at Beverly Grove Park. • A central ventilation facility located within the Arncliffe motorway operations complex at Kogarah Golf Course. • An eastern ventilation facility located within the St Peters motorway operations complex. • A longitudinal ventilation system (with no portal emissions) comprising around 54 jet fans in the eastbound tunnel and around 75 in the westbound tunnel. • Emergency smoke extraction facilities at the Bexley and Arncliffe motorway operation complexes. • Air intake facilities at the Bexley, Arncliffe and St Peters motorway operations complexes.
Bridges	• New bridge structures over the Alexandra Canal as part of the Campbell Road and Gardeners Road extensions. • New grade separated pedestrian and cycle bridge over Campbell Road to Sydney Park at St Peters.

Aspect	Description
	• Widening of the Euston Road Bridge over the Munni Street stormwater channel.
Surface road network changes	• Widening of sections of Euston Road, Campbell Street, Bedwin Road, Campbell Road, Bourke Street, Bourke Road and Gardeners Road. • Extension of Campbell Road connecting to the St Peters Interchange via a new bridge over the Alexandra Canal. • A new road (Venice Street) connecting Ricketty Street and Gardeners Road. • Modifications to existing intersections and construction of new intersections along Euston Road, Campbell Street, Campbell Road, Bourke Street and Bourke Road. • Widening of the Kindilan underpass at Kingsgrove, near Canterbury Golf Course, to accommodate the surface lanes on the M5 East Motorway.
Tolling infrastructure	• Toll gantries and control systems would be installed on: o the mainline carriage of the New M5 and M5 East Motorways east of King Georges Road; o the on- and off-ramps of the King Georges Road Interchange for the M5 East Motorway; o the Kingsgrove Road Interchange for the M5 East Motorway; o the Bexley Road Interchange for the M5 East Motorway; and o the eastern portal at the St Peters Interchange.
Noise abatements structures	• Installation of new noise barriers on the northern and southern side of the project in the vicinity of the western portals.
Cycling facilities	• A new pedestrian and cycle path (bridge) extending from the Bourke Road cycle path at Mascot to Sydney Park. • A shared pedestrian/bicycle path along the western side of Euston Road between Campbell Road and Sydney Park. • Incorporation of an on-road cycle lane along Bourke Street/Bourke Road between Campbell Road and Church Avenue.
Ancillary Facilities	• Four electrical substations located at the Kingsgrove, Bexley Road, Arncliffe and St Peters facilities. • Deluge systems. • Fire and life safety systems. • CCTV in the tunnel and approaches. • Vehicle cross passages for emergency use. • Pedestrian cross passages between the two main tunnel alignments. • Drainage infrastructure, including an operational water treatment plant at Arncliffe. • Incident response systems. • Signage including traffic, locational, directional, warning and variable message signs within the tunnels and at the surface connections approaching the tunnels.

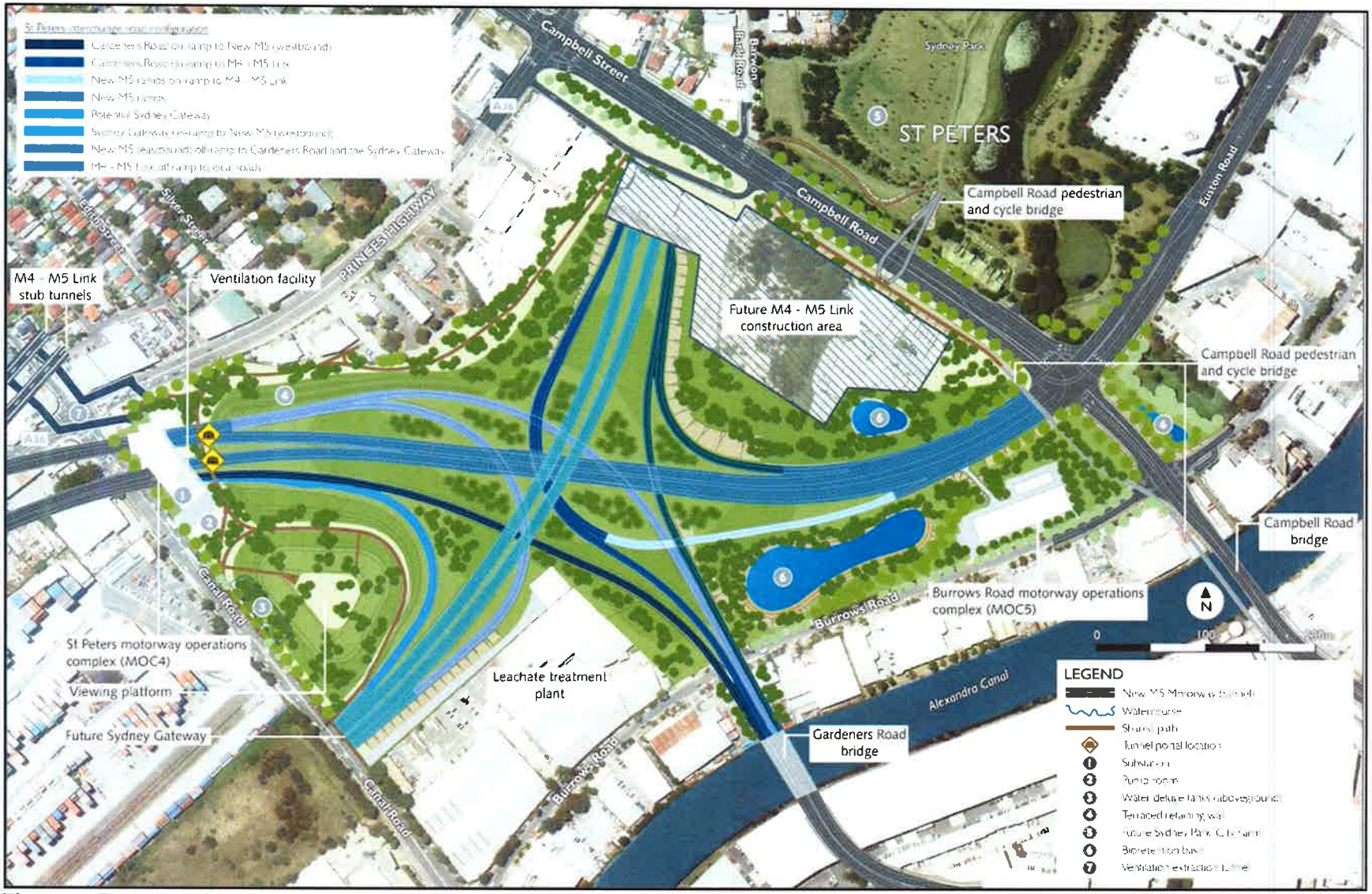

Figure 4: Proposed St Peters Interchange (Source: EIS)

2.2. Construction Works

Construction of the New M5 project, if approved, is expected to take three and a half years with the tunnel open to traffic in late 2019. The NSW Government has established the Sydney Motorway Corporation to deliver WestConnex, with construction by the private sector.

The total area required for construction of the project is approximately 139 hectares, comprising 84 hectares at surface level and 55 hectares below ground. The key construction works are summarised in **Table 2**. The majority of above ground infrastructure is proposed to be constructed between 7:00 am and 6:00 pm weekdays and 8:00 am to 1:00 pm on Saturdays. However, some works would need to be undertaken outside of these hours for safety and operational reasons. Tunnelling and associated support facilities would operate continuously 24 hours a day, seven days a week.

Table 2: Construction Works Overview – WestConnex New M5

Component	Activities
Enabling Works	• Property acquisition • Demolish existing buildings • Traffic management changes and measures • Installation of safety and environmental controls • Establishment of construction compounds and access • Set up of monitoring equipment • Relocation of utilities
Alexandria Landfill Closure Works	• Construction of access roads and site access and exit • Bulk earthworks • Capping • Establishment of leachate collection and treatment system • Construction of groundwater seepage cut-off wall • Landscaping
Tunnelling	• Construct declines and shafts • Excavation of mainline tunnels (including blasting) • Spoil management • Finishing works in tunnel and provision of permanent tunnel services and infrastructure • Testing of plant and equipment
Surface earthworks and structures (including portals)	• Vegetation clearance and topsoil stripping • Excavate new cut and fill areas • Construct dive and cut and cover tunnel structures • Widen M5 East Motorway • Construct required retaining structures • Installation of utility infrastructure • Finishing works
St Peters Interchange construction	• Bulk excavation and material disposal • Foundation works • Pavement construction • Construction of interchange bridges • Construction of pedestrian/cycle bridge • Construction of bridges over Alexandra Canal • Construction of retaining walls and landscaping
Local road upgrades	• Removal of existing road pavements • Earthworks and excavation • Installation of new road base, kerb and guttering • Asphalting and finishing works
Operational ancillary facilities	• Ventilation systems and facilities • Fresh air supply facility • Water treatment facility

Component	Activities
	• Motorway operations complexes • Electrical substations • Test plant and equipment
Finishing works	• Line marking of new road surface • Erect directional signage and other roadside furniture such as street lighting • Erect toll gantries and other control systems • Landscaping works • Roadside furniture and lighting • Site demobilisation and rehabilitation of temporary construction ancillary facilities

Fourteen construction compounds are proposed along the project corridor (refer **Figure 5**). **Table 3** sets out the proposed activities to be carried out at each compound.

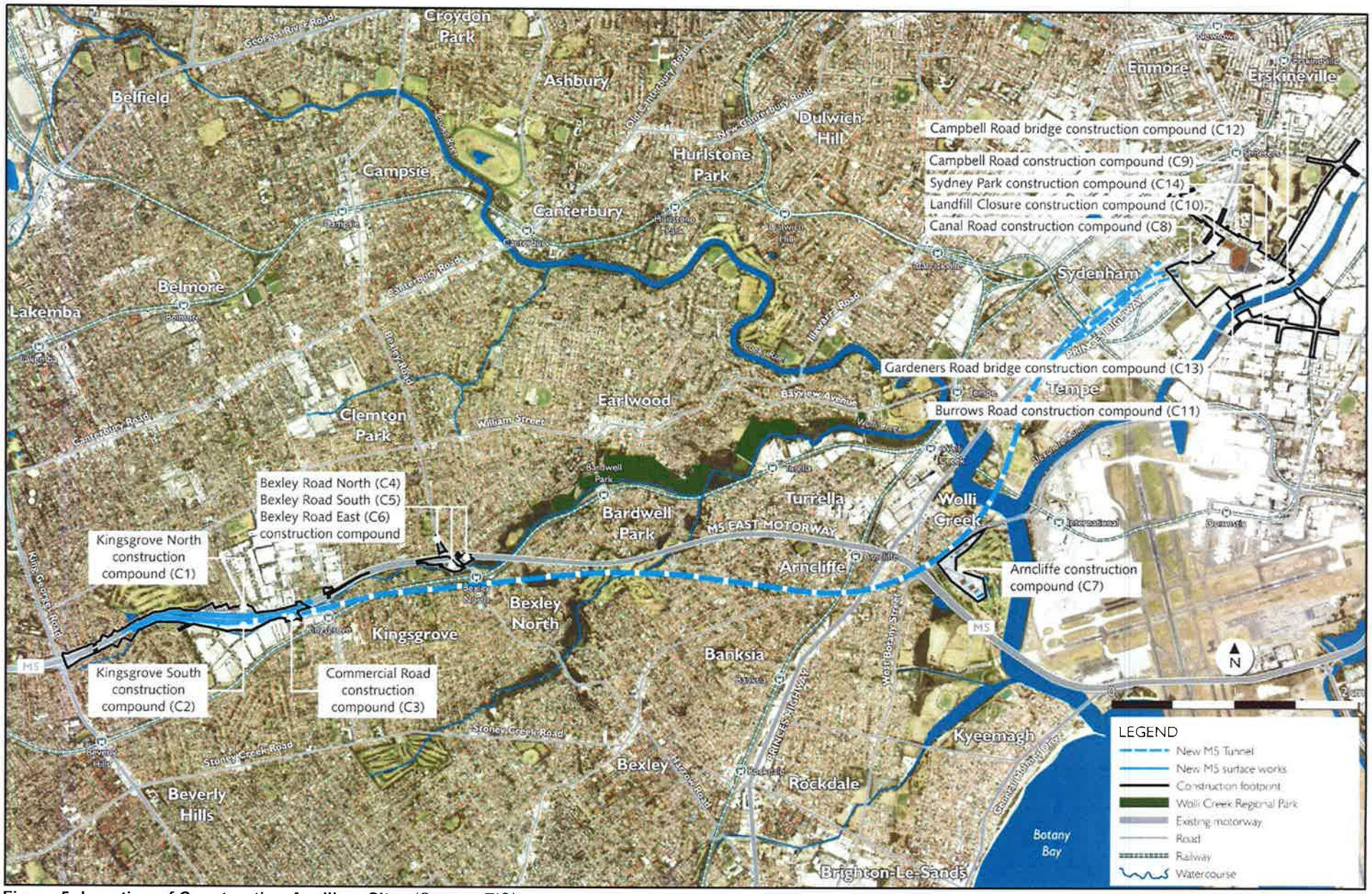

Figure 5: Location of Construction Ancillary Sites (Source: EIS)

Table 3: Construction Compounds and their Functions (Source: EIS)

No.	Site		Temporary facilities								
		Civil & surface works	Site offices	Staff & workforce amenities	Laydown area	Workshop & maintenance	Tunnel launch & support	Tunnel spoil management	Construction water treatment plant	Tunnelling Support	Parking
C1	Kingsgrove North	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C2	Kingsgrove South	✓	✓	✓	✓	✓		✓			✓
C3	Commercial Road	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C4	Bexley Road North	✓		✓	✓	✓	✓	✓		✓	
C5	Bexley Road South	✓		✓	✓	✓	✓	✓	✓	✓	✓
C6	Bexley Road East	✓	✓	✓	✓					✓	✓
C7	Arncliffe	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C8	Canal Road	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C9	Campbell Road	✓	✓	✓	✓			✓			✓
C10	Landfill Closure	✓	✓	✓	✓			✓			✓
C11	Burrows Road	✓	✓		✓			✓			✓
C12	Campbell Road Bridge	✓		✓	✓						✓
C13	Gardeners Road Bridge	✓	✓	✓	✓			✓			✓
C14	Sydney Park	✓		✓	✓						

2.3. Project Need and Justification

Overall WestConnex Scheme

Sydney's road and motorway network supports economic growth across NSW by connecting people to jobs, facilitating trade between businesses and providing the required infrastructure for efficient freight movements. Efficient transport systems will become increasingly important in facilitating future population and economic growth.

The broader Sydney road network is congested through much of the day. The *NSW Long Term Transport Management Plan* (Transport for NSW, 2012) anticipates that congestion will increase if improvements are not made to the road network. The Plan notes that congestion currently costs the NSW economy approximately $5.1 billion a year, largely due to time delays. This is forecast to increase to $8.8 billion by 2020 if no improvements are made. The *NSW Long Term Transport Management Plan* identifies the WestConnex project as an integral part of a long-term transport solution.

Delivery of WestConnex is in addition to the delivery of other non-motorway projects detailed in the *NSW Long Term Transport Management Plan*, with more than $60 billion in infrastructure committed over the next four years to facilitate the transport needs of Sydney and meet future growth requirements.

WestConnex is expected to deliver broad economic benefits to NSW in the order of $24.3 billion over its lifespan through improved access to and reliability of the motorway network, enabling more efficient freight movements, journeys to work and connectivity to and from businesses and services (*WestConnex Strategic Business Case 2015*).

Journey to work data compiled by the Bureau of Transport Statistics shows that 72 per cent of journeys to work in the greater metropolitan area are by private vehicle, either as a driver or a passenger. The Department accepts that the many of these journeys are from dispersed locations and are best served by road transport and recognises the importance of WestConnex in providing more efficient connections between varied destinations across the metropolitan area.

Modelling figures by the Bureau of Freight Statistics estimates that on an average weekday, the number of trips made by rigid trucks would increase by approximately 30 per cent from 271,000 to 355,000 between 2011 and 2031 with the number of trips made by articulated trucks increasing by around 65 per cent from 95,000 to 157,000. The Department recognises the importance of WestConnex in facilitating these freight movements.

WestConnex New M5

The M5 Motorway (comprising East and West Motorways) is the main road corridor providing passenger, commercial and freight connections between south-west Sydney, the CBD, Sydney Airport, Port Botany and Sydney's eastern suburbs. The corridor also links with Sydney's orbital road network and the wider southern and south-western Sydney road network including King Georges Road, the Cumberland Highway, the Hume Motorway and M7 Motorway.

The M5 East Motorway currently experiences heavy traffic congestion, slow speeds and unreliable travel times particularly in the morning and afternoon peaks, and increasingly at other times of the day and on weekends, resulting in extended AM and PM peaks. In addition, the road network surrounding the proposed project has proportionately higher road congestion that the Sydney network average.

Sydney's metropolitan population is expected to grow by around 1.6 million people between 2014 and 2031. This would increase travel demand on an already constrained transport network, with much of this focussed on eastern metropolitan areas due to employment opportunities. The M5 East Motorway carries a high volume of traffic in the order of 100,000 vehicles per day of which approximately 10,000 are heavy commercial vehicles. Users primarily originate from suburbs in south-western Sydney, southern Sydney and west-central Sydney, with about 48 per cent travelling to the port and airport area. Congestion on the M5 Motorway, particularly the M5 East, and the arterial road network will inevitably increase if there are no road network capacity improvements.

The Department considers the New M5 project is justified in its own right because it would provide immediate and long-term operational benefits in relieving congestion along the M5 corridor. This will be achieved through the introduction of an alternative high speed route between Kingsgrove and St Peters.

The New M5 would also provide a practical response to inadequacies in the motorway network between Sydney's port and airport precincts and south-western Sydney. It would provide commuters from south-western Sydney with a more direct connection to the employment zones to the north and west of the Sydney Airport/Port Botany precinct as well as allow commuters connecting to the CBD to bypass the airport/port precinct.

Average traffic speeds along the M5 East corridor are well below the posted 80 kilometres per hour. Currently, the average traffic speed is 42 kilometres per hour eastbound and 68 kilometres westbound in the AM peak. Average speeds during the PM peak are 55 kilometres per hour eastbound and 31 kilometres per hour westbound. Traffic modelling suggests that the New M5 would reduce average travel times by around a half and double average travel speeds during the morning and afternoon peaks. The New M5 would also

improve traffic safety. Modelling indicates that the project would result in a 14 per cent reduction in average annual crash costs in 2021.

The New M5 would contribute to improved freight transport travel times and fuel consumption costs to and from Sydney Airport and Port Botany. Freight volumes through Sydney Airport and Port Botany are forecast to increase, with the Sydney Airport Corporation projecting a 164 per cent increase in freight tonnage between 2012 and 2033 (*Sydney Airport Master Plan 2033*, 2014). The efficient movement of this freight needs a well-connected motorway that would be provided by the construction of the New M5. The project would also enhance the commercial and freight generating land uses located within the Port Botany precinct, which are currently impeded by congestion.

In addition to traffic benefits, the project would deliver around 14 kilometres of new and upgraded pedestrian and cycling infrastructure. New active transport infrastructure in the St Peters, Mascot and Alexandria precincts would improve and encourage active transport use for both commuters and recreational users.

The Department is satisfied that the New M5 project would provide safer, faster and more reliable travel times for motorists on Sydney's motorway network. Reductions in congestion and travel times would also assist the movement of freight and business related travel. The Department is also satisfied there is a need for the New M5 project because of the benefits for both road users and the neighbouring communities.

The New M5 project is expected to create up to approximately 4,390 full-time construction jobs including:

- 1,250 full-time workers directly employed on the project;
- 1,590 full-time workers employed by businesses supplying directly to the project; and
- 1,550 indirect full time jobs.

Construction of the project is predicted to directly contribute around $460 million to the gross State product for each average year of construction, with indirect effects of around $210 million, giving an estimated total contribution of $670 million for each average year of construction.

In addition, the Department considers the project is strategically justified and consistent with the government's key priorities and high level planning framework including:

- ***NSW State Priorities (2015)*** – the project constitutes the delivery of infrastructure aligned with the government's commitment to build extra road capacity, and would contribute to growth of the NSW economy;
- ***NSW Long Term Transport Master Plan (2012)*** – WestConnex, including the New M5 project, is a critical link in Sydney's motorway network, resulting in increased capacity to accommodate commercial vehicles and freight demand, as indicated in **Figure 6**;
- ***A Plan for Growing Sydney (2014)*** – WestConnex is consistent with several key directions including delivering infrastructure, enhancing capacity at Sydney's gateways and freight networks, and expanding the reach of the Global Economic Corridor;
- ***NSW Freight and Ports Strategy (2013)*** - WestConnex is consistent with the strategic action programs which include improving network efficiency and capacity. The Strategy recognises that WestConnex is a key component in expanding capacity on NSW roads which would provide benefits of freight movements, particularly around major freight centres including Port Botany and Sydney Airport;

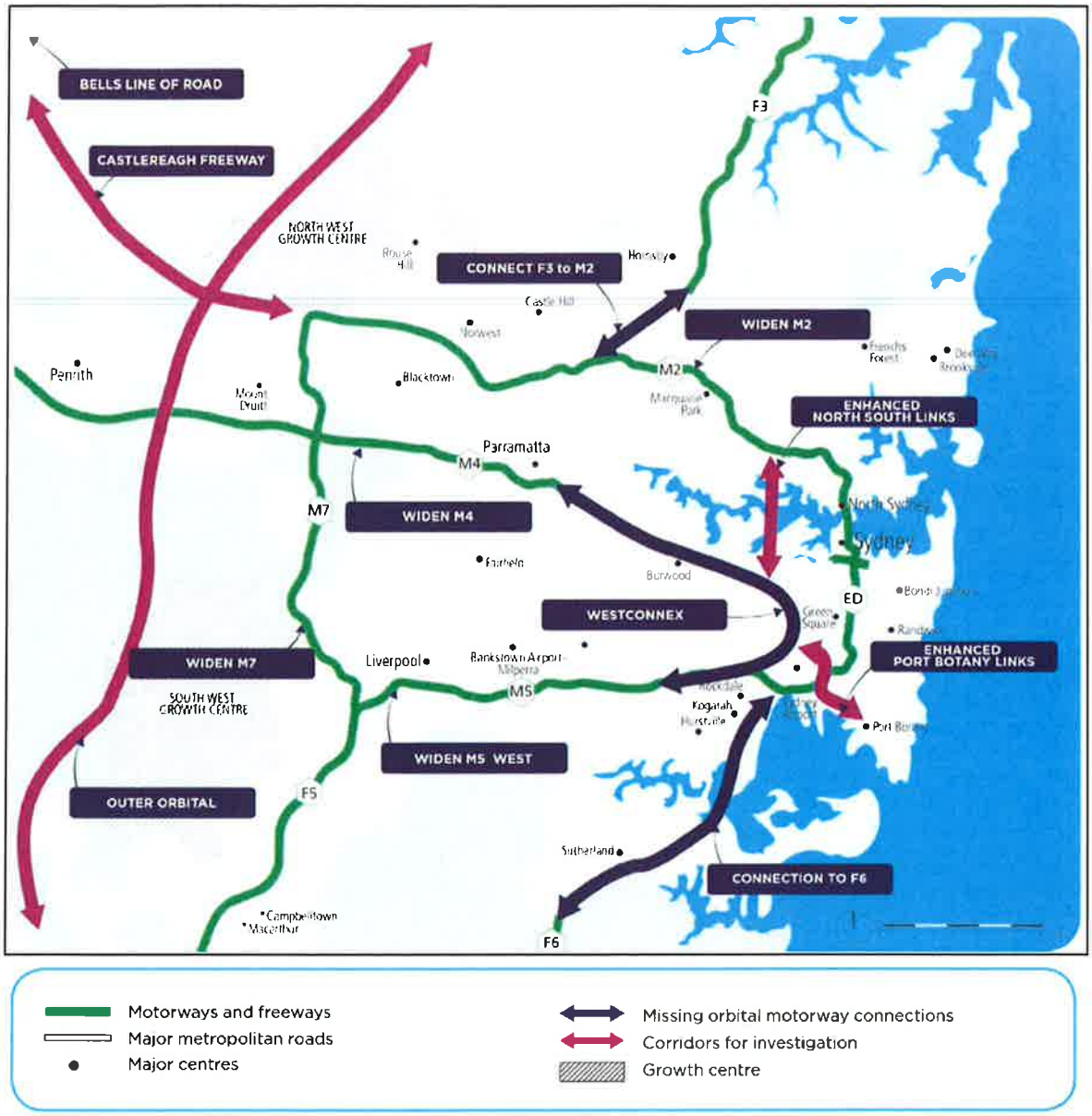

Figure 6: Potential Connections to Complete the Sydney Motorway Network by 2031
(Source: Long Term Transport Master Plan, Transport for NSW 2012)

- ***State Infrastructure Strategy Update (2014)*** – the Strategy reiterates the importance of WestConnex to improving general and freight transport through its connection to Port Botany and Sydney Airport;
- ***National Infrastructure Plan (2013)*** – WestConnex is identified with the primary objective to improve accessibility, speed, congestion, reliability and connectivity of the roads linking Sydney's international gateways and places of business across the city. Action 6 of the Plan is to 'create a complete national freight network'. WestConnex would improve connection to Sydney Airport and Port Botany; and
- ***National Land Freight Strategy (2012)*** – WestConnex is consistent with the Strategy's goals of improving access arrangements for heavy vehicle freight.

2.4. Project Development and Alternatives

The Environmental Impact Statement (EIS) considers the merits of the project in the context of a number of alternative project options, including:

- 'do nothing/do minimum';

- undertake improvements to the existing road network;
- investment in public transport and rail freight improvements; and
- demand management.

The assessment also addressed alternative designs within the project including tunnel corridor options, options for locating ventilation facilities and interchange options.

Alternative 1 – 'Do Nothing/Do Minimum'
This approach would involve the M5 Motorway retaining its existing arrangement within only minor improvements over time to improve capacity including minimal new infrastructure and routine road and intersection upgrades of local and arterial roads to improve capacity.

The Department is satisfied that this is not a feasible alternative as the current road network would not support a growing population and the M5 East Motorway would continue to operate beyond capacity. Traffic modelling indicates morning peak travel times on the M5 East Motorway in the eastbound direction between King Georges Road and Foreshore Road at Botany would almost double from around 15 minutes to 26 minutes by 2031.

This option would see increased congestion, and associated impacts such as noise, along the M5 East Motorway corridor and parallel local and arterial roads. It would also continue to impact on the NSW economy through longer delivery and transport times, particularly for businesses and commuters travelling to and from south-western Sydney and the Sydney Airport and Port Botany precincts.

Alternative 2 – Optimising the Performance of Existing Road Infrastructure
Improvements to the M5 East Motorway could be achieved through widening surface sections of the Motorway and/or providing additional capacity within the existing tunnels. However, widening of the Motorway between Marsh Street and General Holmes Drive would significantly encroach into the wetlands at Marsh Street and Eve Street at Arncliffe. In addition, increased capacity in this section would increase demand on the existing M5 Motorway in the vicinity of Sydney Airport which is already operating at or near capacity during peak periods.

Increasing the capacity of the Motorway tunnels by the addition of an additional lane or a double-decker arrangement was not considered feasible as connection to the surrounding road network would be difficult and highly disruptive to existing traffic during construction.

The Department agrees with the Proponent's assessment that major arterial road network improvements are an inadequate response to the significant traffic and transport challenges along the M5 East Motorway corridor. The existing arterial road network has limited capacity for widening and/or upgrades which means that any improvements would require considerable social (acquisition and amenity impacts) and environmental impacts. Further, this option would provide only incremental improvements to relieve traffic congestion, rather than supporting the additional capacity required for future demands related to increased traffic volumes, improved access and connections between Sydney Airport and Port Botany with Western Sydney, and increased regional traffic growth.

Alternative 3 – Investment in Public Transport and Rail Freight Improvements
A common issue raised in the public submissions is that the NSW Government should provide further investment in public transport infrastructure, rather than construct the New M5. However, improved public transport would only partly contribute to relieving congestion on arterial roads and the M5 East Motorway and would not enhance the productivity of commercial and freight generating land uses around Port Botany and Sydney Airport and Western Sydney.

A key focus of the project is on longer distance passenger movements, as well as the movement of heavy and light freight and commercial goods and services. Travel patterns for these sectors are dispersed and disparate in nature. Currently 63 percent of freight in NSW is moved by road and 37 percent by rail, with just 14 percent of all container freight moved by rail to and from Port Botany. Shifting more freight onto rail remains a priority for the NSW Government. However, assuming the target of doubling the share of container freight moved by rail is achieved by 2020, more than 70 percent of Port Botany's projected trade would continue to be moved by road. In addition, freight services and commercial businesses within the Sydney metropolitan area rely on dispersed point-to-point transport connections to customers and this cannot be met by public transport options or rail freight improvements in isolation of improvements to the road network.

The Department notes that the WestConnex project does not represent the NSW Government's total investment in transport infrastructure planning or expenditure, with Government investing in a number of public transport projects across the greater Sydney region, and improved freight rail transport. Public transport and rail freight projects are generally complementary services supporting the project and the broader WestConnex scheme.

Alternative 4 – Demand Management

Demand management relates to reducing individual car trips and making various transport options more viable. Options include land use planning policies which promote urban consolidation, restrictions on parking provisions in new developments and pricing transport options to reduce travel demand (e.g. tolling). Demand management measures can take many years to achieve changes in travel behaviour and would require changes in social attitudes and government policy. While demand management may help spread the demand for peak travel to less congested time periods, it would be limited by other constraints including the availability of alternative forms of travel at the user's origin and destination, and flexibility of working arrangements to take advantage of travel outside of peak periods.

Alternative 5 – Tunnel Corridor Options

The *M5 Transport Corridor Study* (Roads and Traffic Authority, 2009) identified duplicating the M5 East as the preliminary preferred option for alleviating congestion and improving amenity along the M5 East Motorway. Following engagement with the private sector, three strategic alignment options (southern, central and northern alignments) were identified. All three alignments extended between Kingsgrove and St Peters. Following the introduction of a possible future Southern extension, the alignment was moved further south than the options considered during the initial design phase. The Department is satisfied that the proposed route provides a compromise between geology, overall length of the mainline tunnel, construction issues associated with the Southern extension tunnels, and environmental costs and benefits.

3. STATUTORY CONTEXT

This section explains the legal context for the project and how it was assessed with regard to these requirements, including how the proposal would comply the Environmental Planning and Assessment Act 1979 and with the principles of Ecologically Sustainable Development.

3.1. State Significant Infrastructure

The proposal is SSI under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Section 115U(2) of the EP&A Act provides that a State environmental planning policy may declare any development, or any class or description of development, to be SSI.

Clause 14 of *State Environmental Planning Policy (State and Regional Development) 2011* provides that, pursuant to Clause 115U of the EP&A Act, development is declared to be State significant infrastructure if:

(a) the development on the land concerned is, by the operation of a State environmental planning policy, permissible without development consent under Part 4 of the Act; and

(b) the development is specified in Schedule 3.

The New M5 proposal is for the purpose of a road carried out by a public authority that is permissible without consent under clause 94 of *State Environmental Planning Policy (Infrastructure) 2007.* The proposal is also development specified in Schedule 3, in that it is infrastructure that would, in the opinion of the Proponent, require an EIS under Part 5 of the EP&A Act. The project is therefore State significant infrastructure under Part 5.1 of the EP&A Act.

3.2. Critical State Significant Infrastructure

On 20 November 2015, the Minister for Planning declared the proposal to be Critical State Significant Infrastructure (CSSI) project under Section 115V of the EP&A Act. The Minister for Planning is the approval authority for CSSI projects.

3.3. Permissibility

As noted above, the proposal is development permitted without consent in accordance with clause 94 of *State Environmental Planning Policy (Infrastructure) 2007.*

3.4. Environmental Planning Instruments

In accordance with Section 115ZF(2) of the EP&A Act, the only environmental planning instruments that apply to the proposal are *State Environmental Planning Policy (Infrastructure) 2007*, as it relates to the declaration of development that does not require consent, and *State Environmental Planning Policy (State and Regional Development) 2011,* as it relates to the declaration of infrastructure as SSI and CSSI. There are no other environmental planning instruments that substantially govern the carrying out of the project.

3.5. Objects of the Environmental Planning and Assessment Act 1979

Decisions made under the EP&A Act must have regard to the objects of the Act, as set out in Section 5 of the Act. The relevant objects are:

(a) to encourage:

- *(i) the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, water, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment;*
- *(ii) the promotion and co-ordination of the orderly and economic use and development of land;*
- *(iii) the protection, provision and co-ordination of communication and utility services;*
- *(iv) the provision of land for public purposes;*
- *(v) the provision and co-ordination of community services and facilities;*

(vi) the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities, and their habitats;
(vii) ecologically sustainable development;
(viii) the provision and maintenance of affordable housing;

(b) to promote the sharing of the responsibility for environmental planning between the different levels of government in the State; and

(c) *to provide increased opportunity for public involvement and participation in environmental planning and assessment.*

The Department has considered the objects of the EP&A Act including:

- how the proposal would impact on the management, development and conservation of the area, with reference to the management of air quality, noise and vibration, soils and water (refer to **Chapter 5**);
- the strategic justification of the proposal in terms of the orderly and economic use and development of land (refer to **Section 2.3**), and how the proposal would affect traffic and access throughout the region and beyond (refer to **Section 5.1**);
- protection of the environment by assessing the effectiveness of proposed management and mitigation measures, including the impacts on biodiversity (refer to **Chapter 5**);
- the principles of ecologically sustainable development (refer to **Section 3.7**); and
- public involvement and participation in the assessment of the proposal by placing the proposal documents on exhibition at community locations in the local area (Council offices and libraries) for 64 days and on the Department's website. The Submissions and Preferred Infrastructure Report were also made publicly available on the Department's website (refer to **Chapter 4**).

3.6. Environment Protection and Biodiversity Conservation Act 1999

On 11 August 2015, the Commonwealth Department of the Environment (DoE) determined the proposal to be a 'controlled action' under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), as it was considered likely that the proposal could have a significant impact on listed threatened species and communities.

Following notification from the Commonwealth of the decision that the project is a controlled action, the Department confirmed that the project would be assessed in the manner specified in Schedule 1 to the NSW Assessment Bilateral Agreement (February 2015). Under this agreement, the Commonwealth has accredited the assessment process under Part 5.1 of the EP&A Act for the purposes of the EPBC Act, enabling a single assessment of the proposal. Note that an approval decision under the EPBC Act is still required by the Commonwealth decision-maker. Accordingly, NSW has conducted an assessment of the potential impacts on the relevant Matters of National Environmental Significance in accordance with the requirements of the bilateral agreement.

The relevant controlling provision of the EPBC Act is threatened species and ecological communities. The assessment of Matters of National Environmental Significance is provided in **Section 5.4** of this report and includes sufficient detail such that the Commonwealth decision-maker may consider those impacts when determining whether to approve the project. Additionally, this Assessment Report makes a recommendation and proposes conditions to the Commonwealth Minister for the Environment in relation to an approval decision.

3.7. Ecologically Sustainable Development

The EP&A Act adopts the definition of Ecologically Sustainable Development (ESD) found in the *Protection of the Environment Administration Act 1991.* Section 6(2) of that Act states that ecologically sustainable development requires the effective integration of economic and environmental considerations in decision making processes, and that ESD can be achieved through the implementation of:

(a) the precautionary principle;
(b) inter-generational equity;
(c) conservation of biological diversity and ecological integrity; and
(d) improved valuation, pricing and incentive mechanisms.

The Proponent has considered the principles of ESD in its EIS. The EIS includes detailed discussion on the sustainability of the project, as well as detailed studies and/or consideration in the areas of construction and operational traffic and transport management, noise and vibration, air quality, heritage, biodiversity, water quality, socio-economics, human health, climate change and cumulative impacts.

The EIS has considered the precautionary principle to address potential risks through the selection of the proposed route, which avoids to the greatest extent possible impacts to known areas or items of environmental value. For example, the project design avoids direct impacts to Wolli Creek Regional Park. However, it is acknowledged that the project would impact on areas of Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion at Kingsgrove (1.4 hectares) and the foraging habitat of the Green and Golden Bell Frog at the Lower Cooks River. The Proponent has developed measures for managing the impacts to the threatened species and ecological community. The Department considers that the proposed mitigation measures are appropriate and commensurate with the degree of impact and its assessment of this issue is provided in **Section 5.4**.

The assessment of the proposal has considered the impacts of the project in terms of inter-generational equity and notes that it would provide the following benefits for current and future generations reduced traffic congestion and improvements to road safety and the existing transport network, resulting in shorter travel times for road users.

The Department accepts the results of the air quality assessment which indicate that the contribution of project tunnel ventilation outlets to pollutant concentrations is predicted to be negligible for all affected sensitive receivers. However, it is noted that minor increases in the concentration of criteria pollutants are predicted to occur to the south of the M5 East Motorway and around the southern perimeter of Sydney Park at St Peters. In addition, some air quality criteria would be exceeded at a small proportion of sensitive receivers, but this would also occur should the project not proceed. The Department considers the changes in human health risk levels at localised areas are acceptable. The Department's assessment of the impacts of the project on air quality is presented in **Section 5.3**.

The assessment of the proposal has also considered pricing in terms of the user pays principle. The application of a toll on the operation of the project would ensure that road users make a contribution for the service provided and reduce the burden on NSW tax payers.

In conclusion, the Department considers that the proposal is consistent with the principles of ESD.

4. CONSULTATION AND SUBMISSIONS

This section describes the details of the exhibition of the EIS, summarises the key issues raised in submissions from NSW Government agencies, local councils, the public and special interest groups and explains the changes to the project that were made by the proponent in response to the submissions that were received.

4.1 Exhibition

Under Section 115Z(3) of the EP&A Act, the Department is required to make the EIS publicly available for a minimum period of 30 days. The Department exhibited the EIS (**Appendix A**) from Friday 27 November 2015 until Friday 29 January 2016 (a total of 64 days). The EIS was published on the Department's website, and also made available for viewing at the following locations:

- Department of Planning & Environment, Information Centre, Sydney;
- Roads and Maritime Services (Head Office), North Sydney;
- Canterbury Council, Campsie;
- Hurstville City Council and Hurstville City Library, Hurstville;
- Rockdale City Council, Rockdale;
- Marrickville Council, Petersham and Marrickville Library, Marrickville;
- Council of the City of Botany Bay, Mascot;
- Council of the City of Sydney, Sydney;
- Campsie Library, Campsie;
- Bexley Library, Bexley;
- Arncliffe Library, Arncliffe;
- St Peters Library, Sydenham;
- Mascot Library, Mascot;
- Newton Library, Newton;
- Green Square Library, Zetland; and
- Nature Conservation Council of NSW, Newtown.

The Department advertised the public exhibition in the Sydney Morning Herald, Daily Telegraph, The Australian Financial Review, Inner West Courier, St George & Sutherland Shire Leader, Southern Courier, Canterbury Bankstown Torch and Cooks River Times. The Department also notified State and relevant local government authorities of the exhibition in writing.

A total of 10,195 submissions were received from approximately 8,044 individual submitters. Of the 8,044 individual submitters, 8,029 were identified as members of the public and special interest groups. Eight submissions were received from State government authorities, and seven submissions from local councils. One additional submission was received outside of the exhibition period. A summary of the key issues raised in the submissions follows. A full copy of all submissions can be found at **Appendix B**.

4.2 State Government Agency Submissions

The following summarises the key issues raised in the State government agency submissions.

The **Environment Protection Authority (EPA)** raised concerns about noise and vibration, air quality impacts and water quality.

In regards to noise and vibration impacts, the EPA indicated that as significant construction noise and vibration impacts are predicted, additional information on the impacts and mitigation measures should be developed prior to determination, rather than deferred as a post-determination requirement. It recommended conditions relating to the management of construction noise and vibration, including ground-borne noise and vibration limits, and operation of the project (including an operational noise mitigation review and compliance with the *NSW Road Noise Policy* (Department of Environment, Climate Change and Water, 2011), *NSW Industrial Noise Policy* (EPA, 2000) and *Assessing Vibration: a technical guideline* (Department of Environment and Climate Change, 2006).

In regards to air quality, the EPA requested:

- further justification for the meteorological data used to support the GRAMM/GRAL dispersion model used to assess air quality impacts;
- justification for use of the 98th percentile background data in the NO_2 conversion methodology and that it be updated to be specific to the New M5 project;
- verification that the modelled NO_x emissions rate in the regulatory worst-case scenario is the same as the proposed emission limit;
- the total air quality impact at receptors for all pollutants (except air toxics) be provided for the regulatory worst-case scenario;
- the predicted impact of speciated air toxics at receptors be provided;
- the air quality monitoring data from the newly established M4 East and New M5 monitoring stations be included in the discussion of background air quality;
- verification that the emissions used in the modelling for Alexandria Landfill are representative of normal and/or worst-case emissions;
- assessment of pollutants (in addition to $PM_{2.5}$) and short-term average concentrations be undertaken at elevated receptors;
- validation of the assumptions regarding trends in fuel mix types for vehicles and particulate matter exhaust factors used in emissions estimations and reassessment of the fixed NO_2 fraction based on current trends in fuel mix type and new light diesel vehicle sales; and
- further assessment of the air quality impacts associated with heavy vehicles and off-road diesel equipment and plant used during construction.

In regards to water quality, the EPA made recommendations on the parameters to be included in the discharge criteria for each discharge point during construction and operation. It also recommended details on the water quality objectives and environmental values of receiving waters be provided along with details on how the project would be operated to protect these. In addition, the EPA requested a commitment from the Proponent to treat and discharge polluted groundwater during operation.

The **Ministry of Health (NSW Health)** provided the following comments:

- although the model used to estimate air pollution has not been adequately validated in the EIS, it is recognised that substantial additional work has since been undertaken to validate the model and NSW Health is happy to accept the model as appropriate;
- there is an inconsistency in the variables reported in the air quality assessment and human health risk assessment;
- future development proposals and rezoning allowing for elevated residences near ventilation outlets should consider the increased risks of both exposure to air pollution and the impact of new developments on airflows stemming from the outlets;
- further work should be undertaken to assess measures for reducing the ground-level concentration of pollutants in areas predicted to experience an increase;
- the air quality assessment should take into consideration the potential future operation of the additional lanes that are being built into the tunnel and travel through multiple tunnels;

- there is a need for a strategy to actively promote motorists to use recirculated air when travelling through the tunnel;
- construction noise levels at some locations are estimated to significantly exceed acceptable levels for extended periods of time, potentially leading to adverse health impacts for sensitive residential receivers. In addition, significant noise exceedances are predicted during operation of the project, especially around the St Peters area. Therefore, it is essential that noise and vibration impacts are appropriately mitigated;
- discussion should be provided on the acceptance of a 10 dB(A) reduction in noise levels between the inside and outside of dwellings versus a 5 dB(A) reduction, which could occur for some types of house construction, and the impact this would have on the number of sensitive receivers requiring mitigation;
- there is a need to assess the potential noise and vibration impacts resulting from the concurrent construction of the project and proposed M4-M5 link; and
- the Southern Sydney Region of Councils should be consulted on the water quality monitoring program.

The **Office of NSW Chief Scientist and Engineer** provided comments on the air quality assessment and noted that the EIS provided a thorough assessment. It recommended that:

- a worst-case scenario is developed describing the maximum likely degree of transfer of traffic from the M5 to the surface road network and the impact on local surface receptors or justification as to why this is not required;
- the air quality assessment should address the risk of exposure at elevated receptors to short-term elevated concentrations of NO_2;
- there is a lack of quantification of the construction air quality impacts and such impacts do not take into consideration exhaust emissions from machinery and vehicles; and
- a stronger emphasis should be placed on the proposed mitigation measures during the construction phase to reduce annoyance due to dust nuisance, and to reduce the risk of health effects from increased exposure to particulate matter.

The **Department of Primary Industries – Water (DPI (Water))** raised concerns regarding the groundwater assessment, including if the reported standing water levels were representative, and the effectiveness of the modelling in predicting impacts on nearby registered groundwater users and groundwater dependent ecosystems. DPI (Water) recommended that:

- the proposed groundwater monitoring program include monitoring of the groundwater levels in the western edge of the Cooks River alluvia and in other parts of the Botany Sands aquifer;
- the project be comprehensively assessed against the requirements of the *NSW Aquifer Interference Policy*;
- further consideration be provided on the impact of on-going drawdown on forest areas along Bardwell Creek and Stotts Park;
- 'make good' provisions be implemented where water supplies are impacted by construction and/or operation of the project; and
- riparian widths and construction of the project are in accordance with the DPI's *Guideline for Controlled Activities on Waterfront Land*.

DPI (Water) also recommended a number of conditions on the scope and duration of water quality monitoring and reporting, further assessment of the potential for fracturing and subsidence beneath Wolli Creek and the Cooks River, and amendments to the proposed surface and groundwater management measures.

The **Heritage Council of NSW** raised concerns regarding impacts of the project on the following heritage items and locations:

- Alexandra Canal – the Heritage Council recommended that the Proponent explore detailed design options in consultation with heritage specialists and the Heritage Council;
- Rudders Bond Stores at St Peters – the Heritage Council recommended retention of the building and a detailed comparative analysis against other laminated truss Symonds buildings in NSW and Australia be undertaken; and
- 28-44 and 82 Campbell Street at St Peters – the Heritage Council recommended that the houses be included in the heritage interpretation of the area.

The Heritage Council also recommended that a detailed historical archaeological assessment report (including research design and excavation methodologies) be prepared for the affected section of the former Brickworks Pty Ltd City Yard along Euston/Campbell Roads and the NSW Brick Company Ltd at the intersection of Euston Road and former Huntley Street, St Peters. In addition, it recommended better consideration of the integration of sympathetic urban design and engineering outcomes around places of heritage value.

The **Office of Environment and Heritage (OEH)** provided an assessment of matters of national environmental significance in accordance with the Bilateral Agreement between the Commonwealth of Australia and the State of New South Wales. OEH concluded that the Framework for Biodiversity Assessment has been conducted correctly with the exception that the biodiversity offsetting strategy did not confirm the location or quantity of offsets. Consequently, it recommended that the timing and security of offsets be specified in the conditions of any approval. OEH also suggested that the conditions of approval should require the Proponent to provide additional offsets should the worst-case scenario arise in which the population of Green and Golden Bell Frogs at the Kogarah Golf Course is lost.

The OEH also noted that it considered that its comments raised on 6 November 2015 regarding flooding remained relevant. These comments included:

- questions whether the diversion of rain water into the tunnels and the need for drainage have been considered in the design of the project;
- the need to identify the specific measures that would be incorporated into the detailed design to mitigate residual flood-related impacts; and
- the need to consider the long-term impacts (i.e. beyond 2070) of climate change on flooding due to sea level rise during detailed design, and measures to manage any identified risks.

Sydney Water confirmed that trunk and reticulation assets are present within the project area. It requested that it be consulted during the detailed design, construction and operational phases of the project to ensure impacts to stormwater assets are minimised, and improvements to receiving environments are achieved.

Fire and Rescue NSW proposed several recommended conditions of approval, including the preparation of an Emergency Response Plan, a Fire and Smoke Hazard Management Plan, and ongoing annual hazard reviews during the first five years of operation.

4.3 Local Government Agency Submissions

The following summarises the key issues raised in the local government agency submissions.

City of Botany Bay Council raised the following issues:

- works along Alexandra Canal should take into consideration the proposed pedestrian corridor/cycle path in this location;

- the project should consider its potential impacts on the planning proposal to introduce additional 'airport-related' permitted uses (e.g. business and office premises, airport-related services, passenger transport facilities, and tourist visitor accommodation) in the area bounded by Gardeners Road-Coward Street/Alexandra Canal/O'Riordan Street/Joyce Drive-Qantas Drive;
- it is not clear whether the EIS has taken into account additional approved residential and commercial developments in the precinct along Kent Road and Gardeners Road;
- the potential impacts on parking consequent to property adjustments on Gardeners Road;
- there is a need to demonstrate that the project will not impact on the function, amenity and traffic movements of businesses located on Gardeners Road, Botany Road and the Mascot Town Centre;
- flood mitigation measures must be integrated into the design of the project to avoid increased averse flood impacts; and
- there is a need to upgrade the existing stormwater drainage system to manage surface drainage from the project.

Canterbury City Council raised the following issues in its submission:

- the tunnel ventilation system may be inadequate to ensure safe and compliant air quality in-tunnel and in the immediate vicinity of the ventilation outlets at all times;
- there is insufficient information on the effects of construction on surface water and groundwater systems including potential water pollutants and their treatment;
- there is inadequate discussion of the impacts on the Wolli Creek riparian corridor and the proposed rehabilitation measures;
- not all flora and fauna species have been considered;
- degradation and loss of open space will result in an increase in the 'urban heat island' effect;
- increased traffic on local and regional roads will occur from motorists avoiding tolls; and
- potential accelerated road pavement deterioration arising from construction heavy vehicle movements.

City of Sydney Council indicated that it opposed the project and was of the opinion that the EIS does not fully assess the impacts of the project, nor does it satisfactorily justify the need for the project. Key concerns raised by the City of Sydney Council included:

- increased traffic (including rat-running) resulting in decreased amenity and increased noise and air quality impacts;
- impacts on the amenity of Sydney Park;
- further provision of useable and safe open space, including sporting facilities;
- failure of the project to provide for active transport connections;
- inadequate consideration of land use changes and the resultant impacts on travel behaviour;
- traffic modelling undertaken is inadequate and does not represent all traffic impacts;
- air quality assessment is inadequate and should include portal emission management and impacts on different uses within Sydney Park;
- the human health assessment is limited to technical assessment against regulatory standards;
- the opportunity cost of the St Peters Interchange;
- there are numerous sites that are subject to contaminating activities which require further investigation;
- loss of items of heritage value;
- inadequate description of vegetation and consideration of threatened species;
- use of inappropriate landscaping; and

- consideration of the government's strategic cycle strategies in providing facilities and further resolution of the proposed cycleway and pedestrian connections.

Consequent to the concerns raised, City of Sydney Council recommended conditions relating to a number of issues including (but not limited to) traffic management, connectivity, air quality management, noise mitigation, surface water and groundwater management, heritage conservation and biodiversity.

Hurstville City Council indicated that although it supports the project, it believes the EIS does not provide sufficient information to fully assess the impacts of the project on the local environment and community. Key issues raised included:

- a need to consider alternate air quality ventilation systems;
- baseline data and details on drawdown and groundwater inflow are inadequate;
- insufficient information is provided on surface water management including the fracturing or cracking of creek beds;
- consideration be given to Council's draft *Hurstville Overland Flood Study* in assessment the potential impact on overland flow;
- not all existing fauna species and vegetation communities have been considered as part of the biodiversity assessment, indirect impacts on flora and fauna should be addressed, and the assessment fails to address the potential extinction of the local Green and Golden Bell Frog population; and
- there is a need for the Proponent to develop a strategy for reducing toll avoidance.

Marrickville Council indicated that it opposed the project and raised concerns in regards to justification for the project. The Council recommended a set of alternative multi-modal projects which should be evaluated and where appropriate, implemented instead of WestConnex. Issues raised in Marrickville Council's submission included:

- inadequacies in the transport assessment including a lack of long-term traffic modelling, and inadequate assessment of the impacts of additional traffic on residential streets and parking, the effects of tolling and excessive road widening;
- design of the St Peters Interchange results in inaccessible lost space and should be redesigned to allow more of the site to be used productively;
- need for a more detailed social impact assessment;
- the contamination assessment is considered to be 'preliminar'" and a more detailed assessment should be undertaken prior to approval;
- increased flooding impacts in the local area;
- inadequacies in the assessment of biodiversity impacts and impact of the project on climate change;
- lack of a pedestrian and cycle strategy and the potential for improved connections; and
- improvements to pedestrian access and safety.

Rockdale City Council stated support for the project, but raised a number of concerns with the project assessment including:

- inadequacies in the traffic modelling;
- lack of consideration of existing flood studies and modelling;
- inadequate consideration of alternate ventilation systems;
- insufficient information on surface water management and the impact of discharges on receiving water bodies;
- groundwater quality has not been modelled;
- not all fauna species and vegetation communities have been considered;
- the assessment of impacts on the Green and Golden Bell Frog excludes potential extinction of the species; and

- the need to provide a commuter cycleway adjacent to the rail corridor between Kingsgrove and Mascot, consistent with the commitment given in the M5 East Motorway project.

Leichhardt Council made a submission of objection, but is not located within the project area. Key issues raised in its submission include:

- inconsistency of the project with world's best practice urban development in terms of the project's encouragement of private vehicles over public transport;
- lack of assessment of project alternatives, justification, costs and benefits, and assessment of broader impacts of the project;
- insufficient traffic modelling, including details on induced traffic and land use assumptions, resulting in a potential underestimation of future traffic volumes;
- the scope of the flora and fauna surveys are limited and therefore the degree of impact could be underestimated;
- the need to consider the project in light of proposed urban revitalisation projects proposed throughout the Sydney region; and
- confirmation that the EPA has approved the air quality assessment methodology and additional information is required on the worst-case air quality impacts.

4.4 Submissions from the Public and Special Interest Groups

A total of 10,195 submissions were received from approximately 8,044 individual submitters. Of the 8,044 individual submitters, 8,029 were identified as members of the public and special interest groups. Eight submissions were received from State government authorities, and seven submissions from local councils. One additional submission was received outside of the exhibition period.

There was a diverse range of issues raised from members of the public, businesses operating in the local area, and special interest groups. The key issues raised in the submissions are summarised below and further assessed in **Chapter 5.**

<u>Project Justification and Alternatives</u>

- the predicted travel time savings is not justified given the project construction costs, as well as the social and economic impacts that would be experienced;
- the project is not a suitable long-term solution to Sydney's traffic congestion;
- the EIS fails to compare the project to alternative public transport options and discourages investment in public transport; and
- the costs of the project outweigh the benefits and the project fails to provide value for money.

<u>Traffic and Transport</u>

- the project encourages increased private vehicle usage instead of promoting the use of public transport;
- the EIS fails to consider potential changes in travel demands and behaviours;
- introducing a toll on the New M5 and M5 East would push more cars and trucks on to alternative routes and encourage 'rat-running' along local roads;
- projected traffic increases would result in congestion on the broader road network around St Peters;
- the impacts of increased traffic on suburban streets as a result of rat-running and increased access at St Peters has not been adequately evaluated;
- the EIS has not adequately assessed the impact of induced traffic (i.e. the effects of more traffic choosing to use the road network than would be the case if the project did not proceed);

- traffic impacts associated with construction, particularly spoil haulage, have not been adequately addressed;
- many local streets and intersections throughout the project area would become further congested as a result of the construction and operation of the project;
- alterative designs should be considered for a number of local roads around St Peters including Campbell Street/Campbell Road, May Street, Euston Road, Unwins Bridge Road;
- increased traffic at St Peters would impede pedestrian connectivity and impact on the safety of pedestrians and cyclists;
- the project does not incorporate adequate pedestrian and cyclist infrastructure and should include a cycle path with inter-regional links;
- the project should include a 'park and ride' facility at St Peters;
- the EIS does not adequately consider the effects of construction activities and traffic on the performance of the road network, pedestrian safety and accessibility, and parking;
- lack of assessment of impacts associated with spoil transportation;
- the operational traffic forecasts and traffic modelling are inadequate; and
- the project will not alleviate Sydney's traffic congestion

Air Quality

- there is a significant potential for dust to cause nuisance during construction, particularly at St Peters;
- ventilation facilities should be relocated away from residents, schools and public open space;
- the proposed ventilation facilities should be increased in height and filtered to reduce the impact of emissions, and to disperse emissions more widely;
- the air quality modelling is inadequate and its application questionable as it has not previously been used in Australia;
- air pollution would increase in the vicinity of the St Peters Interchange and in local areas where the tunnel portals are located;
- portals should be included in industrial areas;
- air quality monitoring should occur at the ventilation facilities; and
- air pollution as a result of traffic is linked to higher rates of respiratory and other illnesses.

Noise and Vibration

- construction of the project (particularly in areas where construction is proposed to be undertaken 24 hours a day) would have a significant adverse impact on the acoustic amenity of residents living in proximity to surface works and at locations adjoining and nearby construction compound sites;
- there is a lack of justification for out-of-hours works;
- the proposed construction noise management measures are insufficient;
- the proposed tunnelling methods would generate ground-borne noise and vibration impacts at sensitive receivers and have the potential to damage buildings;
- there is insufficient information on dilapidation surveys for homes potentially impacted by construction vibration;
- the operational noise assessment is inadequate;
- there is a need for noise barriers along Campbell Street and Euston Road;
- the removal of the existing noise barriers at the western end of the project would result in unacceptable noise impacts;
- no measures are being implemented to alleviate noise levels in outdoor open spaces; and
- once operational, the project would see an increase in road traffic noise levels at sensitive receivers, particularly in the vicinity of the St Peters Interchange.

Social and Economic Impacts

- there is insufficient justification for acquiring private properties and public land, and the process of acquisition is inequitable;
- partial acquisition of Sydney Park is unacceptable;
- the project has the potential to negatively affect valuations of non-acquired properties adjacent to the project;
- there is insufficient information on the impacts to community cohesion and impacts on displaced residents and residents that remain in the severed communities;
- the project divides and segregates established land uses and communities at St Peters, limiting the potential for quality liveable mixed-use environments and connectivity with social infrastructure and community facilities;
- the social impact assessment fails to adequately assess the impacts on all community facilities and businesses that may be affected by the construction and operation of the project; and
- the project has the potential to sterilise land earmarked for future development (e.g. Kingsgrove South Industrial Precinct);

Biodiversity

- the project would result in the loss of vegetation alongside local roads and within public open spaces resulting in losses to biodiversity;
- the project would result in the clearing of endangered ecological communities and effect the viability of the Green and Golden Bell Frog (a threatened species);
- the proposed biodiversity offsets are insufficient; and
- the flora and fauna assessment understates the significance of the flora to be impacted by the development and degree of impact on flora and fauna species;

Visual Amenity

- the St Peters Interchange and local road upgrades would impact on the landscape character of the area, in particular on Sydney Park;
- the associated operational facilities would adversely impact on the landscape character of the adjoining areas, including open space areas such as Kogarah Golf Course, M5 Linear Park, Beverly Grove Park, Tallawalla Street Park and Wolli Creek Valley;
- the proposed street and interchange lighting would affect adjoining residents at night;
- the proposed noise barriers would be visually obtrusive; and
- the project would result in the loss of mature trees along Euston Road at St Peters and at Beverly Grove Park, Kingsgrove reducing visual amenity.

Human Health

- construction and operation of the project would result in increased vehicle numbers with the consequent effect of increased vehicle emissions resulting in health impacts such as respiratory illnesses and lung cancer;
- increased construction and operational traffic has the potential to cause sleep disturbance and noise nuisance and consequently result in stress and anxiety;
- the removal of asbestos waste from the Alexandria Landfill could expose the community to asbestos dust;
- emissions from the ventilation outlets would adversely affect human health;
- the project does not consider the costs to human health; and
- the assumptions regarding air quality, traffic and noise were inadequate for human health assessment.

Other Issues

- the project does not align with the objectives and planning proposals of local government councils and is inconsistent with the community wants and needs;
- the total and increasing cost of the project is unacceptable;
- the proposed tolling regime would be unaffordable for many households;
- the project would increase greenhouse gas emissions through increased vehicular movements;
- the flooding and drainage assessments are inadequate and further details are required on potential localised flooding and mitigation measures;
- the project has the potential to adversely affect the structural integrity of heritage buildings and will result in the demolition of a number of heritage items putting at risk the heritage value of heritage conservation areas; and
- the adequacy of the contamination assessment at the Alexandria Landfill and the Proponent's ability to safely and effectively remediate the site is questionable.

4.5 Proponent's Response to Submissions

Following completion of the formal exhibition period, the Department directed the Proponent to prepare a response to the submissions received. The Proponent's consideration of submissions led to a number of changes to the project. Consequently, a Preferred Infrastructure Report was prepared and included in the Proponent's Response to Submissions Report (refer **Appendix C**). The changes to the project design included:

- the Marsh Street ponds would consist of two ponds designed to provide breeding habitat and one pond to provide refuge habitat, a drainage swale, and water supply systems to fill and drain the ponds; and
- changes to the local road upgrades including:
    - Euston Road/Sydney Park Road/Huntley Street intersection to be upgraded from a roundabout to signalised intersection;
    - Albert Street/Campbell Road intersection to have permanent instead of temporary signals;
    - new Campbell Road (extension)/Southend Distribution Centre intersection to be signalised; and
    - provision of a separated (rather than combined) pedestrian and cycle path within Sydney Park and realignment of the path to provide a more direct connection to the Campbell Road pedestrian and cyclist bridge.

Consequent to the change in the design of the project, and in response to the submission received, the Proponent prepared additional assessments for:

- traffic and transport;
- noise and vibration;
- flooding and drainage; and
- biodiversity.

Eight State government agencies and six local government councils provided comments on the Submissions Report. The State Government agencies and councils reiterated a number of the issues raised in their original submissions and well as recommending conditions should the project be approved. The residual issues raised by the State Government agencies have been considered by the Department in its assessment and are addressed in **Chapter 5** and the recommendations integrated into the recommended instrument of approval, as appropriate. The new or residual issues raised by agencies and councils include the following:

Fire and Rescue NSW reiterated their previously recommended conditions of approval.

The **NSW Chief Scientist and Engineer** recommended a monitor and mitigate approach to ensure air quality impacts to non-project roads, as a result of toll avoidance, are identified and managed during operation.

Sydney Water Corporation requested consultation be undertaken in regards to required acquisition of Sydney Water land at Sydney Park.

The **Office of Environment and Heritage** requested further discussions concerning conditions for the project.

The **Heritage Council of NSW** recommended that they be consulted on the Alexandra Canal crossings and have design input from heritage specialist prior to finalisation of detailed design. The Council reiterated its recommendations on a Comparative Analysis and its conditions relating to the Rudders Bond Store. The Council also recommended interpretation as well as archival recording be implemented for impacts to houses along Campbell Street. For archaeological relics uncovered during construction, the Council recommended a heritage interpretation plan be implemented.

The **Department of Primary Industries (DPI (Water))** recommended the groundwater model to be revised during detailed design to enhance management of groundwater impacts. It was recommended that consultation be undertaken with DPI (Water). DPI (Water) also recommended that the operational surface water quality monitoring program be extended to align with the timeframe requirements of M4 East and that a groundwater monitoring and management plan be implemented for the project.

The Ministry of Health (NSW Health) recommended a number of conditions if the project is approved. These included development of planning restrictions for elevated residences that may be affected by the ventilation stacks, implementing reasonable and feasible mitigation measures to limit noise impacts, communication strategy to encourage motorists to use recycled air and close windows when in the tunnel, in-tunnel monitoring and a communication and response plan for impacted people.

The **Environment Protection Authority (EPA)** provided additional comments in regards to air quality, noise and vibration and water quality. The EPA considered that the Proponent should pursue optimisation of ventilation stacks to reduce predicted ground level concentrations and that any future analysis of the GRAL model and the WestConnex project should incorporate site specific data. The EPA also recommended that dust emissions from the Alexandria Landfill be managed. Whilst the EPA recommended that future developments should consider the impacts of the ventilation facilities. The EPA also questioned the assessment of future tunnel developments to ensure that such assessment use the PIARC model and document and apply a number of parameters relating to fleet fuel mixes and heavy goods vehicles emissions factors.

In regards to noise and vibration, EPA reiterated its recommended conditions regarding issues such as construction hours, construction noise and vibration levels, management plans and compliance review measures to ensure contingency measures are implemented should the need arise. The EPA also recommended conditions in regards to sediment and erosion control to minimise water pollution from runoff emanating from construction sites.

City of Canterbury recommendations included local offsetting of Cooks River/Castlereagh Ironbark Forest losses, collection of seed from Beverly Grove Park to assist in revegetation, reinstatement of the M5 Linear Park in with an improved condition and amenity, incorporation of Water Sensitive Urban Design practices and that the quality of some roads be attended to prior to their use by heavy vehicles.

City of Botany Bay raised additional concerns regarding the need for further traffic modelling investigations to address discrepancies and raised potential impacts to local roads as an issue. Council requested consultation in regards to integration of the project with Council's existing and planned pedestrian and cycleway networks.

Leichhardt Council identified a number of issues that were not considered to have been satisfactorily addressed including traffic modelling and assessment issues, assessment of the WestConnex scheme in stages rather than holistically, use of population projects that are not inclusive of urban renewal projects in the area and an absence of long term impacts associate with induced demand and travel behaviour changes as a result of the project.

City of Sydney reiterated the key issues raised in its previous submission and lack of demonstrated strategic need for the project. Other issues raised included Campbell Street elevated walk and cycle path and Campbell Road extension, Sydney Park impacts, impacts to urban renewal areas and air quality and noise concerns.

City of Sydney requested the Department seek further information on traffic modelling, provision of further detailed designs particularly of St Peters Interchange, independent reviews of the Biodiversity Report, toll avoidance behaviours and details of any integration with public transport. Whilst objecting to the project, City of Sydney also provided a range of recommended conditions such as formation of an Urban Design Advisory Panel, post-operational reviews at specific intervals, making publicly available data regarding the motorways patronage, maximising functional open space at the St Peters Interchange dependent on air quality data, built form requirements, consulting with Transport for NSW regarding active transport integration, delivering the King Street Gateway as a part of the New M5 project, and adopting sustainability targets.

Rockdale City Council requested further consultation during design of the project and during the preparation of environmental management plans.

Marrickville Council did not raise any new issues, and maintained the positions outlined in its submission on the EIS.

The Department has considered the issues raised in all submissions in its assessment of the project as detailed in **Chapter 5**.

5. ASSESSMENT

This section addresses the key issues that were raised in submissions, how the Department assessed each key issue, and the conclusions from the assessment including recommended conditions of approval. The key issues are grouped under major themes including traffic and transport, noise and vibration, air quality, urban design and visual amenity, heritage, social and economic considerations, groundwater and a range of other issues.

5.1. Traffic and Transport

The M5 corridor is the main freight, commercial and private vehicle route connecting Sydney's west and south-west with the Sydney CBD, Sydney Airport and Port Botany. The New M5 aims to relieve congestion, reduce travel times, increase speed and reliability and improve road network safety. To demonstrate this, the traffic and transport assessment provided in the EIS included:

- an assessment of existing and future intersection and road network performance across the project area;

- an assessment of construction traffic impacts;
- an assessment of operational traffic impacts; and
- proposed mitigation measures for identified impacts.

To assist the Department in its assessment, an independent traffic consultant was engaged to undertake a technical review of the Proponent's traffic and transport assessment. The review report is provided at **Appendix D**.

The traffic modelling used in the Proponent's assessment used the WestConnex Road Traffic Model (WRTM). The WRTM is a network-wide model that outlines potential changes in travel patterns under different scenarios. These scenarios included land use change, introduction of new transport infrastructure, induced traffic, road tolls, and traffic impacts with and without the project. The modelled scenarios are outlined in **Table 4**.

Table 4: Modelled Traffic Scenarios – WestConnex New M5

Scenario	Assumptions
Existing case (2012)	Current road network with no new projects or upgrades (base year).
Construction (2016)	Current road network with no new projects or upgrades, with construction traffic movements.
Operation 'do minimum' (2021)	Includes the King Georges Road Interchange Upgrade and M4 Widening projects, but excludes all remaining WestConnex stages.
Future case with the project (2021)	Includes the project, the King Georges Road Interchange Upgrade and M4 Widening, but excludes any other WestConnex projects.
Operation 'do minimum' (2031)	Includes the King Georges Road Interchange Upgrade and M4 Widening projects, but excludes all remaining WestConnex stages.
Future case with the project (2031)	Includes the project, the King Georges Road Interchange Upgrade and M4 Widening, but excludes any other WestConnex projects.
Cumulative case (2031)	Includes all WestConnex stages and future Southern extension.

Existing Traffic Volumes

In determining the existing traffic volumes across the project area, the EIS focused on the M5 corridor and the road network surrounding the proposed St Peters Interchange. Conditions along the M5 were assessed based on Automated Traffic Count (ATC) surveys and mid-block Level of Service (LoS). The road network conditions around the St Peters Interchange were modelled in Paramics. The study area is shown in **Figure 7**. The location of key roads in proximity to the proposed St Peters Interchange is shown in **Figure 8**.

M5 Corridor

ATC surveys were conducted in late 2014 and early 2015 at three locations along the M5 East motorway corridor. The traffic surveys recorded the following:

- morning (AM) peak: the highest one-hour volume of traffic recorded between midnight and midday;
- evening (PM) peak: the highest one-hour volume of traffic recorded between midday and midnight;
- the percentage of total vehicles that comprise heavy commercial vehicles (HCVs) within the AM and PM peak periods;
- the average weekday traffic (AWT) counting 24 hour traffic volumes from Monday to Friday; and
- the average daily traffic (ADT) counting 24 hour traffic volumes from Monday to Sunday.

The three ATC survey site (mid-block) locations are shown in **Figure 7**. The data recorded at each survey site is provided in **Table 5**.

Table 5: Summary of Traffic Volumes - M5 East Corridor (Source: EIS)

Location	AM Peak (HCV%)	PM Peak (HCV%)	Average Weekday Traffic (HCV%)	Average Daily Traffic
Site 1: M5 East Motorway, east of King Georges Road				
Eastbound	2,380 (14%)	3,499 (5%)	50,769 (11%)	60,605
Westbound	3,505 (10%)	3,564 (10%)	57,359 (10%)	59,767
Two-way	5,885 (12%)	7,063 (8%)	108,128 (10%)	120,372
Site 2: M5 East Motorway, east of Bexley Road (in tunnel)				
Eastbound	3,539 (12%)	3,500 (5%)	56,806 (12%)	56,062
Westbound	2,856 (12%)	2,937 (10%)	50,327 (13%)	50,255
Two-way	6,395 (12%)	6,437 (7%)	107,133 (13%)	106,317
Site 3: M5 East Motorway, at Cooks River				
Eastbound	2,773 (12%)	2,518 (5%)	40,115 (13%)	39,400
Westbound	2,566 (11%)	2,439 (9%)	38,946 (13%)	38,478
Two-way	5,339 (12%)	4,957 (7%)	79,061 (13%)	77,878

Consistent traffic flows are generally experienced between 5:00 am and 7:00 pm in both eastbound and westbound directions along the M5 East Motorway. The ATC surveys indicate the AWT and ADT volumes are similar at all three surveyed sites, indicating consistently high traffic volumes where demand is not biased towards weekday work-related trips.

Table 5 indicates that the predominate traffic flow along the M5 East Motorway, east of King Georges Road (Site 1) is westbound during the AM peak and eastbound during the PM peak, which is contrary to typical AM and PM peak hour traffic trends. The EIS states that this is due to congestion and queuing downstream of the King Georges Road Interchange which restricts additional traffic from entering the carriageway during the AM peak. A similar trend is observed for westbound traffic flows during the PM peak. Therefore, the surveyed traffic volumes at Site 1 only represent satisfied demand. The actual demand is underestimated due to the impact of broader road network congestion.

The high percentage of HCVs recorded at each of the ATC survey sites indicates the importance of the M5 East Motorway as a critical freight and commercial route between Sydney Airport, Port Botany, south-western Sydney and beyond.

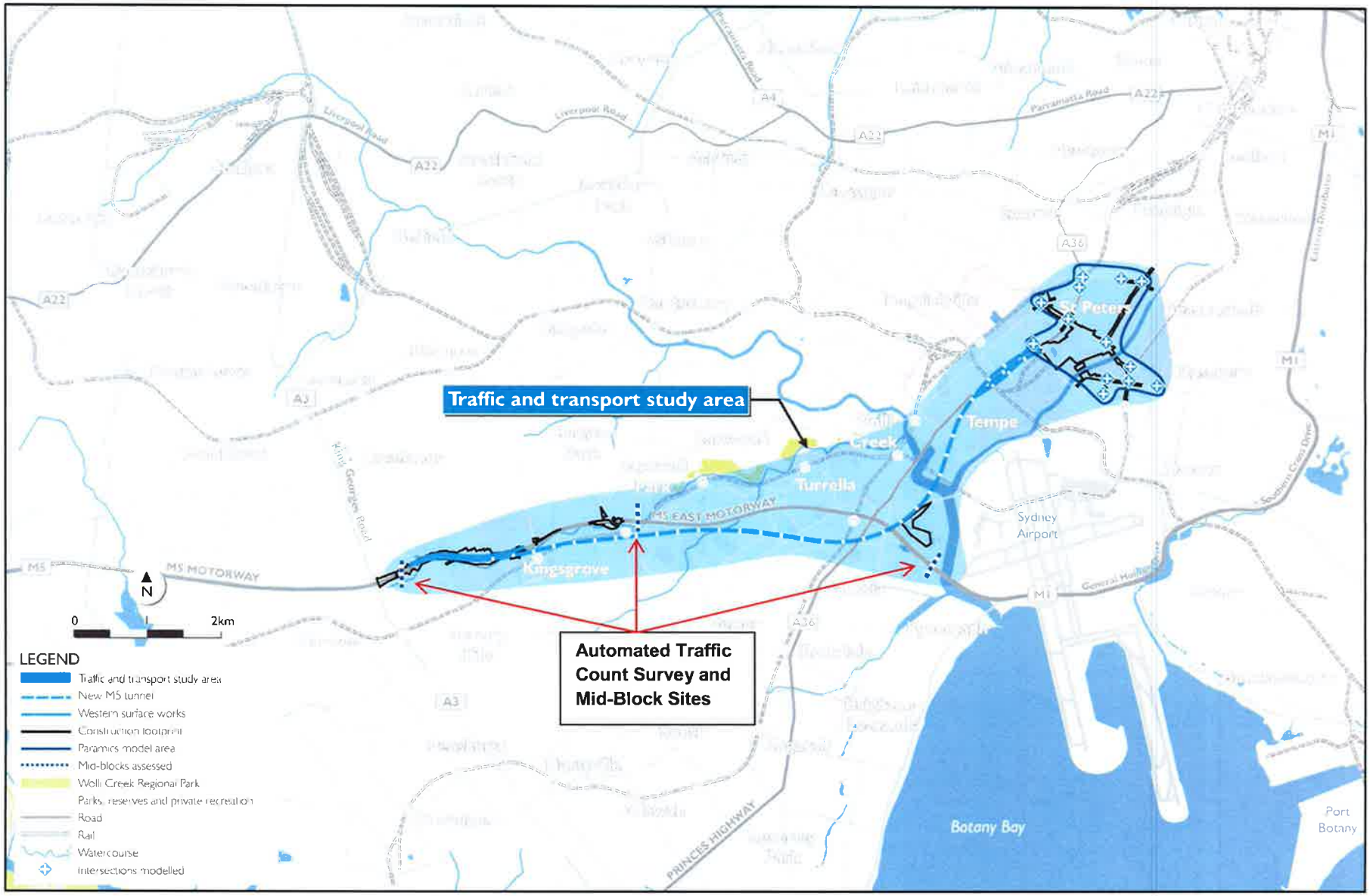

Figure 7: Traffic and Transport Study Area – WestConnex New M5 (Source: EIS)

Figure 8: Road Network Surrounding Proposed St Peters Interchange (Source: EIS)

Mid-block LoS measures the operational conditions of a road or intersection. Six levels of service (A to F) are used, with LoS A representing optimum conditions and LoS F the worst. When a road falls to LoS D, RMS commences investigations into remediation before performance deteriorates further. The EIS included details of the existing mid-block LoS currently experienced during the AM and PM peak periods at three sites modelled along the M5 East Motorway, as shown on **Figure 7**. The mid-block analysis determined that each survey location is operating at a LoS D or E during the AM and PM peaks in both eastbound and westbound directions. The exception is the M5 East Motorway at the Cooks River where the mid-block LoS is currently operating at an acceptable LoS C during the PM peak.

St Peters Locality

The St Peters Interchange would be bound by the Princes Highway, Canal Road, Burrows Road and Campbell Road. Other key arterial roads in the locality include King Street, Gardeners Road, Campbell Street, Euston Road and Bourke Road. **Figure 8** shows the location of key roads in proximity to the proposed interchange.

The existing peak period traffic volumes (including heavy vehicles) on key roads around the St Peters Interchange are outlined in **Table 6**.

Table 6: Summary of Traffic Volumes - St Peters Area (Source: EIS)

Location	Direction	AM Peak *(HCV%)	PM Peak *(HCV%)	Average Weekday Traffic *(HCV%)
King Street, south of Alice Street	Northbound	1,019 (5%)	953 (2%)	-
	Southbound	781 (7%)	941 (3%)	-
Princes Highway, north of Campbell Street	Northbound	1,661 (5%)	981 (3%)	18,818 (6%)
	Southbound	558 (9%)	1,601 (4%)	17,371 (7%)
Princes Highway, south of Campbell Street	Northbound	1,715 (11%)	1,043 (6%)	19,681 (9%)
	Southbound	612 (10%)	1,553 (9%)	17,798 (10%)
Railway Road, west of Princes Highway	Northbound	626 (12%)	638 (4%)	-
	Southbound	389 (17%)	550 (5%)	-
Princes Highway, south of Railway Road	Northbound	3,368 (5%)	1595 (5%)	26,902 (15%)
	Southbound	784 (10%)	2,607 (2%)	25,443 (17%)
Euston Road, north of Campbell Street	Northbound	411 (13%)	185 (7%)	3,117 (13%)
	Southbound	199 (23%)	188 (7%)	2,559 (16%)
Euston Road, north of Sydney Park Road	Northbound	1,220 (7%)	597 (5%)	-
	Southbound	503 (15%)	1,334 (5%)	-
Campbell Road, west of Euston Road	Eastbound	864 (9%)	407 (12%)	7,533 (11%)
	Westbound	161 (21%)	320 (13%)	3,555 (14%)
Campbell Road, east of May Street	Eastbound	358 (8%)	318 (8%)	4,988 (8%)
	Westbound	142 (16%)	275 (11%)	2,994 (12%)
Edgeware Road, west of Edinburgh Road	Northbound	670 (8%)	814 (3%)	-
	Southbound	730 (7%)	777 (1%)	-
Ricketty Street	Eastbound	2,285 (7%)	1,162 (9%)	22,159 (11%)
	Westbound	963 (17%)	1,830 (7%)	20,614 (12%)
Gardeners Road, west of O'Riordan Street	Eastbound	1,090 (13%)	920 (15%)	14,237 (14%)
	Westbound	1,001 (11%)	1,121 (12%)	15,235 (11%)

* Percentage of vehicles that comprise heavy commercial vehicles

Several intersections near the St Peters Interchange experience significant delay during the AM and PM peak periods, indicating the local road network is nearing capacity and would be adversely impacted by even a small increases in demand without intersection improvements. The intersections currently operating at a LoS E or F include:

- Princes Highway and May Street, St Peters (AM peak);
- Princes Highway and Canal Road, St Peters (AM and PM peak);
- Princes Highway and Railway Road, Sydenham (AM and PM peak); and
- Gardeners Road and O'Riordan Street, Mascot/Alexandria (AM peak).

Figure 9 and **Figure 10** illustrate the LoS currently experienced at intersections surrounding the proposed St Peters Interchange in the AM and PM peak periods, respectively.

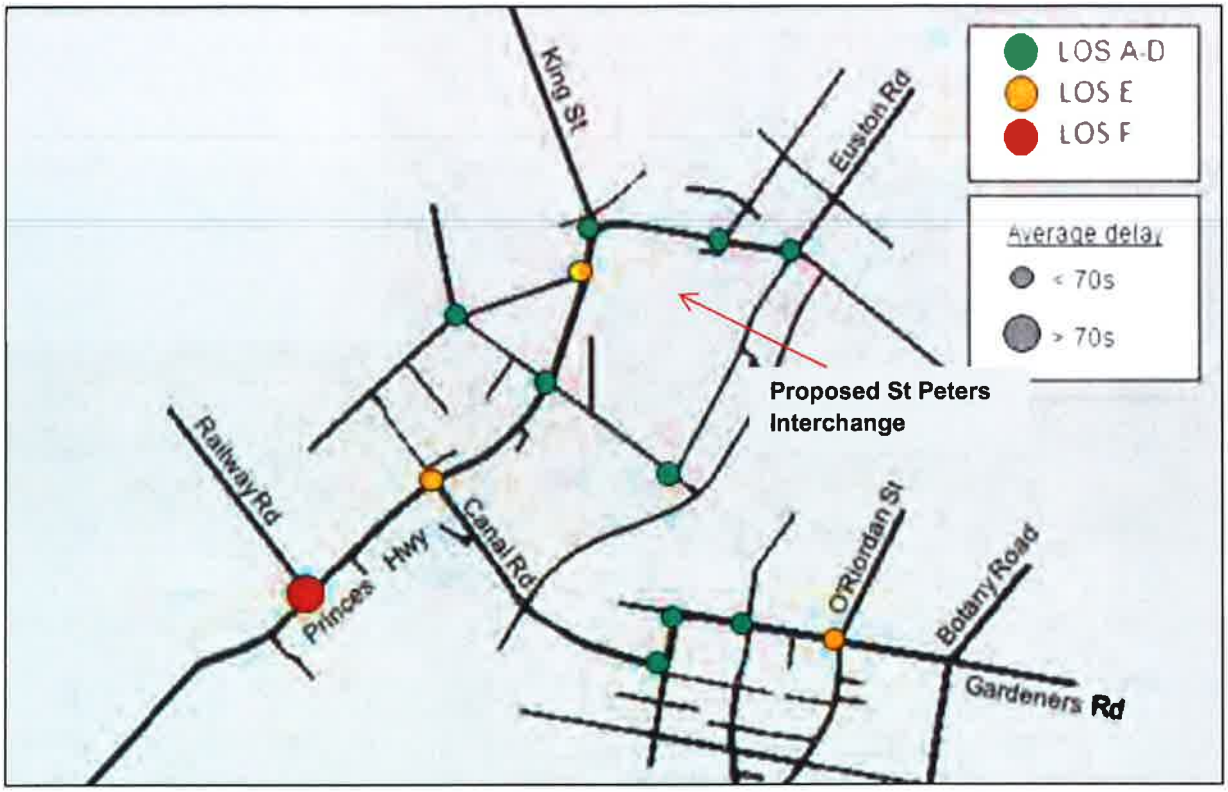

Figure 9: Intersection LoS around St Peters Interchange - AM Peak (Source: EIS)

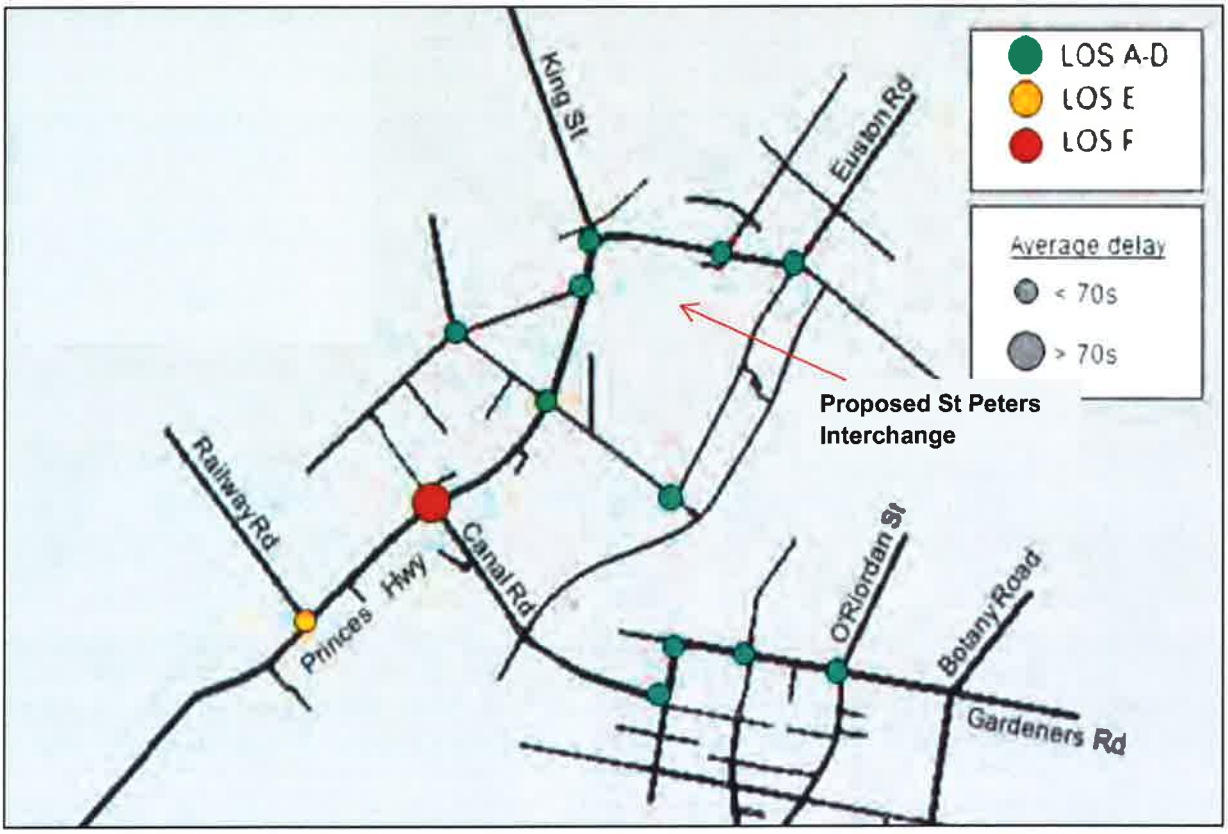

Figure 10: Intersection LoS around St Peters Interchange - PM Peak (Source: EIS)

5.1.1 Construction Traffic

Issue
Construction works associated with the project would potentially create congestion on the surrounding road network through the introduction of heavy and light construction vehicles. These vehicles will be needed to support tunnelling activities and for construction of the tunnel portals and interchanges, temporary road closures, the diversions of roads, pedestrian and cyclist routes, and amendments to traffic speed limits. Construction is expected to occur over a three year period from the end of 2016 to 2019.

Construction Traffic
A total of 14 construction compounds are proposed – identified in **Figure 5**. Spoil haulage routes have been nominated on the basis of minimising impacts on local residential streets and maximising movements along State and regional roads. Spoil from tunnelling activities would be transported from the following construction compound sites:
C1 – Kingsgrove North;
C3 – Commercial Road;
C4 – Bexley Road North;
C5 – Bexley Road South;
C7 – Arncliffe; and
C8 – Canal Road.

Other construction vehicle movements would include the delivery of materials, plant, equipment and concrete from batching plants to site locations. The forecast daily light and heavy construction vehicle numbers accessing each of the construction compound sites is outlined in **Table 7**.

Table 7: Forecast Construction Vehicle Numbers (Source: EIS)

Construction Compound	Vehicle Type	AM Peak (vehicles/hour)	PM Peak (vehicles/hour)	Daily Vehicles
Kingsgrove North (C1)	Light	31	26	989
	Heavy	62	56	1,975
Kingsgrove South (C2)	Light	1	1	24
	Heavy	3	3	72
Commercial Road (C3)	Light	7	7	133
	Heavy	8	8	192
Bexley Road North (C4)	Light	4	4	96
	Heavy	18	18	432
Bexley Road South (C5)	Light	4	4	96
	Heavy	18	18	432
Bexley Road East (C6)	Light	32	32	418
	Heavy	0	0	0
Arncliffe (C7)	Light	17	17	374
	Heavy	60	60	1,055
Canal Road (C8)	Light	40	54	1,132
	Heavy	50	50	710
Campbell Road (C9)	Light	52	52	1,038
	Heavy	26	32	716
Landfill Closure (C10)	Light	10	10	170
	Heavy	12	12	218
Burrows Road (C11)	Light	12	14	260
	Heavy	8	10	200
Campbell Road bridge (C12)	Light	4	4	79
	Heavy	5	4	117
Gardeners Road bridge (C13)	Light	12	14	260
	Heavy	8	9	196
Sydney Park (C14)	Light	4	4	96
	Heavy	4	4	61

The majority of the compounds would be accessed via arterial roads. However, access would be required along a number of local roads including, but not limited to Garema Circuit,

Kingsgrove (C1 and C2), Commercial Road, Kingsgrove (C3), Burrows Road, St Peters (C11, C12 and C13) and Campbell Road, St Peters (C9, C10 and C14). The proximity of arterial roads to each compound site means construction traffic would avoid extensive travel through established residential neighbourhoods. In some instances, small sections of local roads may be required, including light vehicle access to C6 via Wolli Avenue at Earlwood.

Intersection LoS and Mid-Block Performance

Intersections that would potentially be impacted by construction traffic are discussed below.

1. *Western and Bexley Road surface works construction compounds:*
    - Bexley Road and the M5;
    - Bexley Road and Kingsgrove Avenue;
    - Bexley Road and Homer Street;
    - Kingsgrove Road and Homer Street;
    - Kingsgrove Road and Moorefields Road;
    - Moorefields Road, Wirega Avenue and Chapel Street;
    - Kingsgrove Road and the M5; and
    - Kingsgrove Road, Commercial Road and Kingsgrove Avenue.

Congestion already affects the intersections of Bexley Road and Homer Street (during the PM peak) and Kingsgrove Road and Homer Street (during the AM peak). Additional construction-generated traffic would further decrease the performance of these intersections.

2. *Arncliffe construction compound:*
    - Princes Highway and Wickham Street;
    - Wickham Street and West Botany Street;
    - Marsh Street and West Botany Street;
    - Marsh Street and the M5; and
    - Marsh Street and Flora Street.

Congestion already affects the Princes Highway and Wickham Street intersection during both the AM and PM peak periods, and construction will increase this further. The remaining intersections including those in the vicinity of the Arncliffe compound are predicted to be only marginally impacted by construction traffic.

3. *St Peters Interchange construction compounds:*
    - Princes Highway and Railway Road;
    - Princes Highway and Canal Road;
    - Canal Road and Burrows Road;
    - Princes Highway and Campbell Road;
    - Campbell Road and Euston Road; and
    - Campbell Road and Burrows Road.

With the exception of the Canal Road and Burrows Road intersection in the AM peak, the remaining intersections in the vicinity of the St Peters Interchange compounds would only be marginally affected by construction traffic.

Temporary Road Closures

Temporary road closures and diversions would be required throughout construction of the project. **Table 8** outlines the locations and timeframes for the required closures.

Table 8: Temporary Road Closures and Diversions During Construction (Source: EIS)

Location	Description	Duration
M5 East Motorway	Temporary lane closure for the installation, relocation and removal of traffic barriers and line markings	At night within approved times
Marsh St	Temporary lane closure for the installation of changed traffic signals at the intersection of Marsh Street, Flora Street and access to the Arncliffe construction compound	At night within approved times
Campbell Ln, Woodley St, Harber St, Holland St	All properties acquired and the roads permanently closed	Permanent closure
Brown Street	Vertical geometry amended to tie into the upgraded Campbell Street	Long-term closure
Florence Street	Vertical geometry amended to tie into the upgraded Campbell Street	Short-term closure
Bedwin Rd, Unwins Bridge Rd, Campbell St, Campbell Rd, St Peters St, Church St, Princes Hwy, Euston Rd, Burrows Rd, Sydney Park Rd, Huntley St, Bourke Rd, Bourke St, Gardeners Rd	Intermittent installation of new barriers and realignment of the road for temporary and/or permanent traffic switches	Short-term closure
Canal Rd	Intermittent installation of new barriers and realignment of the road for temporary and/or permanent traffic switches	At night within approved times

Construction Car Parking

Local residents and businesses would be impacted by construction workers utilising existing on-street parking. The EIS notes that construction personnel would be encouraged to use public transport, active transport and to car-pool. The total number of construction car park spaces to be provided for each construction compound site is outlined in **Table 9**.

Table 9: Construction Worker Car Parking Supply and Demand (Source: EIS)

Site	On-Site Car Parking Supply	Employee Peak	Difference (+/-)
Kingsgrove North	170	200	- 30
Kingsgrove South	20	20	-
Bexley Road East	112	89	+ 23
Arncliffe	220	300	- 80
St Peters Interchange*	290	320	- 30
Campbell Road bridge	10	15	+ 5
Gardeners Road bridge	10	10	-

* Includes Canal Road, Campbell Road, Landfill Closure, Burrows Road, and Sydney Park construction compounds.

Submissions

The **City of Botany Bay Council** considered it essential that the planned upgrades to Campbell Street/Campbell Road including the intersection with the Princes Highway be completed prior to the addition of construction traffic associated with the project. It also recommended a shuttle service to move construction workers between compound sites and public transport services.

The **City of Canterbury Council** raised concern regarding the deterioration of local and regional road pavements caused by increased light and heavy vehicle movements during construction.

Hurstville City Council raised concerns about additional construction vehicles using the M5 during peak periods and impacts to on-street parking in Beverly Hills.

Marrickville Council requested construction movements avoid local roads and that any pedestrian and cyclist infrastructure removed during construction be replaced with temporary facilities. Concern was raised regarding the loss of on-street parking and asked that the Proponent consult with Council about worker parking prior to construction starting. Council further requested consultation with the Proponent in the event of temporary changes in traffic movements and road closures required during construction.

Rockdale City Council questioned the validity of traffic modelling around the Arncliffe ancillary site because the base case results do not reflect the current road network conditions. It also requested a shuttle bus service for construction workers between Wolli Creek train station and the Arncliffe ancillary site.

The **City of Sydney Council** raised concerns about the loss of car parking during construction of the St Peters Interchange and the impacts this would have on local businesses.

Public Submissions

Key issues raised in public submissions relating to construction traffic included:

- temporary closure of local roads during construction;
- the introduction of construction vehicles to the local road network and residential streets; and
- property access and construction vehicles parking on local streets.

Department's Consideration

The Department acknowledges traffic impacts are unavoidable during construction of the project because of the scope and nature of the work.

The Department's independent traffic specialist recommended that a Construction Traffic and Access Management Plan be prepared including a construction car parking strategy, haulage movement details, proposed methods to maintain peak period traffic capacity and public transport operations, and methods to maintain pedestrian and cyclist connectivity during construction.

Subsequently, the Department has recommended the Proponent prepare a Construction Traffic and Access Management Plan in consultation with the relevant councils, local businesses and road user groups. The Plan would provide details of management measures to minimise construction traffic impacts during construction of the project.

To address the community's concerns in regards to construction traffic impacts on local residential streets, the Department has recommended a condition restricting the use of local roads by heavy construction vehicles. All heavy vehicles will be required to adhere to the nominated haulage routes identified in the Construction Traffic and Access Management Plan. The Proponent would be required to provide justification and obtain approval of the Secretary for the use of local roads not specified in the conditions of approval.

A key concern raised by a number of councils was the potential for local road damage due to construction heavy vehicle movements. To ensure the condition of existing local roads are maintained and repaired where required, the Department has recommended the Proponent prepare a Local Road Dilapidation Report to assess the current road conditions and make provisions for the repair of any damage caused by construction heavy vehicles. The Report is required to be submitted to the relevant councils to review at least two weeks prior to the use of local roads by construction traffic.

The Department recognises there will be a shortfall of up to 80 car parks for construction workers at the Arncliffe construction compound. To address this issue and Rockdale City Council's concerns in regards to overflow parking in the vicinity of the Arncliffe construction compound site, the Department has recommended a condition requiring the provision of onsite car parking for all workers during construction.

The Department has also recommended that the Proponent prepare a Construction Parking and Access Strategy which includes:

- details on the measures to be implemented to avoid a net loss in on- and off-street parking during construction, including strategies for the staged management of measures to ensure that not all temporary losses of parking occur concurrently within a locality; and
- measures to reduce construction personnel use of remaining on- and off-street parking stock, including temporary use of part of the Alexandria Landfill or nearby RMS owned land and the provision of shuttle services from the parking facility to construction areas and working with councils to implement time-restricted/resident only parking zones.

To ensure the safety of pedestrian and cyclists throughout construction, the Department has recommended a condition requiring the Proponent establish safe pedestrian and cyclist access through and around work sites. In circumstances where access is restricted, a satisfactory alternate route must be provided and signposted.

5.1.2 Operational Traffic

Issue

The project is expected to deliver reduced travel times along the M5 East corridor between King Georges Road in the west and Foreshore Road in the east, resulting in improved speed, reliability and safety. The Department's assessment of operational impacts has considered intersection LoS, mid-block analyses and screenline assessments of both the M5 corridor and modelling undertaken in the area around the proposed St Peters Interchange.

Screenline Analysis

A screenline analysis involving traffic counts (including induced traffic) at theoretical boundaries was undertaken by the Proponent. The analysis compared the forecast AWT volumes at each screenline location for the years 2021 and 2031, both 'with' and 'without' the project.

The eastern screenline captures traffic on the proposed New M5 and four parallel arterial roads including the Princes Highway, Marsh Street, the M5 and General Homes Drive. The western screenline captures east-west traffic volumes on the M5 corridor and three parallel arterial roads including Canterbury Road, Stoney Creek Road and Forest Road/Queens Road. The screenline locations are shown in **Figure 11**.

Key observations from the screenline analysis for the year **2021** include:

- two-way AWT 'with' the project at the western screenline is forecast to be 2% less than 'without' the project. At the eastern screenline, AWT is forecast to be similar both 'with' and 'without' the project;
- the share of two-way AWT crossing the western screenline on the M5 motorway corridor is forecast to reduce from 53% to 46% 'with' the project, with traffic forecast to relocate to Stoney Creek Road and Canterbury Road;
- the existing M5 share of two-way AWT crossing the eastern screenline is forecast to reduce from 29% to 23% 'with' the project, with traffic forecast to relocate to the New M5; and

- the existing M5 and New M5 are forecast to carry approximately 30% of the total two-way AWT traffic 'with' the project at the eastern screenline. The existing M5 would otherwise carry this traffic 'without' the project.

Key observations from the screenline analysis for the year **2031** include:

- two-way AWT 'with' the project at the western screenline is forecast to be about 6% more than 'without' the project;
- the share of two-way AWT crossing the western screenline on the M5 motorway corridor is forecast to reduce from 50% to 47% 'with' the project. This traffic is forecast to mainly relocate to Stoney Creek Road, predominately in peak periods;
- the existing M5 and New M5 are forecast to carry almost 50% of the total AWT at the western screenline 'with' the project;
- two-way AWT at the eastern screenline is forecast to be approximately 4% more than 'without' the project; and
- two-way AWT along the existing M5 at the eastern screenline is forecast to reduce from 28% to 24% 'with' the project. Some of this traffic is forecast to relocate to the New M5 with reductions on the Princes Highway and Marsh Street.

A detailed analysis of the screenline assessment is outlined in **Tables 5** to **7** of **Appendix E** including screenline predictions for the 2031 'full WestConnex and southern extension' scenario.

St Peters Interchange

A key focus of the Department's assessment included the operational traffic conditions in the area surrounding the proposed St Peters Interchange. The interchange would be a four level interchange with connections between:

- the New M5 and Euston Road at the intersection of Campbell Road;
- the New M5 and Gardeners Road;
- the New M5 and the future Sydney Gateway;
- the future M4-M5 Link and the future Sydney Gateway;
- the future M4-M5 Link Gardeners Road; and
- the future M4-M5 Link and Euston Road at the intersection of Campbell Road.

Motorists would have four routes to choose from heading eastbound, including:

- continuing on to Euston Road and toward the Sydney CBD, which would also take motorists to Alexandria;
- extending Campbell Road across Alexandra Canal providing a new local connection to Mascot town centre;
- a new direct connection to Mascot via Gardeners Road; and
- Campbell Street/Road for local access to St Peters.

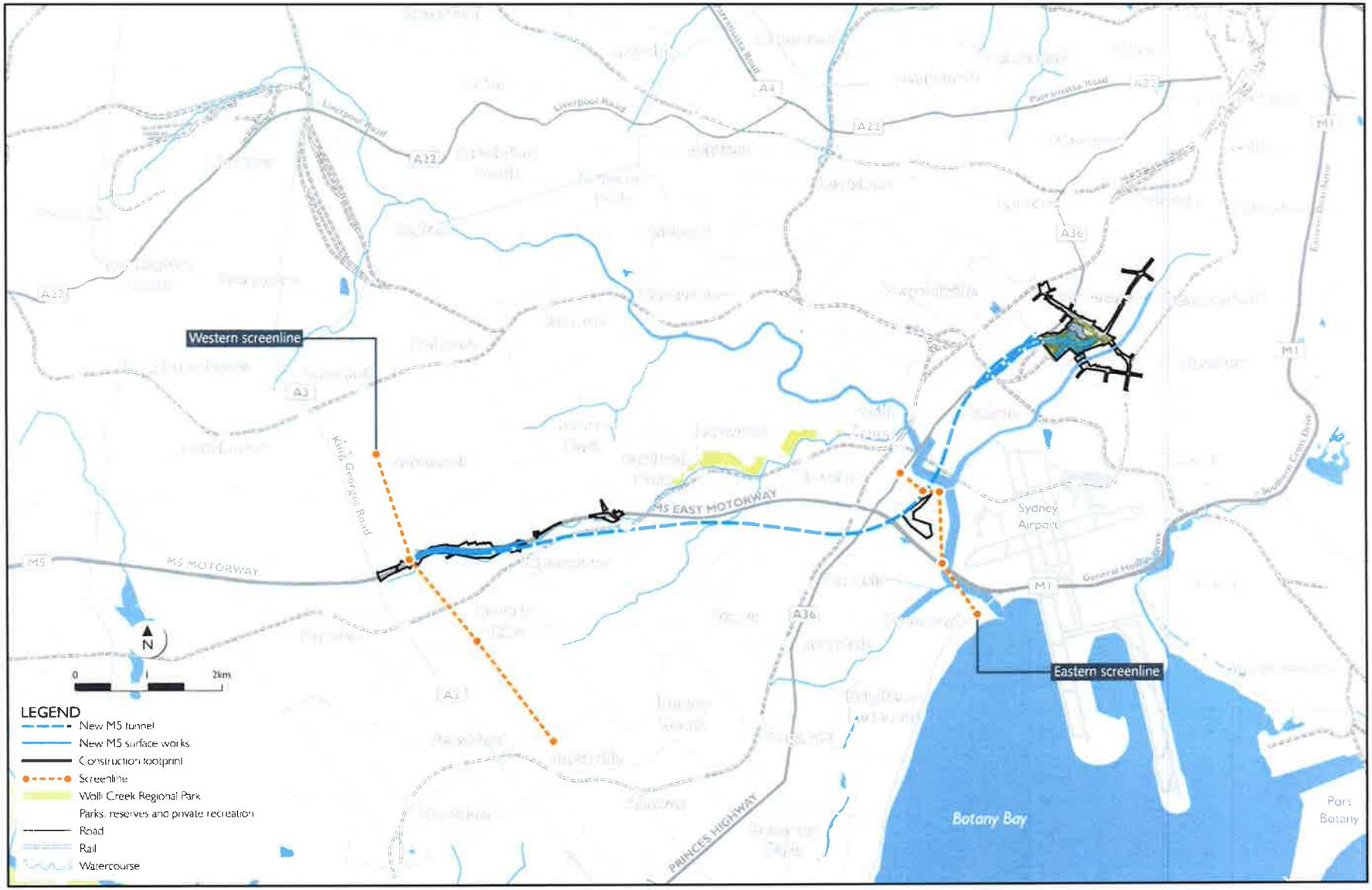

Figure 11: Modelled Screenline Locations (Source: EIS)

Intersection Levels of Service

Tables 1 and **2** of **Appendix E** outlines the predicted intersection LoS in the St Peters locality for peak periods in 2021 and 2031, both with and without the project. The modelling indicates there would be notable improvements in intersection LoS by 2021 if the project proceeds. Significant improvements by 2031 are predicted with the full WestConnex program of works complete, in comparison with the 2031 without project scenario. Nonetheless, challenges would still remain in 2031 at several intersections which are predicted to operate at a LoS E or F in peak periods (even with the full WestConnex scheme and Southern extension in operation). These intersections include:

- Princes Highway and Campbell Street (AM and PM peak);
- Princes Highway and Railway Road (AM and PM peak);
- Campbell Road and Euston Road (PM peak);
- Campbell Road and Bourke Road (PM peak);
- Gardeners Road and Bourke Road (PM peak); and
- Gardeners Road and O'Riordan Street (AM and PM peak).

Mid-Block Levels of Service

Tables 3 and **4** of **Appendix E** provides a comparison of the years 2021 and 2031 mid-block LoS with and without the project during peak periods. **Table 10** and **Table 11** show the changes in traffic flow for key roads in the vicinity of the St Peters Interchange during the AM and PM peak periods.

Table 10: 2021 Comparison of Peak Period Traffic Flow 'with' and 'without project' (Source: EIS)

Location	Direction	AM Peak			PM Peak		
		Without Project	With Project	Change in flow	Without Project	With Project	Change in flow
		Veh/hour	Veh/hour	%	Veh/hour	Veh/hour	%
King Street, south of Alice Street	Northbound	880	800	-10%	830	910	+10%
	Southbound	560	620	+11%	1,030	1,010	-2%
Euston Road, north of Sydney Park Road	Northbound	1,050	1,950	+86%	820	1,280	+56%
	Southbound	790	1,110	+41%	1,340	1,940	+45%
Gardeners Road, west of O'Riordan Street	Eastbound	1,230	1,350	+10%	1,410	1,570	+11%
	Westbound	1,150	1,150	0%	1,060	1,270	+20%

Table 11: 2031 Comparison of Peak Period Traffic Flow 'with' and 'without project' (Source: EIS)

Location	Direction	AM Peak			PM Peak		
		Without Project	With Project	Change in flow	Without Project	With Project	Change in flow
		Veh/hour	Veh/hour	%	Veh/hour	Veh/hour	%
King Street, south of Alice Street	Northbound	1,100	870	-21%	890	940	+6%
	Southbound	450	730	+62%	980	1,210	+23%
Euston Road, north of Sydney Park Road	Northbound	990	2,120	+114%	780	1,530	+96%
	Southbound	970	1,580	+63%	1,500	2,160	+44%
Gardeners Road, west of O'Riordan Street	Eastbound	1,280	1,790	+40%	1,560	1,650	+6%
	Westbound	1,150	1,410	+23%	1,140	1,660	+46%

The mid-block analysis indicates there would be significant increases in northbound traffic volumes along Euston Road north of Sydney Park Road, heading toward the Sydney CBD in the AM peak for both the 2021 and 2031 scenarios. There is also predicted to be a large increase in westbound traffic along Gardeners Road west of O'Riordan Street by 2031 during both peak periods. Only marginal changes in traffic flow along King Street in 2021 are predicted, with more noticeable increases in southbound traffic expected by 2031 as motorists seek entry to the westbound tunnel. Northbound traffic along King Street in the AM peak is expected to be reduced by 21% in 2031, presumably as motorists choose to instead make use of Euston Road to access inner Sydney and the CBD.

Car Parking

Extensive changes to the road network around the proposed St Peters Interchange would result in the loss of on-street car parking, predominantly on non-residential streets. **Table 10** in **Appendix E** outlines the indicative number of car parks to be permanently removed as part of the project. The final number of car parking spaces to be removed would be confirmed during detailed design.

Submissions

The **City of Botany Bay Council** included a specialist review of the EIS traffic modelling and assessment, prepared by TTM Consulting. A key finding was that the proposed tolling regime would result in traffic avoiding the motorway by using surrounding local roads. The validity of the project was therefore questioned given the low traffic forecasts within the tunnels. Council also requested pedestrian safety measures in the vicinity of Mascot train station due to the project doubling AM peak traffic volumes on Bourke Street south of Gardeners Road. It suggested that a signalised pedestrian crossing of Bourke Street outside of the station.

The **City of Canterbury Council** and **Hurstville City Council** raised concerns about toll avoidance and the impacts on surrounding local and regional roads. Hurstville City Council asked for further information about traffic management in the event of an accident or break down inside the tunnel.

Marrickville Council questioned the project's viability in the absence of the M4-M5 Link. Council also raised concerns regarding the project's contribution to traffic growth through inner Sydney and impacts on residential streets within the LGA. The project is also expected to increase the demand for parking putting pressure on new or expanded clearways particularly along King Street, Newtown. Council also raised concern about the project's proposed tolling regime and associated impacts on surrounding roads.

Rockdale City Council raised concerns about the impact of increased vehicle numbers on suburban roads as a result of toll avoidance, particularly in the suburbs of Bexley and Wolli Creek. Council also stated that the project provided little opportunity for bus improvements.

The **City of Sydney Council** questioned the traffic assessment methodology and raised concerns that the impacts of future major projects such as the Green Square urban renewal precinct had not been included in the study. Council said the EIS provided little consideration of the long-term operational impacts of the project, including the impact of increased traffic throughout the inner western suburbs and the area surrounding the proposed St Peters Interchange. Council also believed the project would divert traffic into the CBD via Euston Road and surrounding linking roads which are already struggling to cope with the current traffic demand.

Leichhardt Council considered the traffic modelling to be inaccurate and by underestimating the future traffic volumes and congestion under the 2021 and 2031 scenarios. Council also wanted further quantification of induced traffic and the number of

public transport users who would switch to private vehicle usage due to the additional road network capacity.

Public Submissions

Key issues raised in public submissions in regards to operational traffic included:

- increased traffic volumes around the tunnel portals and particularly at the St Peters Interchange which would disperse traffic into the already congested inner western suburbs of St Peters, Alexandria, Erskineville, Newtown, Enmore, Tempe and Marrickville;
- increased traffic along the M5 corridor due to induced demand; and
- 'rat-running' through residential streets to avoid tolls associated with the project.

Department's Consideration

The Department's independent traffic consultant reviewed the Proponent's traffic and transport assessment and provided the following recommendations with regards to operational impacts:

- a post-operations review should be used to monitor traffic patterns and operations, and implement road network mitigation improvements for areas where traffic performance is at unsatisfactory levels; and
- independent road safety audits should be undertaken for all stages of further design development.

Traffic Modelling

Several councils questioned the accuracy of the Proponent's traffic modelling provided in the EIS, with some considering the predicted future traffic volumes have been significantly underestimated. The Department's independent traffic specialist noted that the traffic assessment and modelling tasks have been undertaken thoroughly with an appropriate methodology. The Department also notes that the WRTM incorporated a peer review of the model development and methodologies for the production of traffic forecasts. The Department considers that the WRTM is appropriate in informing the predicted future traffic volumes and patterns as a result of the project and WestConnex project in its entirety.

Local Traffic Impacts

The Department recognises the potential for rat-running' through local streets due to avoid tolls, permanent road closures and as a result of motorists seeking to avoid signalised intersections and known areas of congestion. It is also recognised that the project would increase traffic volumes in the area surrounding the tunnel portals, particularly in the vicinity of the proposed St Peters Interchange. The Department has therefore recommended that the Proponent prepare a Road Network Performance Review Plan within 12 months and at five years after the commencement of operation. The Plan is to be prepared in consultation with the relevant local councils and must include modelling of traffic impacts to the adjoining road network as a consequence of the project, and include mitigation measures to manage traffic performance deficiencies. This would include deficiencies which cause 'rat-running' and toll avoidance behaviours.

The Department notes that the WRTM included provisions for the impact of toll avoidance on surrounding local roads. The accuracy of the predicted impacts would be confirmed through the Road Network Performance Review Plan with opportunities to identify mitigation improvements in areas where traffic performance may be unsatisfactory.

Intersection Performance

The traffic modelling indicates key intersections surrounding the proposed St Peters Interchange would deteriorate further without the project due to future traffic growth. The project is expected to improve the performance of some intersections during the AM and PM

peak periods in the area surrounding the proposed St Peters Interchange under both the 2021 and 2031 'with project' scenarios. Should the project not proceed, some notable deteriorations of LoS are anticipated by 2031, as outlined in **Tables 1** and **2** of **Appendix E**.

The Department has recommended the Proponent undertake further detailed investigations of intersections identified as operating at a LoS D or worse during either the AM or PM peak periods under the 2021 'with project' scenario. The investigations are to form part of the Road Network Performance Review Plan and include the following intersections:

- Princes Highway and Campbell Street;
- Princes Highway and Canal Road;
- Princes Highway and Railway Road;
- Sydney Park Road and Mitchell Street;
- Unwins Bridge Road and Campbell Street;
- Campbell Road and Euston Road;
- Gardeners Road and Bourke Road; and
- Gardeners Road and O'Riordan Street.

The Department is satisfied further mitigation measures to manage any traffic deficiencies at the abovementioned intersections can be implemented if required, as required by the Road Network Performance Review Plan.

Impacts on Arterial Roads – St Peters Locality

The public submissions raised concerns that the project would increase traffic volumes along arterial roads surrounding the proposed St Peters Interchange. Once operational, motorists would be able to access and exit the New M5 tunnels via the interchange at the intersection of Campbell Road and Euston Road, St Peters and at Gardeners Road in Mascot via a new bridge crossing the Alexandra Canal. The predominant concern was that traffic entering and exiting the tunnel at St Peters would increase the amount of through-traffic along Euston Road and King Street in particular, subsequently funnelling additional traffic on to an already congested road network.

Euston Road

The Department notes that, even in absence of the project, traffic volumes and congestion on local and arterial roads in the area around St Peters is expected to increase due to projected population growth. It is considered that without the local road upgrades proposed as part of the project, the forecast traffic growth would in fact worsen any existing traffic congestion issues currently experienced in the area around St Peters. Local road upgrades proposed as part of the project include a new signalised intersection at the corner of Campbell Road and Euston Road connecting to the St Peters Interchange and additional traffic lanes along Euston Road between Campbell Road and Maddox Street, Alexandria. The local road upgrades, including additional lanes along Euston Road in particular, are expected to complement the project as additional road network capacity is being provided to support any induced traffic demand. To determine the effectiveness of the proposed local road upgrades, the Department has recommended the Road Network Performance Review Plan include further detailed investigation of the road network conditions along Euston Road between Sydney Park Road and Botany Road at both 12 months and five years after commencement of operation of the project. Any traffic deficiencies identified along Euston Road can be identified for future improvements, as required by the Plan.

King Street

The Response to Submissions and Preferred Infrastructure Report states that significant changes to traffic volumes along King Street (south of Alice Street) are not anticipated as a result of the project. However, the Department recognises there is ongoing community concern with regards to induced traffic demand as a result of the project. The recommended

conditions therefore require the Proponent undertake further detailed investigation of King Street between Sydney Park Road and Enmore Road as part of the Road Network Performance Review Plan at both 12 months and five years after commencement of operation of the project. **Tables 3** and **4** of **Appendix E** provides further detailed analysis of the predicted changes in peak hour traffic volumes along King Street (south of Alice Street) as a result of the project under the 2021 and 2031 scenarios, respectively.

The public submissions also raised concerns regarding the potential loss of car parking and the provision of clearways along King Street in Newtown. The Proponent's Response to Submissions and Preferred Infrastructure Report states that the project would not remove or modify the existing on-street car parking arrangements along King Street. In addition, there are no plans to implement clearways along King Street, or elsewhere as part of the project. The Department is satisfied with the Proponent's response and considers that any future proposal to increase traffic capacity along King Street through the introduction of clearways would be subject to a separate assessment and approval process.

Impacts on Arterial Roads – Western Extent of the Project

The project is expected to reduce daily traffic volumes along the M5 East Motorway with some traffic shifting to the New M5 as well as arterial and local roads located parallel to, and adjoining the motorway. The Department acknowledges that once the project is operational, traffic volumes will likely shift to the New M5 and notable increases in traffic will also be expected along King Georges Road (south of the M5 East Motorway), Stoney Creek Road, Forest Road to the south and Canterbury Road to the north. The shifts in traffic volumes would be the result of a new alternate high speed route along the M5 corridor, as well as 'rat-running' and toll avoidance.

The recommended Road Network Performance Review Plan is required to detail deficiencies of the surrounding road network within 12 months and at five years after the project is operational, including deficiencies that may be the result of 'rat-running' and toll avoidance behaviours. This would include roads running parallel to, and adjoining the project alignment including Stoney Creek Road, Forest Road and Canterbury Road. The Department considers appropriate mitigation measures can be implemented as part of the Road Network Performance Review Plan to address any traffic performance issues that may occur across the western extent of the project.

Travel Speeds and Travel Times

The additional road network capacity provided by the project is predicted to improve travel speeds and provide travel time savings along the existing M5. Traffic modelling predicts the 2021 'with' project scenario would provide travel time savings of nine minutes (AM peak) and eight minutes (PM peak) for eastbound traffic, and up to six minutes (AM peak) and seven minutes (PM peak) for westbound traffic between King Georges Road and Foreshore Road. More significant travel time savings are predicted for the 2031 scenario which includes the full WestConnex program of works and Southern extension, as detailed within **Table 9** of **Appendix E**.

Conclusion

The project is expected to relieve road network congestion and improve travel times, reliability and safety along the M5 corridor. The anticipated reduced travel times between King Georges Road in the west and Foreshore Road in the east would deliver greater accessibility between the south-western suburbs of Sydney and the CBD, Sydney Airport and Port Botany.

The recommended conditions of approval in regards to operational traffic would assist in the management and mitigation of impacts on the local road network.

5.2. Noise and Vibration

Issue
The existing noise environment along the project corridor is dominated by road traffic, particularly from the M5 East Motorway, Bexley Road, Kingsgrove Road, King Georges Road and the Princes Highway. Other key noise sources include the East Hills, Inner West and Illawarra Railways and aircraft noise from Sydney Airport.

A noise assessment was undertaken by the Proponent in accordance with NSW government noise guidelines and included the prediction of the worst-case noise scenarios across 30 Noise Catchment Areas (NCAs) within a 600 metre buffer around the project corridor (refer **Figure 12 - Figure 14**). This included 11 NCAs within the vicinity of the eastern portal and St Peters Interchange, three NCAs within the vicinity of the Arncliffe motorway control centre and 16 NCAs within the vicinity of the western surface and portal works.

The Department engaged EMGA Mitchell McLennan Pty Ltd to undertake a specialist and independent review of the noise assessment. The independent consultant's full report is provided in **Appendix F**.

Construction Noise
Surface construction activities would generally be undertaken during standard construction hours of 7:00 am to 6:00 pm, Monday to Friday and 8:00 am to 1:00 pm on Saturday. Construction activities undertaken outside of standard construction hours are summarised in **Table 12**.

Table 12: Out of Hours Works

Activity	Works	Justification
Surface construction activities	• Existing M5 East Motorway and western portals, toll gantries • Construction of the St Peters Interchange and eastern portals • Local road upgrade works and bridge construction	Where it would be safer and less disruptive to traffic
Minor surface construction activities	• Installation/relocation of utilities and toll gantries	Where it would be safer and less disruptive to traffic
Minor support activities within construction compounds	• Car parking, fit-out activities	Where the activities do not exceed applicable Noise Management Levels (NML)
Tunnelling and tunnelling support activities	• Main alignment tunnels, tunnel stubs, ventilation extraction tunnels and all underground excavations and spoil handling and haulage	Required to be conducted continuously for 24 hours a day, seven days a week to reduce the overall construction timeframe and prevent traffic congestion on major roads during peak hours

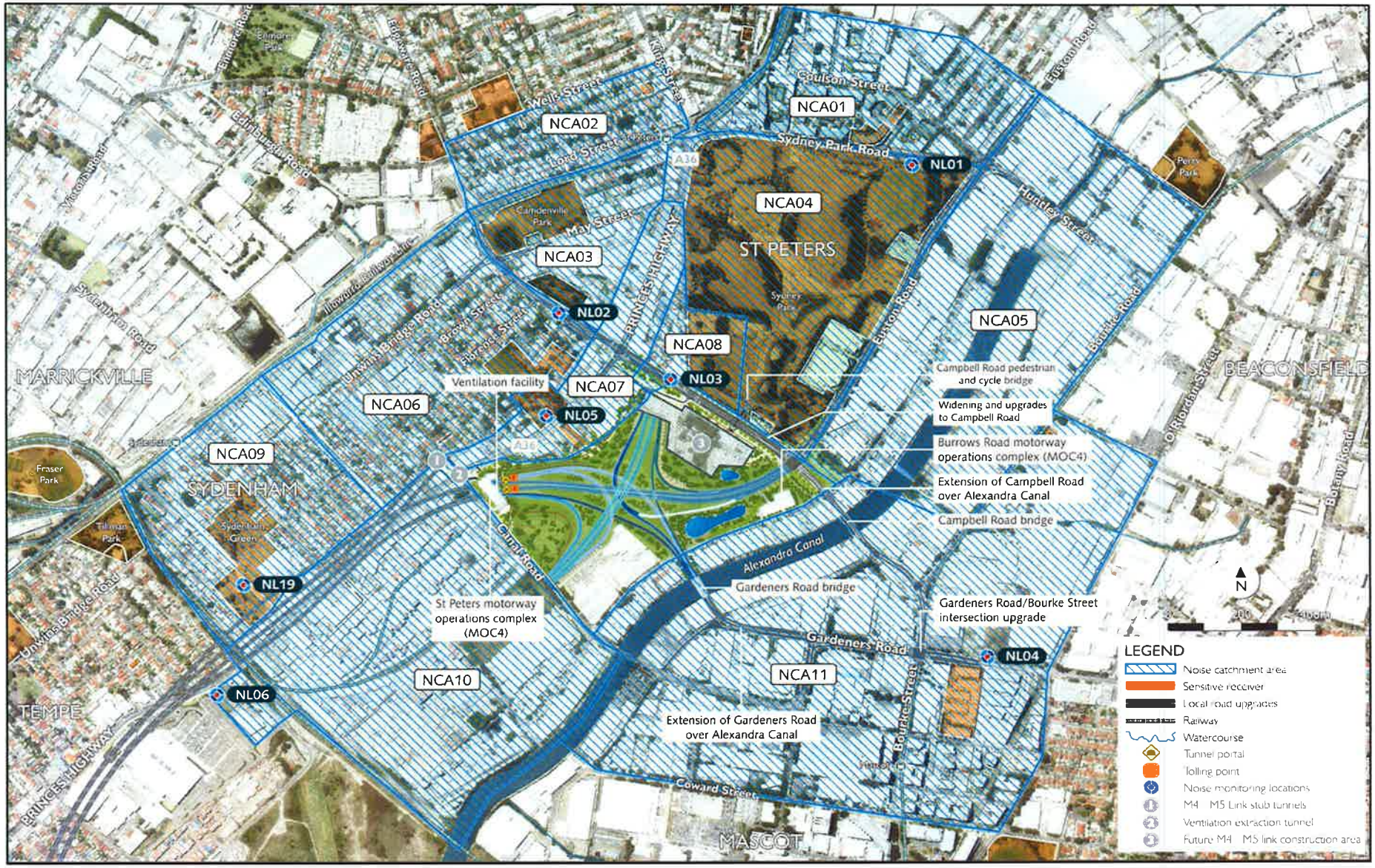

Figure 12: Noise Catchment Areas (NCA1-NCA11) (Source: modified from the EIS)

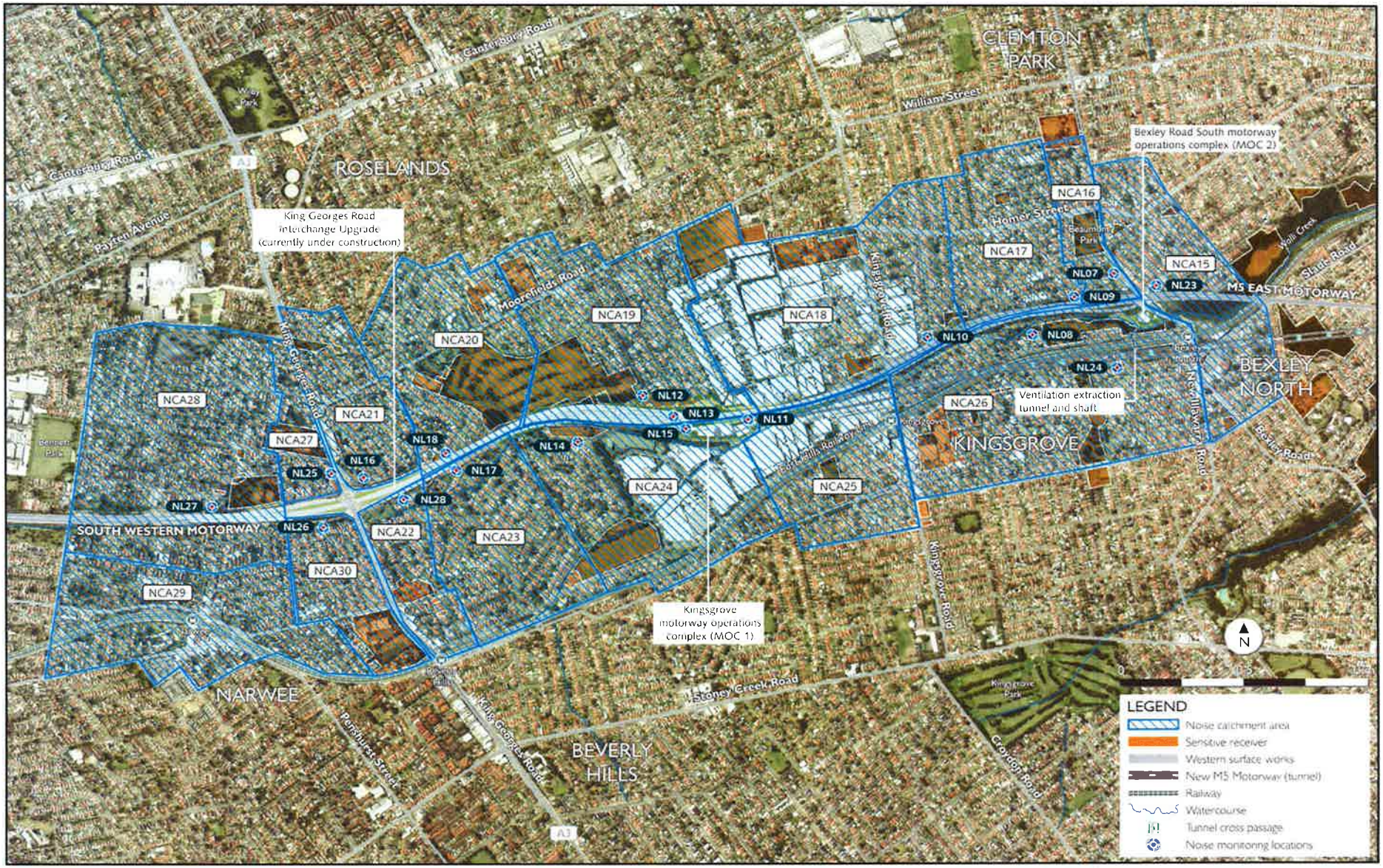

Figure 13: Noise Catchment Areas (NCA15-NCA30) (Source: modified from the EIS)

Figure 14: Noise Catchment Areas (NCA12-NCA14) (Source: modified from the EIS)

Airborne noise

An assessment of potential construction noise impacts was undertaken in accordance with the *Interim Construction Noise Guideline* (ICNG, Department of Environment and Climate Change, 2009). The Guideline outlines NMLs that are used to assess the impact at a sensitive receiver. If levels are exceeded then mitigation measures must be implemented.

The noise assessment predicted that construction NMLs would be exceeded in the majority of NCAs during the construction scenarios as detailed in **Table 13.** Surface road and interchange works are predicted to have the greatest noise impacts on sensitive receivers, with up to 542 receivers being highly noise affected (refer **Appendix G**) and up to 1,200 receivers exceeding the sleep disturbance criteria. Refer to **Appendix H** for detailed worst case exceedances.

Table 13: Worst-case dB(A) exceedances of NML for each scenario of the project*

Activity		Standard Construction Hours			Out-of-Hours		
		No. NCAs with exceedances	Duration of exceedance	Worst-case (dB(A))	No. NCAs with exceedances	Duration of exceedance	Worst-case (dB(A))
Surface Works	Earthworks and site establishment	11	5 days to 9 months	47	6	6-9 months	44
	Portals	5	6-18 months	52	5	6-18 months	29
	M5 East road widening	11	12-27 months	39	10	12-27 months	28
	St Peters Interchange	6	12-27 months	23	5	12-27 months	20
	Toll Infrastructure	5	Up to 6 months	15	5	Up to 6 months	25
	Local road works	9	Up to 24 months	50	9	Up to 24 months	66
	General utility installation and relocation	10	Up to 12 months	55	11	Up to 12 months	57
	Compound and car park	3	Up to 36 months	42	4	Up to 36 months	35
	Motorway Operations complexes	12	12-18 months	29	1	12-18 months	2
	Tunnelling – site establishment	14	Up to 12 months	60	13	6-9 months	46
Tunnelling	Support establishment	11	2- 6 months	29	11	3-6 months	30
	Compound and car park	4	Up to 36 months	43	0	N/A	0
	Tunnelling Support site	7	18-24 months	21	13	18-24 months	26

*Refer **Appendix H** for a detailed summary

Ground-borne noise

Mainline tunnelling would be undertaken using a combination of road headers and blasting. Both methods would generate ground-borne noise (i.e. noise generated by vibration). The noise assessment indicated that daytime noise levels would typically mask ground-borne noise and assessment of ground-borne noise is only relevant in the evening (6:00 pm to 10:00 pm) and night-time (10:00 pm to 7:00 am). Blasting would be limited to between 9:00 am to 5:00 pm, on weekdays and 9:00 am and 1:00 pm on Saturday, resulting in road headers being the only source of ground-borne noise during evenings and night-times.

The ICNG specifies internal ground-borne noise criteria for residences of 40 dB(A) in the evening and 35 dB(A) during night-time. Ground-borne noise levels are predicted to exceed the evening criteria by 5 dB(A) and night criteria by 10 dB(A) in the following locations:

- the western portals;
- the main alignment tunnels from the western portals to Stotts Reserve, Bexley North and around the tunnel cross passages;
- small areas largely beneath the Bardwell Valley Golf Course, Cooks River at Wolli Creek and Tempe Recreation Reserve;
- the main alignment tunnels between the Botany Goods Railway line and the eastern portals; and
- the eastern portals, around Canal Road and a small area of industrial land to the south of Canal Road.

Tunnelling would progress at an average rate of seven metres a day with any one receiver experiencing ground-borne noise for approximately five days, and exceedances for no more than two days. Tunnelling progress would reduce to two to five metres a day around the portals increasing the exposure of nearby receivers to ground-borne noise by an additional one to two days.

Construction road traffic noise

The majority (80 per cent) of construction road traffic noise would be generated by heavy vehicle movements associated with spoil haulage carried out 24 hours a day, seven days a week. Construction traffic would mainly use existing motorway and arterial road networks but some local roads directly adjacent to construction compounds and spoil management locations would also be used.

Increases in traffic noise would comply with the recommended traffic noise goal of no more than 2 dB(A) during standard construction hours at all locations with the exception of:

- Wirega Avenue, Kingsgrove and West Botany Street, Arncliffe (Western and Arncliffe surface works areas, respectively) where heavy vehicle movements would result in increases in noise levels of up to around 3.1 dB(A); and
- Campbell and Burrows Road, St Peters (St Peters Interchange area) where heavy vehicle movements would result in increases in noise levels of up to around 3.8 dB(A).

Increases in traffic noise levels by up to 12.1 dB(A) are predicted outside of standard construction hours in the following areas:

- the western surface works area (Moorefields Road, Wirega Avenue, Kingsgrove Road, Commercial Road and M5 East Motorway);
- the Bexley Road surface works area (Bexley Road, Canterbury Road and Stoney Creek Road);
- the Arncliffe surface works area (Marsh Street, West Botany Street, Wickham Street and Princess Highway); and
- the St Peters surface works area (Princess Highway, Campbell Road, Burrows Road, Canal Road).

Sleep disturbance

The sleep disturbance criteria (60-65 dB(A)) would be exceeded for a number of receivers during the following construction scenarios:

- local road kerbing and drainage works – 804 affected receivers within NCAs 1-4, NCAs 6-8 and NCA 11;
- local road tie-in works – 425 affected receivers within NCAs 1-4, NCAs 6-8 and NCA 11;
- road works during the construction of tolling infrastructure – 246 affected receivers within NCAs 15-18 and NCA 26; and

- decline excavation and construction – 73 affected receivers within NCAs 7, 15,16, 19 and 26.

Construction Vibration

The main sources of construction vibration would be tunnelling, blasting, piling, compaction of road surfaces, excavation and jack hammering. As shown in **Table 14**, there is the potential for vibration to result in cosmetic damage to 304 buildings within 16 NCAs and to exceed the human comfort criterion in 23 NCAs without mitigation measures. Structural damage criteria would not be exceeded.

Table 14: Construction Vibration Assessment Summary (Source: EIS)

NCA	Number of buildings within safe working distance			
	Cosmetic damage criteria			Human comfort criterion
	Residential/Mixed Use	Commercial	Industrial	
1	3	1	0	69
2	0	0	0	25
3	13	10	0	95
4	16	2	2	22
5	0	0	24	43
6	62	6	1	178
7	13	27	0	96
8	10	0	0	30
9	0	0	0	0
10	0	0	0	11
11	4	25	11	69
12	0	0	0	41
13-14	0	0	0	0
15	13	2	0	77
16	7	0	0	26
17	0	0	0	9
18	3	2	1	28
19	21	2	0	61
20	9	0	0	46
21	3	0	0	47
22	0	0	0	44
23	0	0	0	49
24	4	0	1	28
25	0	0	6	17
26	0	0	0	22
27-30	0	0	0	0
Total	**181**	**77**	**46**	**1,133**

Operational Noise

Road Traffic

Operational noise impacts resulting from road traffic have been assessed in accordance with *NSW Road Noise Policy* (RNP – Department of Environment, Climate Change and Water, 2011) and *Noise Criteria Guideline* (RMS, 2015).

The Proponent modelled predicted noise impacts for 2021 and ten years in 2031 based on the following scenarios:

- Without the project (no build) incorporating the existing road network and the M4 Widening and King Georges Road projects; and
- With the project (build) incorporating the main alignment tunnels, portals, ramps and all existing major arterial roads.

The 2021 scenario assumes only the New M5, M4 Widening and King Georges Road Projects are in operation, but the proposed M4-M5 link is not in operation. The 2031 scenario assumes the full WestConnex program of works and the future Southern extension are in operation.

Consideration of noise mitigation treatment to affected receivers is based on three criteria:

- the predicted noise level exceeds the RNP criteria and the noise level increase (i.e. 'build' minus 'no build') is greater than 2 dB(A);
- the predicted Build noise level is 5 dB(A) or more above the criteria and the receiver is significantly impacted by project noise; and
- the predicted noise level exceeds 65 $dB(A)_{LAeq(15hr)}$ or 60 $dB(A)_{LAeq(9hr)}$ regardless of the change in noise levels attributable to the project.

The noise assessment indicates that the project would result in a decrease in road traffic noise along the existing M5 East Motorway and for most receivers around the western surface works area due to the removal and redistribution of traffic, however:

- the daytime road noise criterion of 60 $dB(A)_{LAeq\ (15\ hour)}$ would be exceeded at 53 residential receivers and one school (McCallum Hills Public School), but by no more than 2 dB(A);
- the night-time road noise criterion of 55 $dB(A)_{LAeq\ (9\ hour)}$ would be exceeded at 65 receivers, but by no more than 2 dB(A); and
- noise levels are predicted to exceed the cumulative limit ($L_{Aeq(15\ hour)}$ + 5 dB(A)) at one sensitive receiver (1 Kirrang Street, Beverly Hills).

The project would result in a significant increase in road traffic noise at sensitive receivers adjacent to the St Peters Interchange, particularly in the vicinity of the local road upgrades where the following increases are predicted to occur:

- an increase in daytime noise levels of up to 18.5 dB(A), with the daytime road noise criterion of 55 dB(A) and 60 dB(A) $L_{Aeq(15\ hour)}$ exceeded at 133 sensitive receivers (of which 121 receivers are residential);
- an increase in the night-time noise levels of up to 21 dB(A), with the night-time road noise criterion of 50 dB(A) and 55 dB(A) $L_{Aeq\ (9\ hour)}$ exceeded at 145 sensitive receivers (of which 141 receivers are residential); and
- noise levels are predicted to exceed the cumulative limit ($L_{Aeq(15\ hour)}$ + 5 dB(A)) at 74 sensitive receivers during the daytime and 92 receivers during the night time.

Exceedances of the applicable criteria, as a result of exposure to increased road traffic noise levels, are expected at Beverly Grove Park, peripheral areas of Sydney Park and Simpson Park.

A low-noise pavement is proposed within the western surface works area however this is not considered suitable within the area surrounding the St Peter's Interchange due to the speed limit (and therefore dominance of engine noise).

Noise barriers are to be reinstated at Beverly Grove Park and along the M5 East Motorway (adjacent to Kirrang Street and Tallawalla Street) to reduce the number of noise-affected sensitive receivers. **Table 15** sets out the number of properties eligible for at-property

treatment as a result of the project once at-source noise and pathway mitigation measures have been implemented.

Table 15: Summary of Receivers Eligible for At-Property Treatment

	Estimate number of receivers eligible for at-property treatment			
Scenario/Year	**Total**	**Residential**	**Educational**	**Other Sensitive Receivers**
2021 Day	110	110	0	0
2021 Night	122	122	0	0
2031 Day	132	130	2	0
2031 Night	145	145	0	0

All sensitive receiver locations where noise criteria are noticeably exceeded have been recommended for treatment.

Fixed facilities
Noise impacts associated with the operation of permanent ancillary facilities have been assessed in accordance with INP (EPA, 2000). The main noise impacts would come from the axial ventilation fans housed within the Kingsgrove, Arncliffe and St Peters motorway operation complexes, the in-tunnel jet fans, substation switches and transformers, noise associated with car parking facilities, and pumps and blowers for water treatment.

The noise assessment predicts that the noise levels from permanent operational fixed facilities would comply with the appropriate criteria established in the INP.

Submissions
The **EPA** noted the significance of the noise and vibration impacts and recommended that additional information on mitigation measures be provided prior to approval. It also recommended that noise and vibration controls be developed in accordance with the ICNG and the RNP and recommended ground-borne noise and vibration limits for implementation of reasonable and feasible mitigation measures. It also recommended that any approval of the project be subject to the Proponent preparing and implementing a Construction Noise and Vibration Management Plan, Operational Noise Mitigation Review and Operational Noise Report.

NSW Health noted that acceptable noise levels would be exceeded in several areas affecting a substantial number of receivers during construction. It recommended implementation of mitigation strategies to prevent adverse health effects arising at noise-impacted sensitive receivers. It expressed concern over the number of impacted receivers during operation.

The **City of Sydney Council** raised concern over the noise impacts and recommended that mitigation measures should be applied. It recommended the acoustic impact of the additional road traffic on local roads be evaluated. The City of Sydney Council also requested a review of the sleep disturbance noise level reduction of 10 dB(A) through an open window.

Marrickville Council noted the reduced amenity through increased noise and recommended that night-time work (and particularly blasting) be minimised, residents near construction compounds be consulted and that the spoil from night-time tunnel drilling be transported during day-time hours. It also requested that nearby infrastructure be protected from vibration impacts and that noise barriers be provided.

The **City of Botany Bay Council** noted that the cumulative impact noise assessment did not include all approved developments, including the additional population and traffic

movements associated with the developments. It also expressed concern over the potential impacts on sensitive and public land uses not identified in the EIS.

Public Submissions

Key issues raised in the public submissions included:

- quality of the noise assessment;
- construction noise and vibration impacts on sensitive receivers including cumulative impacts and out-of-hours activities;
- structural damage from surface and tunnelling works, including blasting;
- operational noise and vibration impacts, particularly in the vicinity of the proposed St Peters Interchange and Beverly Grove Park;
- the need for noise management and monitoring, including provision of noise barriers and at-property acoustic treatment;
- removal of the noise mound adjoining Beverly Grove Park, Kingsgrove; and
- lack of consideration of noise impacts on sensitive receivers in multi-storey dwellings and provision of noise mitigation.

Department's Consideration

Construction Noise

Air-borne Construction Noise

The Department considers the predicted construction noise levels and number of affected sensitive receivers to be significant. It acknowledges that these impacts are unavoidable during construction in a highly urbanised area and that the Proponent has proposed a number of mitigation measures to reduce construction noise. These include:

- the use of temporary noise walls or hoardings around construction compounds;
- the erection of acoustic sheds at the Kingsgrove North (C1), Bexley Road North (C4) and Bexley Road South (C5) construction compounds (providing an insertion loss of 25 dB(A));
- installation of non-acoustic sheds at the Commercial Road (C3) and Arncliffe (C7) construction compounds (providing an insertion loss of 10 dB(A));
- location of fixed plant on site away from sensitive receivers; and
- offers of alternate accommodation to receivers potentially affected by night-time construction activities.

The Department notes that similar measures have been employed on other road and large infrastructure projects and have been effective in reducing noise impacts.

The Department acknowledges that construction compounds are critical to the delivery of the project. Activities within the compounds would generate noise for the entire construction phase during both the daytime and night-time periods. Although the Department is satisfied with the installation of temporary noise barriers as a means of reducing noise impacts, it requires more details that the proposed barriers would be the optimum height or built using materials to deliver an optimum level of mitigation. Consequently, the Department has recommended that the Proponent prepare a Temporary Noise Barrier Strategy which assesses temporary noise barriers at all construction compounds where the noise levels are predicted to exceed the ICNG criteria at sensitive residential receivers. The Strategy is to provide justification where barriers would not be erected as well as details on barrier height and fabric where temporary noise barriers are proposed.

To ensure the duration and intensity of construction noise impacts are minimised as early as possible, the Department has also recommended a condition that temporary noise barriers and acoustic sheds are installed at construction compounds as one of the first activities during site establishment works.

Works associated with the local road upgrades in the vicinity of the St Peters Interchange (particularly along Campbell Street) would result in the greatest noise impacts. Noise-generating activities would include the demolition of existing structures, earthworks and kerbing and drainage during the daytime (with exceedances of up to 50 dB(A) predicted), and kerbing and drainage during the night-time (with exceedances of up to 66 dB(A) predicted). The Department notes no temporary noise barriers are specifically proposed in these locations. In this respect, the Department requires the Proponent to prepare and implement a Construction Noise and Vibration Management Plan (CNVMP) which sets out procedures for monitoring noise impacts and provides measures to manage and reduce noise and vibration levels.

The Proponent has committed to constructing operational noise management measures (noise barriers and at-property architectural treatments at eligible residences) at the earliest practicable stage in the construction period. However, the Department acknowledges that it may not be possible to install all of the proposed permanent operational noise barriers due to conflicts with the construction footprint. The Department also notes that no permanent noise barriers are proposed along Campbell Road, Campbell Street or Euston Road due to space constraints. Consequently, the Department has recommended that the Proponent's CNVMP provides details on where permanent barriers and at-property architectural treatments would be provided prior to construction commencing and provide justification for those instances where this is not practical.

The Department considers that where existing operational noise barriers are to be replaced (such as the existing northern and southern noise barriers located adjacent to Kirrang Street and Tallawalla Street on the M5 East Motorway), temporary noise barriers should be installed prior to their removal to provide some relief to residential receivers. The Department has recommended a condition to this effect.

The Proponent has indicated that preference would be given to scheduling construction works within the standard construction hours of 7:00 am to 6:00 pm, Monday to Friday and 8:00 am to 1:00 pm, Saturday with the exception of tunnelling which is proposed to be undertaken 24 hours a day, 7 days a week. A number of construction activities would be required outside of the standard hours (refer **Table 12**), particularly where safety considerations require lane closures. Lane closures are best implemented during the night-time when there is less traffic. Activities that may be undertaken outside of the standard construction hours include portal works on the M5 East Motorway, demolition of existing noise barriers, local road upgrades, installation of tolling gantries and road re-surfacing.

The Department accepts that out-of-hours work is required for technical, efficiency (reducing the timeframe of construction), operational or safety reasons. The Department also recognises that there would be circumstances where flexibility in working hours is warranted. Consequently, the Department has recommended that out-of-hours work permitted where it is appropriately managed through the project's Environmental Protection Licence (EPL) or an approved out-of-hours work protocol. The Department also considers that the CNVMP should identify the receivers eligible for alternative accommodation and has recommended a condition to this effect.

The needs of surrounding educational facilities should also be taken into account. The Proponent has committed to scheduling noisy activities outside normal school hours where practicable and the Department has recommended a condition requiring the Proponent to consult with affected educational institutions to ensure that noise generating activities are not timetabled during sensitive periods (e.g. examinations, school performances).

The Department has also recommended conditions requiring the Proponent to implement a complaints management system and develop procedures for notifying sensitive receivers of construction activities that may impact them.

Ground-borne Construction Noise
The generation of ground-borne noise of an evening and night time is predicted to result in exceedances of the internal ground-borne noise level criteria by up to 10 dB(A). Given the progressive nature of tunnelling works as the road header moves along the tunnel corridor, the Department notes that any exceedances of the criteria is expected to occur for a limited time only. The Proponent has also committed to mitigation measures such as the offer of alternate accommodation for receivers who experience noise levels in excess of 5 dB(A) above the night-time criteria.

Vibration and Blasting
Construction vibration can generate impacts on human comfort and the structural integrity of adjacent buildings. The Department is satisfied the Proponent has sufficiently identified the vibration generating activities that are likely to cause discomfort to the surrounding community. It notes that no exceedance of the structural criteria is predicted.

The Department is also satisfied that the Proponent has identified sufficient safeguards to ensure that appropriate site-specific controls are in place to minimise the risk of vibration impacts on sensitive receivers and structures. However, the Department has recommended:

- compliance with construction vibration criteria for human comfort and structural integrity;
- a land use survey to identify properties that are sensitive to construction vibration;
- pre- and post-construction dilapidation surveys;
- provision of respite periods;
- rectification of any damage caused by the construction of the project; and
- measures and procedures to minimise construction vibration impacts.

The Department recognises that blasting would reduce tunnelling timeframes and lessen the duration that sensitive receivers are exposed to vibration. Consequently, the Department does not object to the use of blasting, and has recommended a range of conditions to monitor and manage blasting including the preparation and implementation of a Blast Management Strategy in consultation with the EPA, and limiting blasting to once per day per sensitive receiver up to six times per week.

Construction Road Traffic Noise
The Proponent's noise assessment indicates there is likely to be noise level increases in excess of 2 dB(A) along local roads as a result of construction traffic, particularly in the Kingsgrove area with Moorefields Road predicted to experience noise level increases up to 7.7 dB(A) and Wirega Avenue up to10.5 dB(A).

The Department notes the Proponent is investigating a left-in right-out arrangement for heavy vehicles using Garema Circuit to access the Kingsgrove North compound. Alternatively, the Proponent states that heavy vehicles could potentially avoid this route and access directly onto the M5 East Motorway at night. The Department does not support the use of local roads in residential areas that are currently not subject to considerable heavy vehicle movements due to the consequent increases in noise impacts at night. Night-time noise can lead to sleep disturbance and negative health impacts; an issue raised by members of the public.

The Department also does not support the use of local roads during standard construction hours where arterial roads or other routes may be available or construction heavy vehicle movements are significant over a number of years. The Department has recommended a

condition restricting heavy vehicle movements on specific local roads unless approved by the Secretary. In seeking approval, the Proponent would need to justify why no other route is practicable and detail the measures that would be implemented to keep traffic noise at an acceptable level.

Operational Noise

Noise levels are predicted to be reduced by at least 1 dB(A) for sensitive receivers within the project area between Beverly Hills and Kingsgrove during both the 2021 and 2031 Build scenarios due to a reduction in traffic from the surface (and into the dive tunnels and main alignment tunnel) and redistribution of traffic across the motorway corridor.

However, the St Peters Interchange and associated local road upgrade works would result in additional noise in the area of (up to 18.5 dB(A) during the daytime and 21 dB(A) at night). A total of 133 residential receivers (and two school buildings) would exceed acceptable noise levels during the day and 145 residential receivers at night. The Proponent has proposed a combination of noise barrier and at-property treatments to reduce noise to acceptable levels (refer below).

To ensure that the noise benefits predicted for the project are realised, the Department has recommended that the Proponent:

- prepare an Operational Noise and Vibration Review confirming the impacts and suitability of the mitigation measures;
- prepare and implement an Operational Noise Management Plan which provides for the monitoring of noise and mitigation measures if noise levels exceed the recommended criteria; and
- undertake operational vibration monitoring and assess performance against the predicted vibration levels for the project.

The above recommendations are consistent with the recommendations of the EPA.

Noise Barriers

The Department is satisfied that the Proponent has undertaken an assessment of noise barriers in accordance with the Environmental Noise Management Manual. However the Department acknowledges public concerns regarding the lack of, or final form of noise barriers in certain locations.

The Department notes the existing noise mound adjoining the M5 East at Beverley Grove Park would be removed and replaced with a new noise barrier, or combination of noise barrier and noise mound. The final form of the noise barrier could impact on the availability of open space. The Department considers the final design of the noise barrier/mound should be determined in consultation with the relevant council and the community and be detailed within the Operation Noise Management Plan and Urban Design and Landscape Plan for the project.

Road traffic volumes and associated traffic noise on Campbell Street, Campbell Road and Euston Road are predicted to significantly increase (by up to 21 dB(A) on Campbell Road at night) following the demolition of existing buildings along Campbell Street and Campbell Road which provide shielding of up to 10 dB(A). No permanent noise barriers are proposed along Campbell Road, Campbell Street or Euston Road due to space constraints with alternative at-property architectural treatments to be provided. The Department considers this a reasonable approach.

'At-Property' Mitigation

The Proponent estimates that over 145 sensitive receivers (plus 2 school buildings) have been identified as eligible for at-property architectural treatment following the implementation of source and path controls. The final number to be confirmed following detailed design and review of the noise barrier locations, particularly the permanent noise barriers to be re-located/re-instated on the M5 East in the vicinity of 1 Kirrang Street, Beverly Hills.

The Department has recommended the preparation of a comprehensive land use survey to identify all receivers that may be affected by increases in noise levels and eligible for architectural treatment to ensure that mitigation measures. The Department has also recommended the Proponent consult with owners of properties eligible for architectural treatment and that these be implemented prior to construction.

'At-property' mitigation for multi-storey dwellings was also raised in public submissions. The Proponent has indicated that it would give consideration to 'at-property' acoustic treatments to all levels of multistorey residential dwellings, and the Department has recommended a condition to this effect.

Permanent Ancillary Facilities and Equipment

The operation of plant and equipment for the tunnel would generate noise from fixed sources. The Department acknowledges specific permanent equipment has yet to be selected and therefore the specific acoustic treatments have not been determined. The Department accepts that noise from the motorway operations complexes would comply with the relevant noise criteria in the INP.

The Department considers that further validation of the assessed impacts, noise goals and plant design is required and has recommended that the Proponent prepare an Operational Ancillary Facility Noise Management Sub-Plan to assess the predicted noise environment, establish noise criteria and implement appropriate mitigation measures for all operational facilities prior to the commencement of construction of permanent facilities.

Conclusion

The Department is satisfied the range of management measures committed to by the Proponent combined with the Department's recommendations would mitigate noise and vibration impacts during construction. This includes the preparation of the Land Use Survey, Temporary Noise Barrier Strategy and Construction Noise and Vibration Management Plan.

The operation of the project in 2021 and 2031 would result in traffic noise levels in excess of the RNP, particularly in the vicinity of the St Peters Interchange and surrounding roads. Areas where this occurs would receive mitigation measures including low noise pavement (around the western surface works area), noise barriers and/or 'at-property' treatment to reduce noise levels.

The Department has recommended a range of conditions to ensure noise levels from operational facilities and the motorway are verified and appropriately mitigated. These conditions include the preparation of an Operational Ancillary Facility Noise Management Sub-Plan, Operational Noise Management Plan, Operational Noise and Vibration Review, and Noise Barrier Location and Design Sub-plan.

5.3. Air Quality and Human Health

Issue

The protection of local and regional air quality is a critical issue within the Sydney Basin. While air quality remains at good levels across broader Sydney, levels of atmospheric pollutants can be heavily influenced at a localised level by road traffic.

The continued improvement in engine and fuel technology has reduced emissions from motor vehicles over the past 20 years, which partly accounts for Sydney's better air quality. However this improvement has been tempered by the increased intensity of motor vehicle use (Climate Change Authority, 2012).

The project has the potential to impact on the air quality of the surrounding areas in the following ways:

- emissions from the tunnel ventilation outlets at Kingsgrove, Arncliffe and St Peters, and emergency exhaust facilities at Bexley North and Arncliffe;
- vehicle emissions within the tunnel, affecting the health of tunnel users and driver visibility;
- vehicle emissions on roads and at interchanges;
- dust, gaseous emissions and odour impacts associated with the remediation of the Alexandria Landfill; and
- dust and vehicle emissions during construction.

Conversely, the project would improve air quality conditions in certain locations due to the changes in traffic conditions, such as improved traffic flows (i.e. reducing congestion) and increased use of tunnels.

The Proponent assessed the air quality impacts of the project in four main phases:

- construction, through a qualitative risk analysis;
- remediation of Alexandria Landfill through a quantitative assessment of dust impacts and a qualitative gas and odour assessment;
- in-tunnel air quality, through calculation from vehicle emission factors; and
- community air quality, through detailed air quality dispersion modelling.

The Proponent's assessment of construction air quality concludes that risks of off-site impacts can be effectively managed using active management controls commonly used in the construction industry, to be detailed in a Construction Air Quality Management Plan.

Similar controls would be used to manage dust emissions to an acceptable level during the remediation and closure of the Alexandria Landfill, with the augmentation of the existing landfill gas management system. Minor gas and odour emissions are expected to remain within the relevant EPA criteria, and the Department is satisfied that the proposed management measures would effectively control these emissions.

The key operational air quality issues associated with the project are vehicle emissions from the tunnel ventilation facilities and surface roads, particularly at the St Peters Interchange. Emissions from vehicles using surface roads to avoid tolls, such as King Georges Road, Stoney Creek Road, Forest Road and Harrow Road, may also impact the air quality of surrounding receivers.

Emissions from the tunnels would be vented to the atmosphere from three ventilation facilities including Kingsgrove, Arncliffe and St Peters. The ventilation outlet at Kingsgrove would be located immediately adjacent to recreational and light industrial areas with established residential areas north of the M5 East Motorway. The Arncliffe ventilation outlet would be located at the Kogarah Golf Course with existing residential areas located to the

north-west and south-west. The St Peters ventilation facility would be located amidst a combination of recreational, residential and light industrial land.

While the project is expected to meet the relevant ambient air quality assessment goals, these emissions may result in an increase to ground level concentrations in the vicinity of the outlets. No emissions are proposed from the entrances and exits (portals) to the tunnels.

To assist with the Department's air quality assessment, the Department engaged Todoroski Air Sciences to undertake a specialist review of the air quality assessment. The full review report is provided in **Appendix I**.

Submissions

The **EPA** considered that the air quality assessment was generally in accordance with the Approved Methods. Issues raised included the need for verification of modelling results specific to the project, particularly for oxides of nitrogen (NO_X and NO_2) and particulate matter, and to review the estimates of vehicle emissions.

The **Advisory Committee on Tunnel Air Quality** chaired by the NSW Chief Scientist and Engineer, appointed two international experts to review the project. The review considered that the operational air quality assessment was a thorough review of high quality. The review noted the sensitivities with surface traffic modelling, including toll avoidance behaviour, on the air quality predictions and indicated that as predictions of $PM_{2.5}$ emissions at elevated receiver heights are on an annual basis, short-term impacts need to be considered. The Committee was concerned that the construction air quality assessment was cursory, given it was mostly qualitative, whereas the EIS included a quantitative assessment of air quality impacts during landfill remediation.

NSW Health advised the air quality model was appropriate based on the sensitivity analysis that was undertaken to validate the modelling for the M4 East assessment. NSW Health indicated satisfaction with the approach adopted for the Human Health Risk Assessment and recommended that there is a need to carefully consider future high rise development in the vicinity of the ventilation facilities to ensure the protection of human health. It also recommended that drivers be encouraged to use recirculated air in vehicles to reduce exposure to vehicle emissions.

Fire and Rescue NSW recommended effective consultation on emergency management systems, and provided a series of recommended conditions.

The **City of Sydney Council** noted the potential air quality impacts caused by congestion at tunnel portals and potential air quality impacts on users of the Sydney Park and recommended these impacts be managed through monitoring and reporting of air quality, City of Sydney Council also noted the importance of managing air quality and odour impacts during remediation/closure of the Alexandria Landfill.

Marrickville Council commissioned a review by Air Noise Environment Pty Ltd (ANE) which concluded that the air quality assessment is appropriate although with some uncertainties, particularly for short-term nitrogen dioxide emissions from ventilation outlets. The ANE review identified other issues to be addressed including limitations of the modelling, use of appropriate meteorological data, quantitative construction impacts and monitoring requirements. The review concluded that operation of the project would not likely affect local and regional air quality, provided the issues raised are addressed.

The **City of Canterbury Council, Hurstville City Council** and **Rockdale City Council** commissioned Molino Stewart to review the air quality assessment for the project. The Molino Stewart review concluded that the general assessment approach is adequate; however it raised concerns with the proposed longitudinal ventilation design given the length

of the tunnels and potential for emissions to not achieve the relevant air quality criteria. The review recommended monitoring and management protocols for construction, landfill remediation and operational impacts. The review also recommended the consideration of alternative approaches to tunnel ventilation and emissions from ventilation outlets.

Leichhardt Council sought confirmation that the modelling methodology was endorsed by the EPA, and additional information about the worst-case scenario and construction air quality impacts. Leichhardt Council also recommended conditions requiring portal emission monitoring and damping of the western ventilation outlet.

Public Submissions

Key issues raised in the public submissions included:

- concerns with the methodology and accuracy of the Proponent's air quality assessment;
- reduced local air quality and associated impacts on amenity and health, particularly from increases in particulate matter and vehicle emissions during construction and operation; and
- concerns with the proposed tunnel ventilation design and in-tunnel air quality.

Department's Consideration

Modelling

Choice of Modelling Approach

The Proponent conducted an external (outlet and surface road) air quality assessment using the dispersion modelling software, GRAL/GRAMM, as with the assessment for the M4 East project. While the software is not listed in the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (the *Approved Methods* – DEC, 2005), the Proponent has received the EPA's agreement to use the model, which is a process allowed for under the Approved Methods.

The modelling approach was subject to detailed review by the Department's independent reviewer, the EPA and the Advisory Committee on Tunnel Air Quality, the latter of which commissioned a review by two international experts in air quality assessment. The Department notes that the concerns raised about the model were addressed in the Response to Submissions Report and it is generally accepted that the issues would have minor consequences on the assessment conclusions regarding the scale of air quality impacts.

The Department considers that the Proponent has conducted an acceptable assessment of the air quality impacts for the project. The Department acknowledges advice provided by the Advisory Committee on Tunnel Air Quality that GRAL is an appropriate model to use and is fit-for-purpose. The Department also accepts that the detailed inputs to the model have been subject to detailed and ongoing review, including the input of the Proponent's peer reviewer. The Todoroski Air Sciences review raised concerns with the GRAL model; however, it was noted that most of these concerns did not relate to the assessment of changes to air quality, and that the Proponent's assessment predicts no receptor would experience an unacceptable change to health risk levels. Consequently, the Department is satisfied that the modelling provides suitable prediction levels to allow the Department to ascertain likely impacts of the project.

Presentation of Findings

The EIS predicts external air quality outcomes for two classes of receptors – residential, workplace and recreational (RWR) receptors and community receptors (including schools, child care centres and medical centres).

Maximum predicted air quality results are presented for approximately 46,000 RWR receptors. Detailed results were provided for 35 community receptors, including a year of hourly predictions. The Department is satisfied that the air quality impact assessment provided contains sufficient detail to evaluate the impacts of the project.

The modelled worst-case scenario (RWC-B) includes operation of the project combined with traffic from other WestConnex projects including the proposed M4-M5 link. As with the M4 East assessment, the RWC-B scenario assumes constant (24 hour) emissions from the ventilation facilities at a rate based on the NorthConnex ventilation outlet limits. These limits are associated with emission rates higher than the worst-case in-tunnel traffic levels predicted for the year 2031. This scenario is conservative, as it inherently overestimates traffic levels at all hours.

The Department considers the worst-case scenario selected is an acceptable basis to consider air quality impacts. The scenario establishes theoretically possible, if very highly unlikely, adverse air quality predictions that have guided the Department's conclusions on the appropriateness of the proposed design and emission limits.

Construction

The Department accepts the Proponent's conclusion that construction air quality impacts would be acceptable with the implementation of best practice adaptive air quality management. The Department has recommended conditions requiring the Proponent to implement best practice management to minimise dust emissions during construction, to monitor meteorological and air quality conditions, and to modify or cease dust generating activities during adverse conditions. It has also recommended that the Proponent prepare and implement a Construction Air Quality Management Plan, which describes the measures that would be implemented to minimise dust and emissions from plant and equipment during construction of the project.

Alexandria Landfill Remediation

The EIS predicts that remediation works would meet the relevant air quality criteria for particulate matter ($PM_{2.5}$, PM_{10}) and deposited dust at all but one receiver location, an industrial land use immediately south of the site.

The EIS includes a qualitative assessment of landfill gas emissions during the remediation of the landfill and the ongoing management of landfill gas during operation of the St Peters interchange. The EIS predicts the landfill currently generates between 100 and 300 cubic metres per hour (m^3/hr) of landfill gas.

Remediation of the Alexandria Landfill and construction of the St Peters Interchange has the potential to mobilise gases (methane, hydrogen sulphide and carbon dioxide) at the landfill site. Gas control measures, comprising cut-off trenches and treatment facilities, have been established in the western part of the site as part of existing management.

The Proponent proposes to upgrade the existing subsurface gas management systems and implement mitigation measures to minimise the uncontrolled emission of landfill gas. Measures include the installation of capping layers and sealing potential pathways around structures (e.g. piles) using clay and geotextile fabric. Collected gas would be flared, assuming it is produced at a sufficient rate, at the south-west corner of the site near Canal Road. Other gas control measures, such as the use of activated carbon filtration or biological treatment, would be investigated as part of detailed design if the gas production is less than the rate required to sustain flaring.

A draft Landfill Closure Management Plan has been prepared for the project, which includes a specific Landfill Gas Management Plan. The Department is satisfied that the proposed gas collection and treatment processes set out in the Plan would ensure the effective

management of landfill gases. Consequently, the Department has recommended that the Proponent finalise and submit to the Secretary the Landfill Closure Management Plan prior to the commencement of any excavation, filling or construction at the site.

The Department notes that not all landfill gas would be captured by the gas collection system. The Department has recommended that the Landfill Closure Management Plan detail the process for monitoring and reporting escaping emissions during remediation of the site and operation of the project.

The assessment also considers potential odour impacts due to the landfill remediation works, which would generally be associated with gas emissions. The predicted 99th percentile odour generation from these activities would comply with the relevant EPA criterion of 2 Odour Units at all locations except the closest southern receiver where a concentration of up to 4 Odour Units is predicted to occur under the worst-case scenario. Although modelling predicted that odour impacts of up to 7 Odour Units may occasionally occur at nearby receivers in the industrial areas, this is unlikely due to the conservative nature of the modelling which assumes the whole site would be uncovered and emitting odour.

The Department is satisfied with the Proponent's approach to cover exposed areas daily during construction to manage odours and counter the higher predicted impacts. This approach would also manage dust emissions and the Department has included a requirement for the odour management measures described in the Landfill Closure Management Plan to be implemented.

Operation

In-tunnel Air Quality

In-tunnel air quality determines both driver exposure underground and changes to external air quality from emissions through the ventilation outlets. The nature of road tunnels concentrates emissions in a confined airspace, increasing motorists' exposure while travelling through the tunnel.

Nitrogen dioxide is the key pollutant of concern in designing the ventilation of major road tunnels. Despite ongoing improvements, modern motor vehicles remain a major contributor of nitrogen dioxide. While carbon monoxide emissions have fallen in the past few decades, nitrogen dioxide emissions have not reduced to the same degree and effective regulation of these emissions is important.

In-tunnel air quality has been calculated using forecast traffic scenarios, and evaluated against limits adopted for the NorthConnex and M4 East, and set out in the *In-tunnel Air Quality (Nitrogen Dioxide) Policy* (Advisory Committee on Tunnel Air Quality, 2016) as shown in **Table 16**.

Table 16: In-tunnel air quality criteria (average along tunnel length)

Pollutant	Averaging period	Concentration Limit or Extinction Co-efficient	Units of measurement
Carbon monoxide	Rolling 3–minute	200	ppm
	Rolling 15-minute	87	ppm
	Rolling 30–minute	50	ppm
Nitrogen dioxide	Rolling 15-minute	0.5	ppm
Visibility	Rolling 15–minute	0.005	m^{-1}

The EIS predicts that the proposed worst-case concentrations (i.e. when the tunnel is at full capacity) would comply with the in-tunnel limits for nitrogen dioxide for all modelled traffic scenarios. Predicted tunnel air quality concentrations were also less than the regulatory

worst-case scenario. In both the worst case and predicted traffic scenarios, concentrations of carbon monoxide are anticipated to peak well under the relevant in-tunnel limits.

The Department considers there are two approaches to further minimise exposure to emissions, through design refinement and through directing the behaviour of tunnel users as recommended by NSW Health. The Department has recommended a condition regarding the use of signage at the tunnel entrance and within the tunnels which instructs drivers to use recirculated air when in the tunnel, and to provide additional information about this on its website.

Tunnel Ventilation Design

The Proponent committed to design the tunnels and ventilation systems so that in-tunnel air quality would meet the relevant criteria under all traffic scenarios, including low speed and emergency situations. Key design factors include limiting the design slope to four per cent (compared with up to eight per cent in the M5 East tunnel) to reduce engine demand and a tunnel cross-section area of 90 square metres and a tunnel height of 5.3 metres which, compared with the M5 East tunnel design, provides more tunnel volume and allows more effective dispersion and dilution of vehicle emissions.

Similarly, the number and location of the proposed ventilation and emergency exhaust outlets, fresh air intakes and tunnel ventilation fans have been designed to ensure the air quality along the full length of the tunnels is maintained to achieve the established in-tunnel air quality standards. Conditions within the tunnel would be monitored continuously with the use of sensors, which would activate the ventilation system to maintain compliance with in-tunnel air quality limits.

The Proponent also proposes to monitor traffic flows and composition, with cameras to detect smoky vehicles and to penalise drivers of offending vehicles.

The Department is satisfied that these measures would manage the concentration of vehicle emissions within the tunnel to meet the relevant criteria and has recommended a condition requiring the implementation of the above procedures during the operation of the tunnels, and for these to be described in a Tunnel Ventilation, Traffic Incident Response and Traffic Management Systems Integration Protocol.

Ventilation Outlet Emissions

The Department accepts that emitting in-tunnel air pollutants through elevated ventilation outlets, via a mechanical ventilation system, remains current best practice for managing major road tunnels. The use of elevated ventilation outlets delivers more effective dispersal and dilution of air pollutants than through portal emissions and are a key driver in achieving acceptable air quality at surrounding receptors.

Consistent with the approach adopted for the M4 East approval, the Department has recommended a condition requiring the ventilation system to be designed to avoid emissions from the entry and exit portals, except in emergency situations and periodic testing. Restrictions on portal emissions are supported by NSW Health, councils and a large proportion of public submissions.

The Department has reviewed the location of ventilation facilities in order to ascertain overall impacts on local amenity. The Department's consideration of the impacts of the facilities is integrated into other areas of the assessment such as visual amenity impacts (refer **Section 5.9**). However, the Department acknowledges that the acceptability of the locations depends on the concentration of pollutants in the emissions from each outlet.

The EIS predicts the contribution of the ventilation facilities to ground level concentrations in the local community. The Department has also considered how operation of the outlets is likely to change air quality from these levels if the project is not built.

These changes have been considered for the worst-case scenario in the context of current (and proposed) air quality goals set in the Approved Methods, and derived from the National Environmental Protection Measure (Air Quality). The maximum outlet emissions for the three key pollutants are presented in **Table 17**.

Table 17: Maximum Ventilation Outlet Emissions (Source: EIS)

Pollutant	Ambient Air Quality Goals	Maximum predicted ventilation outlet contribution	Predicted contribution as percentage of criteria
Carbon monoxide	30 mg/m^3 One hour average	0.33 mg/m^3	1.10%
PM_{10}	50 $\mu g/m^3$ 24 hour average	4.29 $\mu g/m^3$	8.58%
$PM_{2.5}$	25 $\mu g/m^3$ 24 hour average	4.29 $\mu g/m^3$	17.16%

The Department has recommended three inter-related criteria for air quality: in-tunnel and ventilation facility limits, and external ambient (community) air quality goals. The external air quality goals adopt the criteria specified in **Table 17**. The in-tunnel and ventilation facility limits are designed to interact in a way that ensures local air quality meets the community air quality goals.

Maximum increases as a result of outlet emissions would remain small at the worst-affected receptor even under the worst-case scenario. The most substantial change is predicted for $PM_{2.5}$, where it is estimated that outlet emissions would contribute 4.29 $\mu g/m^3$ (17 per cent of the criteria) of $PM_{2.5}$ at the worst-affected receptor.

The human health risk assessment indicates that the maximum increases to risk during operation of the project are either 'negligible' or within the range that can be considered to be 'acceptable' as per the health literature. The calculated maximum increase in human health risks in 2031 is 1 in 10,000, which is considered an acceptable risk level change.

A change of this magnitude is unlikely to occur in practice given the worst-case scenario assumes maximum emissions for all hours of the day. Finally, the predicted total emissions from the project of $PM_{2.5}$ in 2021 and 2031 is 0.8 per cent and 1.2 per cent lower respectively than the equivalent year's $PM_{2.5}$ concentrations under the do-nothing (no tunnel) scenario, demonstrating a marginal improvement in ambient $PM_{2.5}$ emissions from the project itself.

In response to agency and council comments, the Proponent provided a similar analysis for maximum short-term (one hour average) nitrogen dioxide. The analysis was based on a revised regulatory worst case traffic scenario and considered a year's worth of data for the ten most affected receptors in a four square kilometre study area around each outlet. The worst predicted hour of nitrogen dioxide emissions from either ventilation outlet is presented in **Table 18**

Table 18: Maximum Ventilation Outlet Emission for Nitrogen Dioxide – Worst Hour (Source: RtS Report)

Pollutant	Criteria	Max predicted ventilation outlet contribution (2031-DSC)	Predicted contribution as percentage of criteria	Predicted overall concentration	Percentage of assessment criteria
Nitrogen dioxide	246 µg/m^3 One hour average	~119 µg/m^3	48%	144	58%

The Department notes that while the predicted maximum contribution of nitrogen dioxide is significant it only occurs for one hour of the modelled year. In addition, the analysis found that the highest concentrations of nitrogen dioxide occurs when background nitrogen dioxide is low, and the maximum stack contributions are unlikely to coincide with higher background conditions. The full year of predictions for the most-affected receptor are shown in **Figure 15** below.

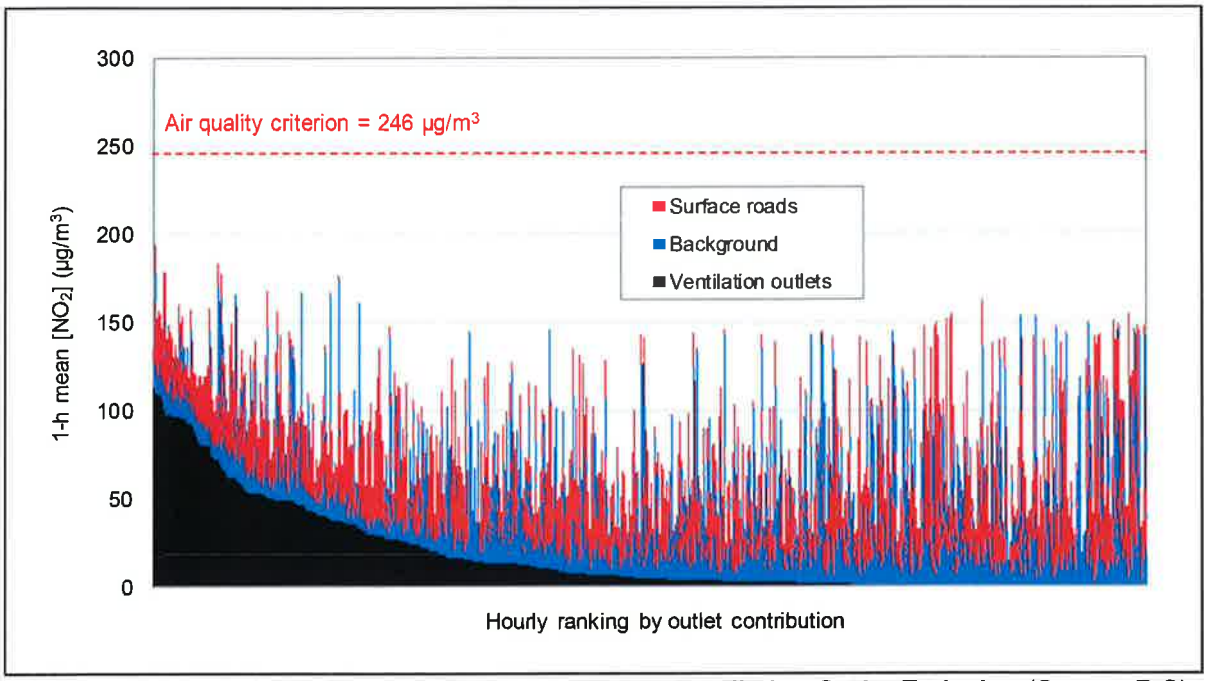

Figure 15: Hourly Predictions Ranked by Maximum Ventilation Outlet Emission (Source: RtS)

The predictions indicate that the ventilation outlet contributions are approximately:

- below 20 per cent of the air quality goal for 90 per cent of the year;
- below 10 per cent of the air quality goal for 78 per cent of the year; and,
- zero for 30 per cent of the year.

Further, the analysis shows:

- the highest ventilation outlet contributions do not correspond with the worst affected hours at the ten worst affected receptors (the large number of modelled hours makes the likelihood of low background and high tunnel emissions unlikely);
- for the substantial majority of the year, concentrations of nitrogen dioxide are dominated by existing background concentrations; and
- at all times the 10 worst affected receptors are predicted to meet the goals for nitrogen dioxide.

A number of community and council submissions requested that the project be modified to include filtration. Based on the predicted air quality outcomes and low human health risk, the Department is satisfied that the proposed ventilation management system would deliver

appropriate local air quality. The Department considers that there are alternate cost-effective initiatives that would help manage emissions from the project as well as addressing surface road emissions including:

- *NSW Cleaner Vehicles and Fuels Strategy* (Department of Environment and Climate Change, 2008) including vapour recovery at service stations, stricter emission levels and the Diesel Retrofit Program;
- Smoky Vehicle Enforcement Project is an initiative under the *NSW Cleaner Vehicles and Fuels Strategy* comprising fines for operators of smoky vehicles; and
- adoption of Australian Design Rules governing on-road motor vehicle emission limits which have been progressively tightened based on United States and European standards.

Community members want local air quality to improve and the EPA has advised that the Proponent should evaluate ways to reduce ground level concentrations from outlet emissions. The Department is satisfied that the predicted external air quality impacts are acceptable, but the Proponent should continue to review and refine its tunnel ventilation design to reduce the level and concentrations of pollutants, particularly nitrogen dioxide.

The Department has recommended conditions of approval requiring the implementation of an optimisation process, requiring a 5-yearly review of emissions standards and the imposition of more stringent emissions criteria if the review indicates improvements in vehicle emissions and ventilation technology and efficiency. It has also recommended that the design of the ventilation system allows for future modification, ensuring any changes can be retrofitted with minimal disruption.

The Department has also recommended conditions that require the Proponent to commission an independent person to verify compliance with the in-tunnel and ventilation outlet air quality limits detailed in the instrument of approval and to review how the ventilation system has been optimised.

The Department considers these recommended conditions would ensure the project continues to improve on the predicted acceptable air quality outcomes during the detailed design stage. The Department also considers that the recommended conditions give the Proponent design flexibility within the bounds of the overarching air quality limits and goals.

Elevated Receptors

The Department acknowledges that councils and NSW Health have expressed concerns about potential impacts on elevated receptors, people living and working in multi-storey buildings.

This issue is of particular strategic importance in the areas surrounding the ventilation outlets at St Peters and Arncliffe given the potential future growth in medium and high density residential development such as Cooks Cove.

Additional air quality mapping was provided by the Proponent in the Response to Submissions that demonstrates the project would cause minimal change to annual average $PM_{2.5}$ concentrations at heights of 10 metres and 30 metres. The additional analysis indicates that changes are generally small at 10 metres and less than the predicted ground concentration increases.

The additional analysis also indicates that impacts at 30 metres are essentially limited to the immediate vicinity of the ventilation outlet and while particle concentrations would rise around the stacks at this height, they decrease at 10 metres high. This reflects the physics of dispersion from the outlets, where emissions rise then disperse, dilute and drop to ground level.

The Department considers that all future medium to high-rise development adjacent to the ventilation facilities should consider the impacts of, and their impacts on, air dispersal from the ventilation outlets. The Proponent proposes to assist and fund councils in developing required air quality assessment processes or controls to manage development around the outlets, and the Department has recommended a condition of approval requiring this be implemented.

Ambient (External) Air Quality
The EIS modelled the potential impacts on air quality at receivers surrounding the road network where traffic changes may be influenced by the project, including surface interchanges at St Peters and Kingsgrove, and existing roads in the network that may be used by drivers avoiding tolls.

The assessment modelled emissions of carbon monoxide, oxides of nitrogen (including nitrogen dioxide), particulate matter (PM_{10} and $PM_{2.5}$) and total hydrocarbons and the relative effects at the RWR and community receptors around the project.

The modelling predicted that air quality impacts would range from reductions in some areas due to reduced traffic congestion, and increases in other areas due to a localised increase in traffic volumes, as summarised in **Table 19**.

Table 19: Maximum Predicted Changes in Ambient Air Quality Due to the Project (Source: EIS)

Pollutant	Air quality goal	Time period	Max predicted increase	Max predicted reduction
Carbon monoxide	10 mg/m^3	Rolling 8 hour	0.1 mg/m^3	0.4 mg/m^3
Nitrogen dioxide	62 $\mu g/m^3$	24-hour	5.5 $\mu g/m^3$	14.8 $\mu g/m^3$
PM_{10}	50 $\mu g/m^3$	24-hour	1.8 $\mu g/m^3$	5.3 $\mu g/m^3$
$PM_{2.5}$	8 $\mu g/m^3$	24-hour	1.2 $\mu g/m^3$	3.5 $\mu g/m^3$

On average across the modelled domain of over 46,000 RWR and community receptors, and compared with the equivalent year without the project, the assessment predicted minor increases in carbon monoxide (7.9 per cent), oxides of nitrogen (1.6 per cent) and particulate matter (approximately two per cent), with a minor reduction in hydrocarbon emissions (2.2 per cent).

The assessment predicts that while 63 per cent of receptors would experience an increase in emissions, the increase would be minimal at 99 per cent of these receptors.

The Department is satisfied that the health effects of the maximum predicted changes in the air quality would be acceptable. The annual $PM_{2.5}$ concentrations were considered to be a critical indicator of the health risk changes associated with the project. As such, the Department has considered an increase in individual human health risk of up to 1 in 10,000 to be acceptable; an acceptable change in risk level would be associated with a <1.76 $\mu g/m^3$ increase in annual $PM_{2.5}$ concentrations. The Department notes that no RWR receptor is predicted to exceed a 1.76 $\mu g/m^3$ increase in annual $PM_{2.5}$ concentrations, and that over 99 percent of the RWR receptors would experience an increase less than half of that figure.

The Proponent proposes to monitor traffic flows on the alternate routes prior to and during operation of the project to determine if a noticeable increase in these roads due to toll avoidance is occurring. Should monitoring indicate toll avoidance is increasing, the Proponent would consider potential measures to prevent or minimise this behaviour.

The Department has recommended a condition of approval requiring the Proponent to carry out this review as part of a Road Network Performance Review Plan within 12 months and five years of commencing operation of the project commencing operations.

Community Participation
The Department considers that continued community participation would benefit the final design and has recommended that the Proponent establish an Air Quality Community Consultative Committee comprising representatives from the community and councils. The Committee would be consulted on the air quality management plans and the siting of monitoring locations. This is consistent with the approach taken on recent major road projects, including the M4 East.

Monitoring, Reporting and Response to Exceeding Standards
The Department has prioritised effective monitoring and reporting, and compliance-based conditions derived from enforceable limits and goals in setting air quality conditions. These conditions emphasise measureable standards, and provide consequences for exceeding these standards. The monitoring and reporting framework includes:

- establishing monitoring stations in agreement with the Air Quality Community Consultative Committee;
- providing real time data on air quality levels recorded at these monitoring stations;
- quality assurance and control measures for monitoring data, including independent external auditing; and
- reporting to the Department and relevant agencies when external air quality goals, or ventilation outlet emissions limits are exceeded.

The Department's recommended compliance-based conditions include:

- set limits on in-tunnel and ventilation outlet concentrations of key pollutants;
- detailed reporting on the nature of limit exceedances;
- set goals for ambient air quality; and
- provide a process by which the Secretary can require changes to the project if tunnel operation is identified to be a significant contributor to the recorded exceedance.

Conclusion
The Department has reviewed the air quality impacts of the project including community submissions, advice from government agencies and the Advisory Committee on Tunnel Air Quality, and the findings of the independent air quality specialist.

The project is predicted to result in both improvements and declines in air quality in areas surrounding the project. As a result, the Department used predictions of degraded air quality based on the worst-case scenario. The Department considers that the project would have a minor impact on local air quality in certain locations, and that the effects on human health in those areas would be small and within the range of the current variations in air quality in the area.

Overall, the Department is satisfied that the proposed construction and operational air quality outcomes would be acceptable, and it has recommended a comprehensive suite of final detailed design, monitoring, reporting and compliance conditions to limit and control emissions from the project.

5.4. Biodiversity[1]

Issue
The project is located in the Cumberland and Pittwater sub-regions of the Sydney Basin Bioregion, which extends from the Hunter Valley to the north, Mudgee to the west and Batemans Bay to the south. The vegetation type in the western part of the project is in the

[1] References to sections of the EIS, Submissions and Preferred Infrastructure Report and the recommended conditions of approval have been included in this section to satisfy the Commonwealth's assessment requirements.

Cumberland sub-region and the vegetation type in the Kogarah Golf Course is in the Pittwater sub-region. The project occurs in a highly urbanised setting, however, remnant vegetation occurs in the Wolli Creek Valley and adjacent to the Kogarah Golf Course.

To assess the impacts of the project on ecological values, the Proponent undertook a biodiversity assessment which included detailed flora and fauna surveys, database searches, a targeted migratory wader survey, opportunistic fauna surveys and a hollow-bearing tree survey.

Bilateral Agreement

The Bilateral Agreement between the Commonwealth and NSW governments for the assessment of environmental approvals under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) has endorsed the *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014) and *Framework for Biodiversity Assessment* (OEH, 2014) as providing a basis for undertaking biodiversity assessments. The Proponent has addressed the Commonwealth requirements and assessed the impacts of the project on Matters of National Environmental Significance in the Biodiversity Assessment Report prepared as part of the EIS. Sections of the EIS relevant to Matters of National Environmental Significance include: Chapter 8 – Overview of Environmental Issues; Chapter 15 – Social and Economic; Chapter 21 – Biodiversity; Chapter 27 – Cumulative Impacts; Chapter 30 – Summary of Environmental Management Measures; Appendix S – Biodiversity Assessment Report; and Appendix T – Biodiversity Offset Strategy.

Terrestrial Flora

Five vegetation communities were identified in the study area:

- Broad-leaved Ironbark Melaleuca decora shrubby open forest on the clay soils of the Cumberland Plain, also known as Cooks River/Castlereagh Ironbark Forest (at Beverly Grove – refer **Figure 16**);
- Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (at Kogarah Golf Course – refer **Figure 17**);
- Turpentine Grey Ironbark open forest on shale in the Sydney Basin (at Tallawallah Road, Beverly Hills);
- Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest in sandstone gullies of western Sydney, also known as Coastal Enriched Sandstone Dry Forest (at Bexley Road); and
- Urban native and exotic vegetation (road batters, street tree plantings, suburban parks).

The Cooks River/Castlereagh Ironbark Forest and the Turpentine Grey Ironbark Forest are listed as endangered ecological communities (EEC) under the *Threatened Species Conservation Act 1995* (TSC Act) and as critically endangered ecological communities (CEEC) under the EPBC Act. The two existing patches of Turpentine Grey Ironbark Forest on the project site did not meet the threshold patch size to be considered as a CEEC under the EPBC Act (Biodiversity Assessment Report 4.1.3); consequently the community was only assessed as an EEC under the State listing. The Turpentine Grey Ironbark community is not directly impacted by the project.

The Paperbark Swamp Forest is listed as an EEC under the TSC Act. The other two vegetation communities identified in the study area are not listed under the TSC Act or the EPBC Act.

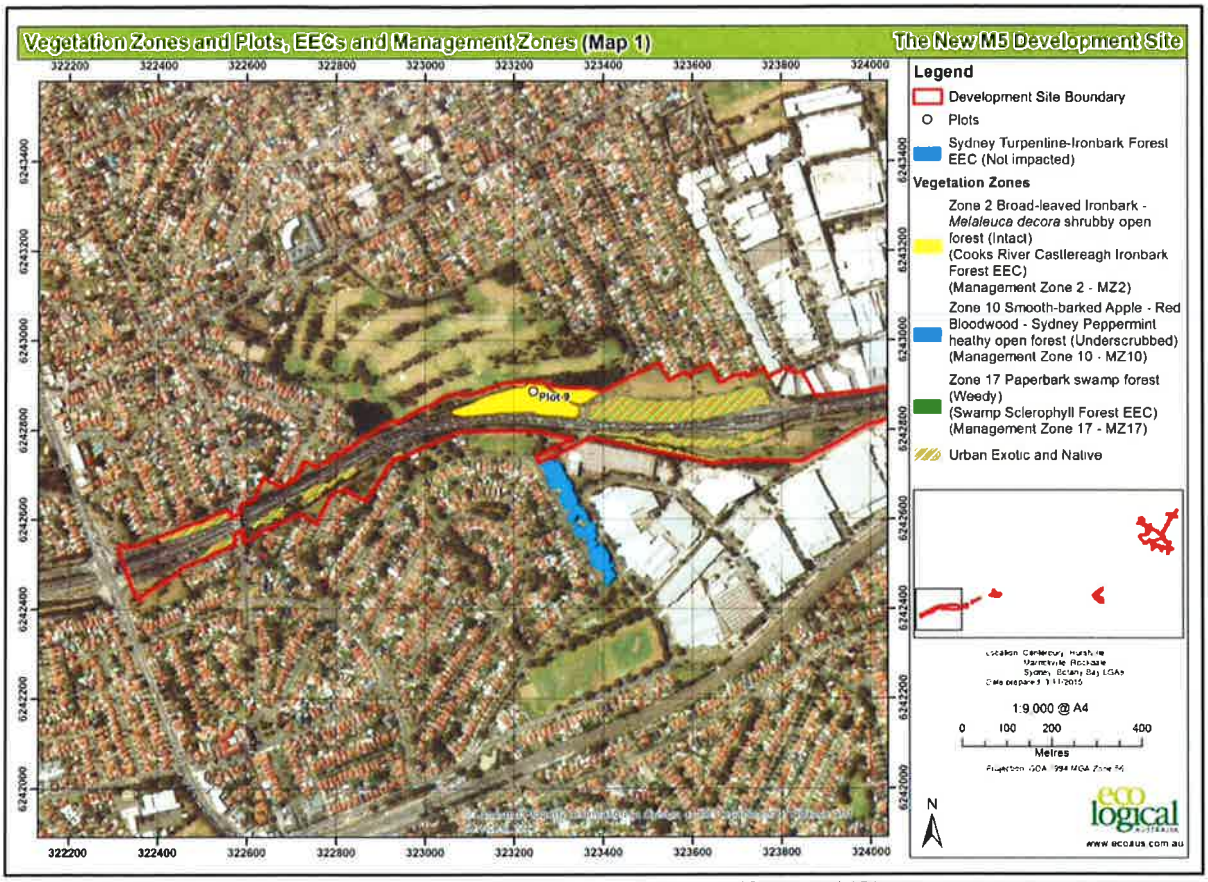

Figure 16: Location of Cooks River/Castlereagh Ironbark Forest (Source: EIS)

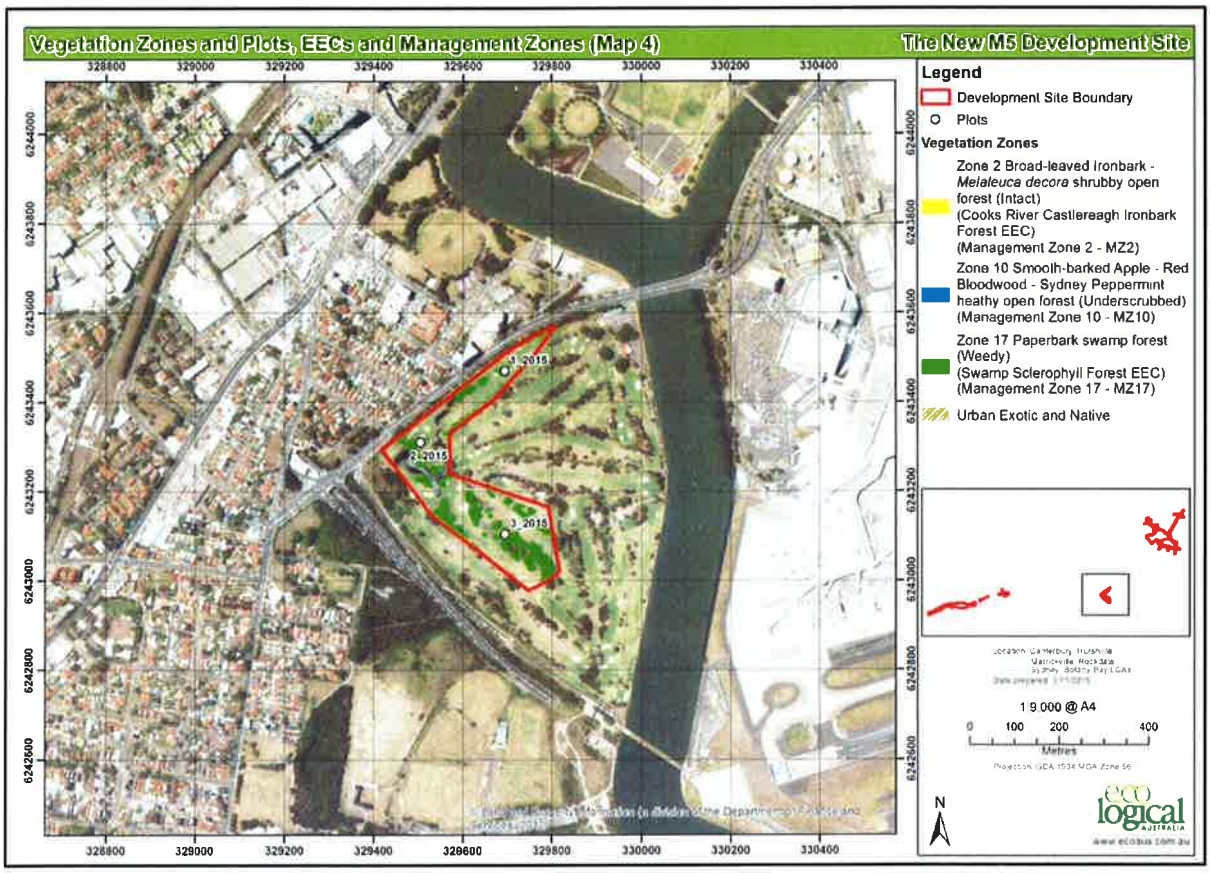

Figure 17: Location of Paperbark Swamp Forest (Source: EIS)

Four of the identified vegetation communities would be directly impacted by the project as detailed in **Table 20**.

Table 20: Vegetation in the Project Footprint (Source: EIS)

Vegetation community/Plant Community Type (PCT)	Total area impacted (ha)	Condition	Project area	Conservation Status
Broad-leaved Ironbark Melaleuca decora shrubby open forest on the clay soils of the Cumberland Plain	1.4	Poor - highly modified	Beverly Grove	EEC / CEEC
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	1.82	Poor – highly modified	Kogarah Golf Course and Marsh Street	EEC
Smooth-barked Apple – Red Bloodwood – Sydney Peppermint heathy open forest in sandstone gullies of western Sydney	0.09	Moderate to good	Bexley Road	Not listed
Urban native and exotic vegetation*	7.45		All surface disturbance areas	N/A
Total	**10.76**			

*Includes areas on road batters, street tree planting and areas dominated by exotics.

DoE found in its assessment of the referral documentation (EPBC 2015/7520) that there are likely to be significant impacts arising from the action on the Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion.

Database searches identified 50 threatened flora species and four threatened flora populations as occurring or potentially occurring within 10 kilometres of the project area. However, no threatened flora species were identified within the study area during field surveys. Applying the methodology set out in the *Framework for Biodiversity Assessment*, 22 threatened flora species and three threatened flora populations were identified as potentially occurring. These species were compared against the habitat features of the project area to determine whether they were likely to be present and subsequently whether targeted surveys were required. The biodiversity assessment considered these species are unlikely to occur because of the degraded condition of the vegetation in the project area. Therefore, the species were excluded from further consideration and assessment.

Seven flora species, were identified in the SEARs as potentially being at risk from the project - *Persoonia hirsuta* (Hairy Geebung), *Pimelia spicata* (Spiked Rice-flower) and *Tetratheca juncea* (Black-eyed Susan), *Acacia bynoeana* (Bynoe's Wattle), *Acacia pubescens* (Downy Wattle, *Melaleuca deanei* (Deane's Wattle) and *Syzygium paniculatum* (Magenta Lilly Pilly). However, field surveys did not record these species in the project area, and given that any potential habitat would be highly modified and unlikely to support these species, they were not considered further. The Biodiversity Assessment Report (EIS, Appendix S, Table 26) provides an assessment of the likely presence of these species. The Department has reviewed this assessment and concurs that the seven identified flora are unlikely to occur.

Terrestrial Fauna

A desktop analysis identified 27 threatened fauna species and one threatened fauna population as potentially occurring in the project area. Seventeen threatened fauna species were identified as potentially occurring in the project area using the *Framework for Biodiversity Assessment* methodology. The Biodiversity Assessment Report (EIS, Appendix S, Biodiversity Assessment Report, Section 5.2, Table 15) provides an assessment of the likely presence of these species. The Department has reviewed this assessment and

concurs that the majority of fauna are unlikely to occur, with the exception of the Green and Golden Bell Frog (*Litoria aurea*).

The Green and Golden Bell Frog, listed as 'endangered' under the TSC Act and 'vulnerable' under the EPBC Act, occurs mainly along coastal lowland areas of eastern NSW and Victoria. Most populations consist of fewer than 20 adults. However, in NSW there are populations of around 100 adults at Captains Flat and over 1,000 at Kooragang Island, Broughton Island and Homebush. The population within the Kogarah Golf course is cited as a key population in the draft *Green and Golden Bell Frog Recovery Plan* (2005), and is one of eight key sites in the greater Sydney Region.

The project proposes permanent and temporary facilities within the Kogarah Golf Course (the Arncliffe surface works area) adjacent to existing breeding ponds for the Green and Golden Bell Frog (referred to as the RTA ponds), which were established and currently managed as compensatory habitat required for the development of the M5 East Motorway project. The proximity of the Arncliffe surface works area to the permanent breeding ponds is shown in **Figure 18.** Direct impacts include the removal of 7.82 hectares of foraging, sheltering, dispersal and ephemeral breeding habitat within the Kogarah Golf Course for the duration of construction (approximately four years). The Biodiversity Assessment Report notes that breeding of this species occurs in a significantly higher proportion of sites with ephemeral (temporary) ponds. Occasional breeding has been reported in the area to be impacted by surface works.

DoE found in its assessment of the referral documentation that there are likely to be significant impacts on the Green and Golden Bell Frog from the action.

The project would impact on approximately 10.76 hectares of potential foraging habitat for the Grey-headed Flying Fox (*Pteropus poliocephalus*) which is listed as 'vulnerable' under the EPBC Act. An assessment of significance conducted by the Proponent concluded that loss of potential foraging habitat would not have a significant adverse impact on this species.

A hollow bearing tree survey identified nine trees as containing hollows, of which eight trees were likely to be directly impacted (removed or lopped) in the western portion of the project (two at Kingsgrove and two at Bexley Road) and in the eastern portion (three along Euston Road and one along Gardeners Road). The hollows were considered to be of low quality and unlikely to be suitable for many hollow dependent fauna.

Aquatic Flora and Fauna

The biodiversity assessment concluded that threatened species/populations are unlikely to occur in the project area due to its lack of intact riparian/aquatic vegetation and highly degraded estuarine/freshwater habitats. Works in or near waterways would have a negligible impact on aquatic flora and fauna and standard mitigation measures such as erosion and sediment control would be implemented to minimise the potential for adverse impacts.

Figure 18: Location of RTA Ponds and Construction Footprint at Kogarah Golf Course (Source: EIS)

Groundwater dependent ecosystems

The assessment identified one groundwater dependent ecosystem (GDE) within the project area - the Cooks River/Castlereagh Ironbark Forest community at Beverly Grove. Three GDEs were identified within the area modelled for groundwater drawdown (i.e. area indirectly impacted by mainline tunnel construction):

- Bardwell Valley Parkland and Broadford Street Reserve – 17 hectares of Hinterland Sandstone Gully Forest with moderate to high potential to be dependent on groundwater;
- Stotts Reserve, Bexley North – 3.5 hectares of Coastal Sandstone Ridgetop Woodland with moderate potential to be dependent on groundwater; and

- Wolli Creek/Wolli Creek Station – 3.4 hectares of Estuarine Fringe Forest and Mangrove Forest with low to moderate potential to be dependent on groundwater.

The assessment concluded there would be negligible impact on GDEs. However, there may be temporary drawdown of groundwater beneath the retained patch of Cooks River/Castlereagh Ironbark Forest at Beverly Grove. Temporary drawdown impacts are likely to be minimal due to the high clay content of the soil, as is permanent drawdown, as groundwater in the western part of the project is already drawn down by the existing M5 East Motorway. Modelling indicates drawdown of less than two metres, which is in the range of seasonal groundwater variations.

The groundwater modelling predicted groundwater drawdown impacts on the GDEs at Bardwell Valley Parkland and Wolli Creek/Wolli Creek Station are likely to be minor (less than one metre) as these GDEs are near the drawdown boundary of the mainline tunnel. Furthermore, the GDEs at these locations are able to draw on surface water in nearby watercourses.

The mainline tunnel would run directly beneath Stotts Reserve and drawdown is predicted to be as much as 10 metres and consequently could result in some trees dying or becoming stressed during dry periods.

Submissions

OEH has stated that the *Framework for Biodiversity Assessment* had been applied correctly and the conclusions of the assessment were appropriate. However, the Biodiversity Offset Strategy did not confirm the location, quantity or quality of the offsets required. The OEH noted there was a low risk of construction impacts causing the loss of the Green and Golden Bell Frog population, but the consequences are high. Additional offsets would be appropriate should the on-site population be lost. Impacts of noise and lighting from the operation of the motorway operations centre also need to be addressed.

DPI noted that forested areas along Bardwell Creek and Stotts Reserve may be impacted by groundwater drawdown. The DPI recommended that impacts on vegetation and listed groundwater dependent ecosystems should be considered when groundwater modelling is re-visited.

The **City Canterbury City Council, Hurstville City Council** and **Rockdale City Council** jointly engaged an environmental specialist (Molino Stewart) to undertake a review of the biodiversity issues associated with the project. The Molino Stewart review indicated:

- there was inadequate consideration of local information held by the three local government authorities on local threatened fauna and flora species and management plans and strategies;
- the assessment of potential impacts cannot be fully assessed as no targeted surveys for threatened species was undertaken;
- the indirect impact of the project on groundwater dependent ecosystems has not been assessed; and
- the assessment has not fully considered a range of species and communities that may be directly or indirectly impacted, therefore the Biodiversity Offset Strategy has potentially not considered all relevant impacts and may not adequately offset all project impacts.

The Molino Stewart review recommended:

- redesign of the Arncliffe surface works area to widen the compound along the northern (Marsh Street frontage) boundary and reduce the southern boundary adjacent to the RTA ponds. This would maintain connectivity for the Green and Golden Bell Frog between the foraging habitat and the RTA ponds The review also recommended

establishment of the Marsh Street ponds prior to removal of existing habitat on the Kogarah Golf Course, and development of a fauna relocation plan and management plan for additional breeding habitat within the golf course waterbodies;
- consideration of seasonally available foraging resources for the Grey-headed Flying Fox and Rockdale Council's management plan for the Grey-headed Flying Fox camp at Turrella;
- a biodiversity offset be provided for the entire patch of Cooks River/Castlereagh Ironbark Forest, as removal of part of the vegetation would result in the local extinction of the entire patch of vegetation;
- undertaking surveys to assess fauna utilisation of the Cooks River/Castlereagh Ironbark Forest at Beverly Grove and similar vegetation in the Canterbury Golf Course and Beverly Park to the south; and
- development of a vegetation management plan to enhance the existing habitat of the Marsh Street and Eve Street wetlands.

Canterbury, Hurstville and Rockdale Councils support the conclusions and recommendations of the Molino Stewart report.

The **City of Sydney** and **Marrickville Council** jointly commissioned a review of the biodiversity assessment. The review concluded that more consideration should be given to species and sites of local conservation significance within the two local government areas, including local information and data records and local initiatives to conserve and enhance habitat. The review noted that the list of candidate species in the biodiversity assessment did not include species that have been recorded in the vicinity of the project and/or where suitable habitat is present and that further assessment of these threatened species is required. The review queried the classification of some native vegetation categorised as urban native and exotic and indicated that the proposed mitigation measures were not adequate in minimising biodiversity.

Leichhardt Council expressed concern that the proposed mitigation measures for the Cooks River/Castlereagh Ironbark Forest may not satisfactorily compensate for the impacts of the project. Council considers the flora and fauna assessment may not have adequately identified all the species present and noted that biodiversity information, records and plans held by local councils have not been considered. The Council recommended that 'like-for-like' biodiversity offsets need to be provided.

Public Submissions

Submissions from the public raised the following key biodiversity issues:
- general loss of native vegetation along local roads and open space areas, including clearing within Sydney Park, near Camdenville Park at St Peters, M5 Linear Park and Beverly Grove, and along Euston Road;
- impacts to flora species and reduction in gains made by previous bushland regeneration;
- impacts to fauna, such as loss of habitat and environmental impacts;
- loss of endangered ecological communities in the vicinity of Wolli Creek Valley; and
- impacts to the Grey-headed Flying Fox and Green and Golden Bell Frog.

Department's Consideration

Assessment Methodology

The submissions from the councils raised concerns that the biodiversity assessment did not consider local information and strategies on biodiversity (flora and fauna) initiatives to conserve and enhance habitats. The councils considered that local knowledge and information would provide a greater level of understanding of biodiversity within the local government areas impacted by the project. The impacts on flora and fauna outside the project corridor were also raised by the councils, in particular indirect impacts to foraging and

roosting habitats for fauna species. However, the OEH indicated that the biodiversity assessment of the project was undertaken in accordance with the *Framework for Biodiversity Assessment* and has addressed all relevant biodiversity matters. The Department has considered the Proponent's biodiversity assessment and is satisfied that the level of assessment is sufficient to enable the Department to form a view of the existing biodiversity values within the project footprint and likely extent and significance of impacts associated with the construction and operation of the project. The Department is satisfied that the residual impacts of the project on threatened species and communities have been considered in accordance with the *NSW Biodiversity Offsets Policy for Major Projects* (OEH, 2014).

The Department acknowledges that through examining alternative locations for surface works, route alignments and the location of ancillary facilities, the Proponent has avoided the following biodiversity values in the project area:

- extensive high quality native vegetation in Wolli Creek Valley;
- a small population of *Syzgium paniculatum* in the Wolli Creek Valley (listed as 'endangered' under the TSC Act);
- a small patch of Sydney Turpentine Ironbark Forest in Kingsgrove (listed as an EEC under the TSC Act);
- a vegetated riparian corridor along Wolli Creek;
- a Grey-headed Flying Fox camp and habitat at Turrella;
- areas of native coastal reedland and mangroves at the confluence of Wolli Creek and the Cooks River; and
- artificial breeding habitat for the Green and Golden Bell Frog at the Kogarah Golf Course.

However, adoption of the proposed tunnel route (over a shorter tunnel with the western portal at Bexley Road near the M5 East Motorway) would impact on the Cooks River/Castlereagh Ironbark Forest at Beverly Grove. The Department accepts that this impact is unavoidable due to the need to balance biodiversity impacts against other environmental, social and economic considerations.

Threatened Flora Communities and Species

Approximately 1.4 hectares of the 1.8 hectare patch of Cooks River/Castlereagh Ironbark Forest at Beverly Grove would be cleared during the construction of the project. Although this loss is small in the context of the total remnant Cooks River/Castlereagh Ironbark Forest vegetation within the Sydney Basin (less than 0.1 per cent) it represents a significant portion of the community (78 per cent) within the project area. The Department notes that the vegetation was set aside for conservation purposes during the construction of the M5 East Motorway with a requirement for its long-term conservation management in accordance with the M5 approval conditions (Biodiversity Assessment Report, Appendix G, p193). The patch is isolated from other stands of Cooks River/Castlereagh Ironbark Forest and has been impacted by edge effects as well as human disturbance (bisected by a cycleway) and nutrient-rich runoff from the Canterbury Golf Course. The biodiversity assessment concluded that it has a low long-term viability as an independent and diverse stand of vegetation.

While the long-term viability is considered low in the Biodiversity Assessment Report, the advice for the Cooks River/Castlereagh Ironbark Forest states that patches that do not meet the condition or are of lower quality may still retain natural values.

The Proponent has proposed a number of measures to limit direct impacts on the Cooks River/Castlereagh Ironbark Forest, including collection of plant material, delineation fencing and the installation of sediment and erosion controls to prevent runoff affecting the remaining stand of vegetation. The Proponent has also committed to preparing and implementing a Construction Environmental Management Plan (condition D65) to manage risks to the

remaining 0.4 hectare patch of Cooks River/Castlereagh Ironbark Forest, including pathogen and weed control. Direct impacts to the remnant patch of this community due to tunnelling impacts on groundwater are discussed in the section concerning groundwater dependent ecosystems. The impacts are understood to be within the range of seasonal groundwater variability and should not impact the condition of the remaining community.

The Proponent has developed an offset strategy consistent with the *NSW Biodiversity Offsets Policy for Major Projects* which involves offsetting the loss of Cooks River/Castlereagh Ironbark Forest through Biobanking (refer to section below on Biodiversity Offsets). The Department is satisfied that the purchase of ecosystem credits would adequately compensate for the unavoidable loss of biodiversity values associated with the clearing of the forest and that the Proponent has demonstrated that 'like-for-like' offsets are available, subject to agreement with property owners.

The project would directly impact 1.82 hectares of Paperbark Swamp Forest within the Kogarah Golf Course (refer **Figure 17**) along its frontage to Marsh Street and the M5 East Motorway. The biodiversity assessment concluded that the vegetation type is in poor condition due to its highly modified state, low native species diversity and exotic groundcover which is regularly mowed. Notwithstanding, the Proponent has committed to offsetting impacts utilising the Biobanking scheme and implementing management measures similar to those proposed for the Cooks River/Castlereagh Ironbark Forest to minimise biodiversity impacts on the Paperbark Swamp Forest (see section below on Biodiversity Offsets). The Department considers these measures to be appropriate.

The Department acknowledges that the clearing of 7.45 hectares of Urban Native and Exotic Vegetation would not have a significant impact on the foraging habitat of threatened fauna species and is satisfied that the Proponent's commitment to rehabilitate cleared areas post construction is a suitable management measure.

Although no threatened flora species were identified, there is the potential for their occurrence within the project site. Subsequently, the Department has recommended a condition of approval (condition D68) requiring the Proponent to develop a procedure for dealing with unexpected finds of threatened species (both flora and fauna) during construction, including stopping works and notification procedures, and updating of biodiversity offset requirements.

Threatened Fauna

The only threatened fauna species likely to occur in the project area is the Green and Golden Bell Frog. Construction of the project would not directly impact the breeding ponds adjacent to the Kogarah Golf Course, or the nearby Marsh Street Wetlands which are connected via a frog underpass of the M5 East Motorway. However, it would directly impact on approximately 7.82 hectares of the frog's foraging, dispersal, sheltering and ephemeral breeding habitat at the Kogarah Golf Course.

Indirect impacts to the RTA ponds established and managed as compensatory habitat for the M5 East Motorway, such as increased dust, light, noise and vibration would also occur during construction. The EIS (Chapter 21 and Appendix S) provides an assessment of the likely indirect impacts on the Green and Golden Bell Frog associated with the construction of the project. The Department, in consultation with OEH, has reviewed the findings of the assessment and has concluded that in general, the proposed mitigation and management measures are appropriate and are based on previous projects that impact the same species (Response to Submissions and Preferred infrastructure Report, Section 4.7.3).

The biodiversity assessment has addressed the Matters of National Environmental Significance Significant Impact Criteria to inform an assessment of the impact of the project

on the Green and Golden Bell Frog and concluded the majority of the direct impacts would be temporary (up to four years).

Notwithstanding the temporary nature of the impacts, the Department notes that the Arncliffe Green and Golden Bell Frog Population has declined over the past years. Between 2003/04 and 2010/11 the population was estimated to range from 60-80 frogs with a peak of 110 in 2012/13. However, surveys carried out in November 2015 and February 2016 captured only six and eight adults, respectively. Monitoring has indicated breeding at the RTA ponds has occurred every year except 2014. In the most recent surveys, tadpoles were observed in a drainage line near the RTA ponds. The Proponent's frog expert considers the current population is unlikely to remain without constant management, and the Green and Golden Bell Frog population at Arncliffe is considered to have poor long-term viability.

To ensure the viability of the population during construction, the Proponent has committed to manage construction impacts through a management plan, presented as the *Green and Golden Bell Frog Plan of Management* (Appendix K of the Biodiversity Assessment Report). The plan of management aims to:

- minimise or eliminate all avoidable construction impact by removing and excluding frogs from the construction zone;
- augment existing foraging habitat to compensate for unavoidable construction impacts on part of the golf course;
- establish a captive breeding colony and manage non construction related threats known to adversely affect the RTA ponds; and
- increase the availability of suitable habitat in the area by creating new habitat at Marsh Street.

The Department considers that these measures are consistent with the objectives of the *Green and Golden Bell Frog Litoria aurea (Lesson 1829) Draft Recovery Plan* (Department of Environment and Conservation, 2005). This plan constitutes the Recovery Plan for the Green and Golden Bell Frog under the EPBC Act. The aims of the Recovery Plan include:

- increasing the security of key populations by habitat protection and management;
- managing existing populations to eliminate or attenuate factors that are detrimental to the species;
- undertaking monitoring to inform habitat management initiatives;
- establishing self-sustaining colonies of at-risk populations; and
- increasing the regional and local awareness of the conservation status of the species, including community involvement in the implementation of the recovery plan.

The Proponent has developed a Habitat Creation and Captive Breeding Plan (submitted as Appendix B of the Response to Submissions and Preferred Infrastructure Report) which involves enhancing the existing breeding ponds (RTA ponds), the implementation of a captive breeding program (to create a viable population that can serve as insurance and seeding populations), and creating new habitat on RMS land adjacent to the Marsh Street wetlands (refer to **Figure 19**).

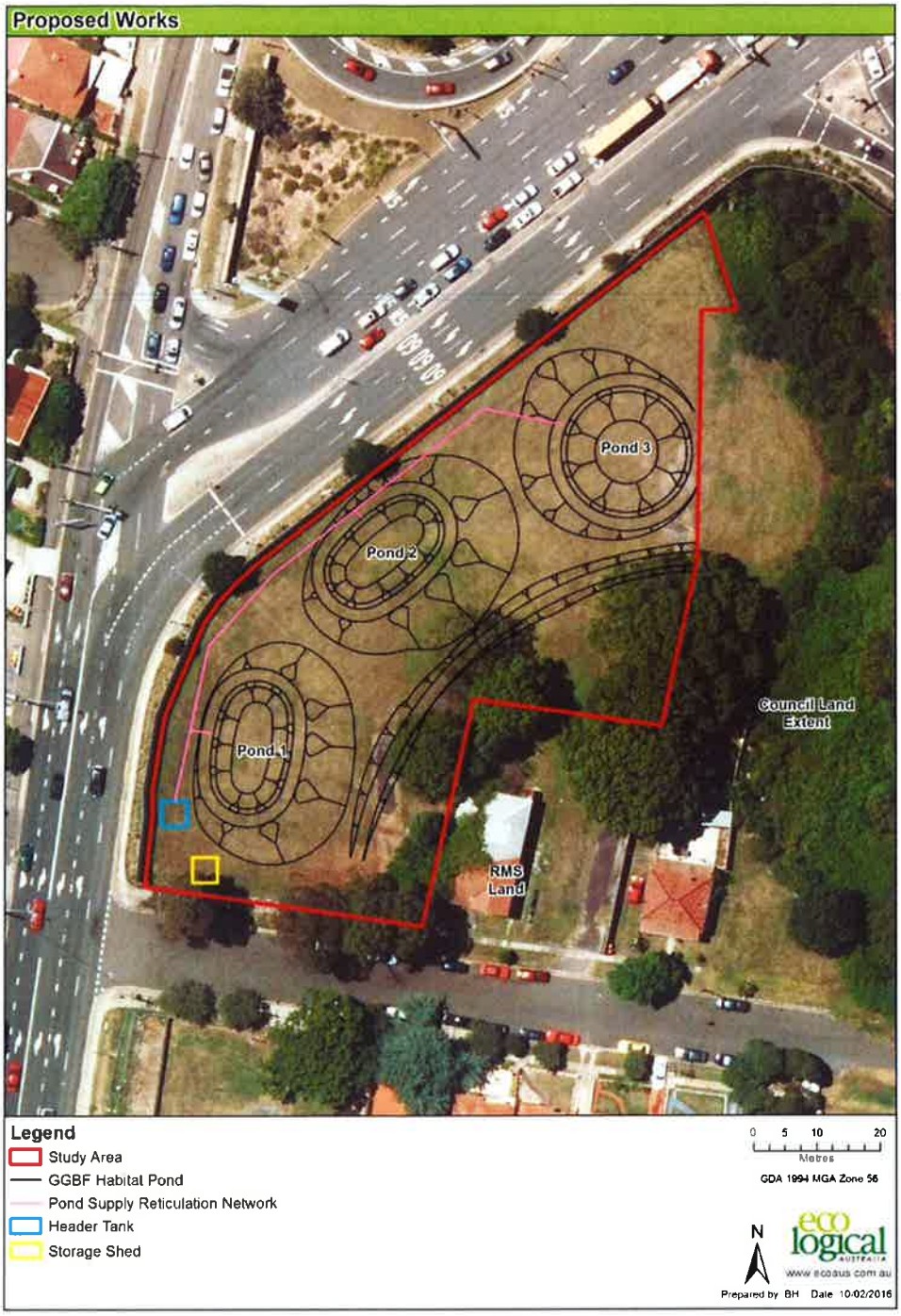

Figure 19: Proposed Marsh Street Habitat Area (Source: EIS)

The Department notes that the captive breeding program would provide security in the event that the wild population is adversely affected. However, the success of the program is not guaranteed and depends on many factors, including the capture of a sufficient number of frogs to establish the program, the breeding success rate, survival rate of tadpoles and young frogs relocated to the new Marsh Street ponds and/or RTA ponds, and whether the frogs are breeding in the new habitat. The Habitat Creation and Captive Breeding Plan does not provide a discussion of the limitations and assumptions underpinning the breeding program. This has prevented a consideration of the likelihood of success for the described captive breeding program. The Department has recommended that the Habitat Creation and Captive Breeding Plan be revised to include details on the husbandry protocols (condition B15). It has also recommended that the revised plan include an adaptive monitoring program to assess the success of the habitat creation and release, colonisation and breeding of Green and Golden Bell Frogs released into the Marsh Street habitat (condition B15).

As captive breeding and survival of the released Green and Golden Bell Frogs cannot be guaranteed, the Department considers that additional offsetting should be provided in the event the captive breeding program and colonisation of the new Marsh Street habitat are not successful and has recommended a condition to this effect (condition B17). This reflects a level of uncertainty regarding the effectiveness of the current management methods at the RTA ponds, which are to be maintained, and the observed decline in population.

An existing frog underpass between the Marsh Street wetlands and RTA ponds was provided as part of the M5 East Motorway. Monitoring has indicated no evidence of its use by frogs. However, frogs have been observed on the cycleway underpass of the M5 East Motorway. Therefore, the Department considers it prudent for the Proponent to monitor the existing underpass particularly once the Marsh Street habitat has been created, and has recommended a condition to this effect (condition B15).

The Proponent has provided the Department with a *Green and Golden Bell Frog Plan of Management* (Appendix S; App K) to address the residual direct and indirect impacts discussed above. The management plan recommends the development of additional measures to minimise predation of Green and Golden Bell Frogs and enhance the existing habitat in addition to the current water management practices. The Department is satisfied the proposed mitigation and management measures for construction impacts on the Green and Golden Bell Frog are appropriate and are likely to minimise the indirect impacts associated with this project However, it considers that additional details are required on the proposed monitoring program, and has recommended that the management plan be revised to address this issue, in consultation with the OEH (condition B14).

In regards to the Grey-headed Flying Fox, the Department notes that the Turrella camp is located outside the project area and is satisfied that the project would not have a significant adverse impact on this species. The project directly impacts a relatively small area of potential foraging habitat for this highly mobile species (which can travel up to 50 kilometres to forage in a single night). Approximately 3.3 hectares of continuous stands of native vegetation is proposed to be cleared, with a further 7.45 hectares of native and exotic vegetation in parks, road batters and street trees directly impacted. Furthermore, the project does not isolate or fragment existing Grey-headed Flying Fox populations.

Although the project would result in the clearing of potential fauna habitat for other native and exotic fauna species, the Department concurs with the Proponent's conclusion that the project would not result in significant habitat fragmentation nor would it isolate any substantial areas of native vegetation.

The Proponent has committed to the implementation of mitigation measures to avoid and minimise direct impacts to fauna species and habitat, which would be detailed in a Construction Flora and Fauna Management Plan for the project. These measures include:

- pre-clearing surveys;
- exclusion zones to protect sensitive vegetation;
- installation of nest boxes to provide for the loss of hollow bearing trees;
- reuse of habitat elements (such as woody debris) where feasible and reasonable; and
- management of weeds and the spread of pathogens.

In addition to these measures, the Department has recommended that the Proponent:

- implement measures to minimise the incidence of fauna being trapped in excavations and develop measures to deal with trapped or injured fauna;
- develop a protocol for the relocation of fauna prior to commencing construction;
- implement measures for the progressive re-vegetation of areas temporarily disturbed by construction; and

- site rehabilitation works include the planting of native species and other habitat species suitable for foraging for a range of fauna.

Groundwater Dependent Ecosystems

The assessment of groundwater dependent ecosystems noted one GDE would be directly impacted by groundwater drawdown, the Cooks River/Castlereagh Ironbark Forest community at Beverly Grove. This community is currently impacted by the M5 East Motorway, and the predicted drawdown (two metres) is within the range of seasonal groundwater variability, and is not expected to have an impact the condition of the remaining community.

The GDEs in the Bardwell Valley Parkland are on the boundary of the predicted groundwater drawdown zone and were assessed as unlikely to be impacted by the project. The assessment considered that drawdown of groundwater (up to 10 metres) during construction and operation could result in some trees dying or becoming stressed at Stott Reserve. It is not known how the species in Stotts Reserve would respond to short-term declines in groundwater.

The significance and duration of groundwater drawdown on GDEs is unknown and would be influenced by the underlying geology, soil type and proximity to watercourses. The Department considers that monitoring of the GDEs during construction would be prudent to identify any adverse impacts on the health and condition of the vegetation. Accordingly it has recommended that the monitoring of the GDEs at Beverly Grove, Bardwell Valley Parkland, Broadford Street Reserve and Stotts Reserve be undertaken during the construction of the project (condition D68). This would ensure that any impacts to the GDE could be addressed in a timely manner.

Biodiversity Offsets

The assessment has identified there would be a residual adverse impact remaining after all possible avoidance and mitigation measures have been exhausted for the Cooks River/Castlereagh Ironbark Forest, Paperbark Swamp Forest and the Green and Golden Bell Frog. Offsets are required for impacts from clearing of the two threatened ecological communities and the loss of foraging, dispersal, sheltering and ephemeral breeding habitat in the Kogarah Golf Course for the latter. The Proponent has prepared a Biodiversity Offset Strategy (contained in the EIS) to address unavoidable biodiversity impacts. The Biodiversity Offset Strategy, prepared in accordance with the *Framework for Biodiversity Assessment*, (Appendix T of the EIS). A total of 261 credits, including 203 credits for Green and Golden Bell Frog and 31 credits for Cooks River/Castlereagh Ironbark Forest, are required to offset direct impacts to biodiversity.

Expressions of interest are being sought for Swamp Sclerophyll Forest to retire credits for the Paperbark Swamp Forest (which is a component of Swamp Sclerophyll Forest). The Proponent expects that within three years of approval all offsets for the project can be secured.

The Biodiversity Offset Strategy would offset all Matters of National Environmental Significance on a 'like-for-like' basis, in accordance with the Bilateral Agreement. 'Like-for-like' offsets are not required for the State listed Paperbark Swamp Forest if offsets are not available and providing offsets for other threatened communities is an option. The Biodiversity Offset Strategy summarises the process the Proponent followed in identifying the required offsets with the aim to securing these in the shortest time possible, including examination of the OEH Biobank site EOI register, identifying candidate sites, liaising with landowners over potential offset sites and seeking expressions of interest to retire credits and canvassing potential supplementary measures. The Department is satisfied with the procedures that the Proponent has and is continuing to undertake to secure offsets for the Matters of National Environmental Significance and for the Paperbark Swamp Forest.

The Department accepts that the Proponent would not have secured the required offsets prior to the Cooks River/Castlereagh Ironbark Forest and Paperbark Swamp Forest ecological communities and Green and Golden Bell Frog habitat being impacted and has consequently recommended that the provision of offsets follow a two-stage process. The first stage involves the Proponent providing the Secretary with a report on the status of securing biodiversity credits for the impacted communities and habitat, prior to them being impacted (condition B12). This requirement would ensure that progress on securing offsets is both achievable and timely. The second stage requires the Proponent to submit a Biodiversity Offset Package for the Secretary's approval within 12 months of construction commencing (condition B13). The Package would provide details of the number of biodiversity credits required, details of the offset credits identified to offset the impacts of the project on the identified communities and habitat, and details of supplementary measures, if required. The Department has recommended that all offsets must be secured within two years of construction commencing (condition B13).

The Department considers that the viability and functionality of the remaining Cooks River/Castlereagh Ironbark Forest has been compromised through its current modified condition, and that new and additional edge effects from the project would further diminish the integrity and value of the vegetation community. Consequently, the Department considers that it would be appropriate for the Proponent to offset the full 1.8 hectare patch of Cooks River/Castlereagh Ironbark Forest and has recommended a condition to this effect (condition B10). This would require a recalculation of the ecosystem credits required to offset the impacts to the Cooks River/Castlereagh Ironbark Forest.

Other Biodiversity Impacts

The project directly impacts 10.76 hectares of vegetation of which 3.31 hectares would be offset in accordance with the *NSW Biodiversity Offsets Policy for Major Projects.* The remaining vegetation comprises natives and exotics in the M5 East Motorway road reservation (road batter), and street trees and trees in suburban parks (approximately 7.45 hectares). Submissions from councils and the public raised concerns about the clearing of street trees and trees in parks for the project. The Department acknowledges the removal of trees in a highly urbanised setting is a significant issue, and notes that this has been raised in the construction of a number of recent linear infrastructure projects. It is also noted that the Proponent has designed the project to minimise the clearing of trees, whether in continuous stands or individual trees. To ensure that the project retains as many trees as possible and provides a net increase in the number of replacement trees, the Department has recommended that an independent arborist prepares a comprehensive report on the removal of trees on the periphery of or outside of the construction footprint as identified in the EIS for the approval of the Secretary (condition B63).

Conclusion

The assessment of biodiversity impacts of the project has been carried out in accordance with the Biodiversity Offset Policy for Major Projects and Framework for Biodiversity Assessment. The Department notes the project would have a direct impact on two threatened ecological communities, one of which is listed as critically endangered under the EPBC Act – the Cooks River/Castlereagh Ironbark Forest. The impacts to both communities would be offset in accordance with the *Framework for Biodiversity Assessment* and secured under Biobanking agreements.

One threatened fauna species would be directly impacted by the project – the Green and Golden Bell Frog. The Arncliffe surface works would remove 7.82 hectares of foraging, breeding and dispersal habitat for the frog on the Kogarah Golf Course. The Proponent proposes to address the impacts through offsetting, (securing and retiring ecosystem credits) and creating new habitat near the golf course at Marsh Street. The Proponent has also prepared a Green and Golden Bell Frog Plan of Management which sets out management

measures that would be implemented at the Kogarah Golf Course and proposed new Marsh Street habitat, and proposes to undertake a captive breeding program to safeguard the survival of the frog population.

The Department notes that the Proponent has minimised impacts to biodiversity by incorporating avoidance measures in the design of the project. These include the examination of alternative locations for surface area works and examining the route alignment and location of ancillary facilities. The design of the project has avoided high quality native vegetation in Wolli Creek, the critically endangered Sydney Turpentine Ironbark Forest at Kingsgrove, Grey-headed Flying Fox camp and habitat at Turrella and Green and Golden Bell Frog breeding ponds adjacent to the Kogarah Golf Course.

The Department considers that the impacts of the project on Matters of National Environment Significance have been adequately addressed by the Proponent. The Department also considers that the likely impacts to the Green and Golden Bell Frog and the Cooks River/Castlereagh Ironbark Forest would be effectively managed and offset through the recommended conditions attached to this decision which require the management of impact to these matters (conditions B14, B15, D58 and D68) and the development and provision of biodiversity offsets (conditions B10, B11, B12 and B13). The Department recommends that the DoE considers and adopts these recommendations. **Appendix J** of this report sets out the additional EPBC Act considerations, including the Commonwealth's international obligations, consideration of relevant approved conservation advices, threat abatement plans and recovery plans.

The Department is of the opinion that provided the recommended conditions are adopted and that the Proponent implements the environmental management measures outlined in the Response to Submissions and Preferred Infrastructure Report, impacts on flora and fauna would be effectively managed and duly compensated through offsetting. On balance, the Department considers the impact of the project on biodiversity, in particular Matters of National Environmental Significance, is acceptable and recommends the Commonwealth Minister for the Environment approve the action, subject to the proposed conditions.

5.5. Groundwater

Issue

Construction of the tunnels is likely to intercept aquifers associated with Ashfield Shale, Mittagong Formation and Hawkesbury Sandstone geological units, and would require dewatering during both construction and operation. Tunnelling would pass through aquifers, requiring collection and treatment of water prior to discharge to surface streams.

During construction groundwater inflows would be pumped to water treatment facilities at five compounds (Kingsgrove North – C1, Commercial Road – C3, Bexley Road South – C5, Arncliffe – C7 and Canal Road – C8) prior to discharge to surface streams. The volume of wastewater to be treated would vary according to the construction activities taking place within the tunnel, the amount of groundwater infiltrating into the tunnel and the length of excavated tunnel.

The final tunnels are not proposed to be lined and would require continual management of groundwater. The Proponent has advised that inflow during operation is anticipated to be up to one litre per second for each kilometre. The groundwater would be treated as two separate streams, due to the potential for contaminated groundwater to occur in the eastern area of the project. Water collected to the east of Cooks River, would be treated at a water treatment plant located at the Arncliffe motorway operations complex through a combination of physical, chemical and biological processes and discharged. Water collected to the west of Cooks River, would be treated through a combination of physical and chemical processes at the Arncliffe water treatment plant. Both treatment streams would ultimately discharge to the Cooks River. **Figure 20** below shows the two treatment streams.

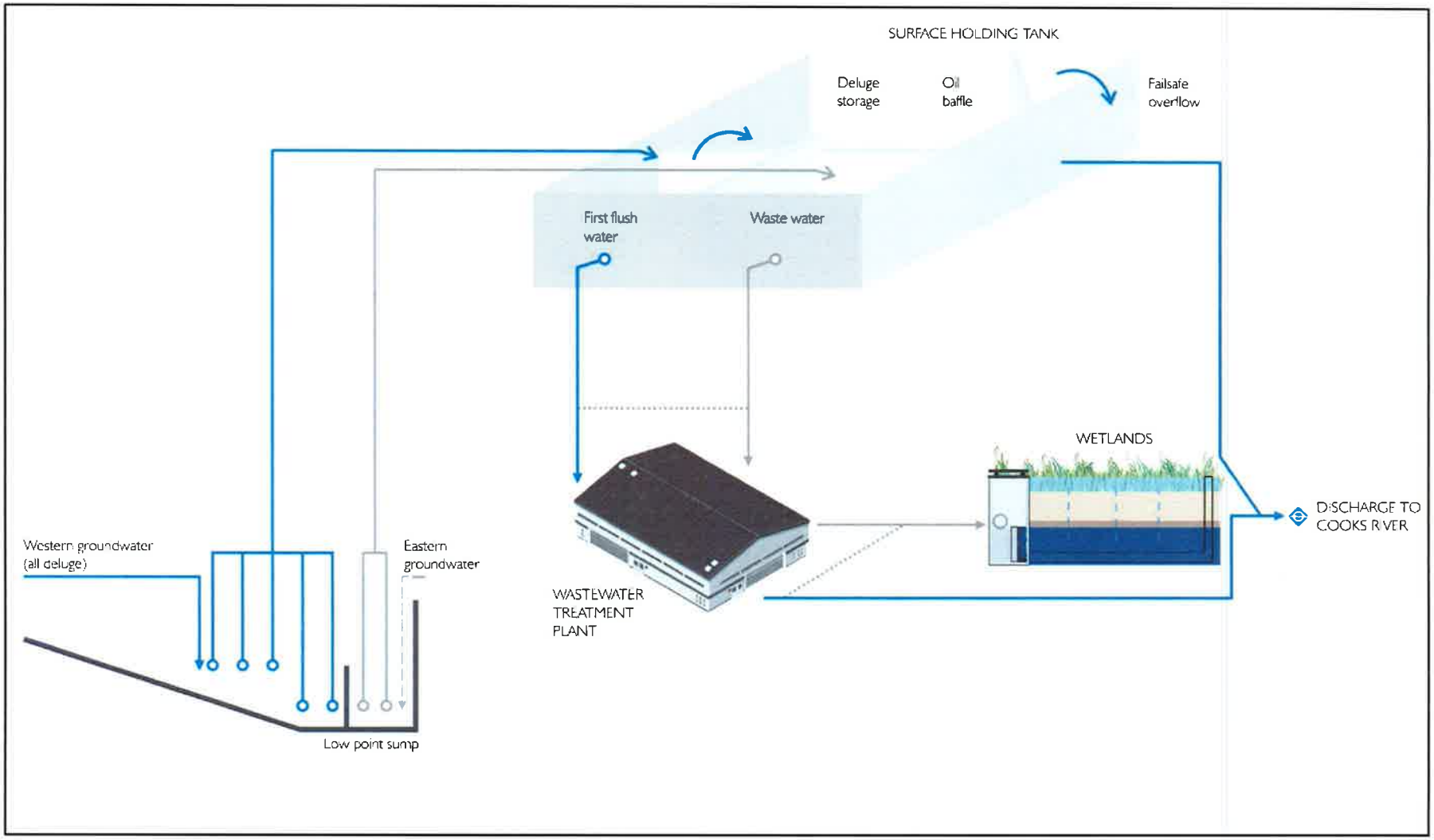

Figure 20: Tunnel Water Management and Treatment (Source: EIS)

There are 61 registered bores within a one kilometre radius of the project and half of these are used for water supply and irrigation. Eleven bores have the potential to be significantly impacted during construction and operation of the project with drawdowns greater than two metres). **Table 21** details the predicted impact to the bores.

Table 21: Predicted Groundwater Drawdown (Source: EIS)

Bore ID	Lithology	Depth (metres)	Water table depth in metres below ground level	Purpose	Predicted drawdown (metres)
GW023191	Sand	4.9	3.3	Water supply – domestic	6.7
GW023194	Sand	2.1	2.1	Water supply – domestic	2.2
GW027664	Sand	6.1	0.7	Industrial	2.4
GW107993	Sandstone	13.6	1.95	Monitoring	11.5
GW108406	Sand	8	N/A	Monitoring	2.4
GW108588	Sand	8	N/A	Test bore	2.7
GW109191	Sandstone	186	93	Industrial	5.7
GW109963	Sand	8	N/A	Other	2.7
GW109964	Sand	8	N/A	Monitoring	2.8
GW109965	Sand	8	N/A	Monitoring	2.4
GW109966	Sand	3	N/A	Monitoring	4.5

A number of the registered bores may see an increase in salinity levels due to a hydraulic connection with the tidal reaches of the Cooks River and its tributaries.

Groundwater and leachate from the Alexandria Landfill would also need to be captured and treated as part of the construction and operation of the project. It is proposed that treated leachate would be discharged to sewer in accordance with the requirements of the existing trade waste agreement with Sydney Water. Management of the leachate would continue as part of the landfill capping works.

To assist with the Department with its groundwater assessment, the Department engaged the Water Resources Laboratory of the University of New South Wales to undertake a specialist review of the Proponent's groundwater assessment. The review report is included in **Appendix K**.

Submissions

DPI (Water) raised concerns regarding the groundwater modelling because it did not sufficiently predict impacts to nearby registered groundwater users and groundwater dependent ecosystems. It also raised concerns that the water level in bores did not represent the water table in all cases, and this may lead to a misrepresentation of the water table. DPI recommended that:

- information on measured groundwater flows be reported at least annually and additional monitoring of groundwater levels in the western edge of the Cooks River alluvia be undertaken to assist with management of the water resource;
- flows and levels in other parts of the Botany Sands should be monitored for potential dewatering effects;
- the Tempe Wetlands, Landing Lights Wetland, Eve Street Wetland and Marsh Street Wetland should be specifically considered, even if predicted impacts are minimal;
- the forest areas along Bardwell Creek and at Stotts Park should be further considered when the groundwater modelling is re-visited; and
- the project should be comprehensively assessed against the requirements of the *NSW Aquifer Interference Policy*, and ensure 'make good' provisions are implemented in the event of adverse impacts to groundwater users.

The **EPA** raised concern regarding the potential contaminants that may be present in the groundwater being discharged to the Cooks River, Wolli Creek and Alexandra Canal, including pesticides and organic toxicants associated with market gardens. The EPA recommended clarification be provided regarding the absence of these pollutants from the proposed discharge criteria, and consideration be given to expanding the list of pollutants to include iron, ammonium and the constituents listed in the draft groundwater monitoring program specifically total hydrocarbons, benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons, phenols, organochlorine pesticides, organophosphorus pesticides and polychlorinated biphenyls.

NSW Health recommended that the proposed groundwater monitoring program be developed in consultation with the EPA, DPI (Water) and the relevant local governments.

Sydney Water noted that it would need to retain access to its assets throughout the life of the project. Any trade waste licence request, most notably for the removal of leachate, would need to meet Sydney Water's requirements and the approval would need to consider the discharge protocols of chlorinated water due to shut down and reconnection of live Sydney Water assets that would need to be adjusted.

The **City of Canterbury Council, Hurstville City Council** and **Rockdale City Council**, through their consultant Molino Stewart, raised concerns relating to:

- the modelling predictions and particularly the lack of predictions during and immediately after construction and calibration;
- inadequate baseline data from the bores;
- no lining of the tunnels;
- the assumption that the western groundwater is not contaminated, even though this area includes the former Bardwell Park landfill site;
- the limited information provided on the potential to intersect deeper palaeochannels, which would result in greater inflows;
- proposed monitoring regime; and
- insufficient details on the potential decline in groundwater quality and consequent impacts to users and ecosystems.

Hurstville City Council and **Rockdale City Council** recommended:

- the groundwater monitoring program be developed in consultation with all relevant government agencies;
- assessment of the impacts of drawdown on surface water bodies should be assessed;
- groundwater monitoring data from the M5 East Motorway should be used to inform the groundwater modelling (not data from other roadways and tunnels which is 'expected' to be an accurate representation of what would occur on the New M5 project); and
- the impacts of salt water intrusion should be assessed.

Hurstville City Council also recommended:

- further groundwater baseline data, including soils salinity data, should be obtained and the assessment revisited once this information is available; and
- the potential impacts of groundwater inflow, groundwater drawdown and salt water intrusion should be understood before the project commences.

Marrickville Council raised concerns that the altered groundwater flow paths may have a negative impact on vegetation, particularly groundwater dependent ecosystems.

The **City of Sydney Council** was largely satisfied with the groundwater assessment, except for the proposed discharge of groundwater from the Alexandria Landfill site into Alexandra Canal and Cooks River during construction and operation. The Council recommended that

the tunnel be waterproofed and other measures for reducing groundwater inflows during construction. It also recommended that:

- shallow perched groundwater within the Alexandria Landfill or Botany Sands should be directed to the leachate treatment plant or the construction water treatment plant prior to discharge;
- groundwater should be stored and reused where possible;
- a groundwater soil and salinity report should be prepared detailing the presence, extent and severity of soil salinity along the alignment and measures for minimising salinity impacts on groundwater systems;
- a groundwater monitoring program should be implemented;
- contingency measures to address leachate management at the Alexandria Landfill during construction should be included in the Construction Environmental Management Plan;
- building materials that are resistant to aggressive groundwater conditions should be selected; and
- in the event that the drawdown in a water supply bore or irrigation bore exceeds two metres, measures should be taken to 'make good' the impact.

Public Submissions

Key issues raised in the public submissions included:

- groundwater impacts during construction;
- potential for construction to contaminate groundwater resources; and
- changes to salinity levels in groundwater resources.

Department's Consideration

Groundwater Modelling

DPI (Water) recommended that the groundwater model be updated to include additional groundwater baseline data to ensure that impacts on nearby registered groundwater users, groundwater dependent ecosystems and forested areas along Bardwell Creek and Stotts Park are sufficiently predicted and appropriately managed. The Proponent has advised that additional baseline data has and continues to be collected and that re-calibration and conceptualisation would be undertaken during detailed design.

The Department concurs with the recommendations of DPI and has included recommended conditions requiring the Proponent to undertake further groundwater monitoring and modelling and to document the outcomes in a Groundwater Modelling Report. DPI (Water) has advised that the model should be updated when at least 12 months of baseline data are available and prior to any construction activities that would potentially impact on groundwater and again when two years of baseline data have been collected, in order to verify impacts and predictions. The Department supports this approach and has recommended a condition to this effect.

Construction Impacts

Tunnelling works would result in groundwater drawdown and have the potential to intercept deeper palaeochannels resulting in additional groundwater flowing into the tunnels. The Department has recommended that the Proponent implement a comprehensive Water Quality Plan and Monitoring Program which includes monitoring of groundwater levels and measures to pro-actively managing groundwater risks.

Concerns were raised about the potential of rock fracturing beneath the streams, as a result of the tunnelling operations, and consequent throughflow of surface water into the groundwater table. The Department acknowledges that there is a risk of stream bed fracturing however, the Proponent argues that the risk is low and that the volume of surface water that would be lost would be small. Notwithstanding, the Department has

recommended that the Water Quality Plan and Monitoring Program including monitoring of stream depth in waterways under which tunnelling would occur.

During tunnelling, captured groundwater would be pumped to water treatment facilities at five of the construction compounds. Three of these compounds (Kingsgrove North – C1, Commercial Road – C3 and Bexley Road South – C5) discharge to Wolli Creek. The flow rates into Wolli Creek are predicted to be 2.8 L/s, 2.8 L/s and 7.6 L/s respectively, equating to a total flow rate of 13.1 L/s, during the three-year construction period. The Department notes that the discharge flow rates are minor and should not have a geomorphological impact on Wolli Creek. The Proponent has proposed monitoring to enable this to be confirmed and protection measures in case geomorphological impacts arise.

To ensure that the discharges do not impact surface water quality, the Department has recommended a condition requiring the Proponent to monitor of discharge quality along with details on the proposed water treatment processes, identification of the proposed discharge locations, and details on any measures required to minimise scour at the point of discharge. The Department agrees with the concerns raised by the EPA with regard to the potential contaminants, and has recommended that clarification be provided regarding the absence of pollutants associated with market gardens, from the proposed discharge criteria. The Department notes that in the Response to Submissions Report that the Proponent has considered expanding the monitoring regime, and has expanded the regime to include: ammonium; phenols; organophosphorus pesticides; and polychlorinated biphenyls (PCBs). The Department is satisfied with the expanded monitoring regime.

Operational Groundwater Management

The project's groundwater impacts are predicated on achieving a groundwater inflow along any given kilometre of tunnel of up to one litre per second (1 L/s/km). This rate is the design standard based on other tunnels in the Sydney Basin. The Proponent's experience dictates that there are a series of measures it can implement to minimise groundwater inflow, such as a sprayed waterproof membrane and grouting along sections of the tunnel that produce more water. The Department considers that the predicted level of groundwater drawdown is acceptable due to the tunnel design and is satisfied that these proposed measures could be used to restrict groundwater inflow to the desired rate of 1 L/s/km. It has recommended a condition requiring the tunnel to be designed to achieve this maximum inflow rate.

The Proponent predicts groundwater impacts would be limited to four licensed bores, and five monitoring bores. Although the Department considers that the predicted level of groundwater drawdown is acceptable, it does not accept that impacts on groundwater users should go unmanaged. Consequently, the Department has recommended a condition requiring the Proponent to ascertain the condition and status of the existing bores, verify predicted impacts as part of the revised groundwater modelling, undertake monitoring of the bores during construction and operation, and build-in 'make good' trigger levels and provisions in the event of adverse impacts to groundwater users, as part of the Water Quality Plan and Monitoring Program.

The groundwater modelling highlighted that groundwater drawdown would potentially result in saline water flowing towards the tunnels. The level of intrusion has not been quantified though it is expected to be minimal, and would continue to increase until a new equilibrium between the fresh and saline groundwater is reached. Monitoring of the groundwater would detect these changes. Under the Aquifer Interference Policy, 'make good' provisions are provided for impacted groundwater users, in the event of a decline in water supply level or quality. The Department has recommended that water quality and quantity declines are included within the Water Quality Plan and Monitoring Program, to ensure that groundwater bore users are adequately compensated for impacts to their water supply.

Groundwater drawdown has the potential to adversely affect groundwater dependent ecosystems. Consequently, the Department has recommended a condition that surface and groundwater monitoring locations include watercourses, groundwater locations and wetlands which are representative of the potential extent of impacts from the project. These include impacts to:

- the Hinterland Sandstone Gully Forest at Bardwell Valley Parkland and Broadford Street Reserve;
- the Coastal Sandstone Ridgetop Woodland at Stotts Reserve;
- the Estuarine Fringe Forest between the southern bank of Wolli Creek and the railway line behind Wolli Creek Station; and
- the forested areas along Bardwell Creek.

The treatment and discharge of groundwater from the operational tunnels was raised by government agencies, councils and the community. Support was generally given for the two treatment streams. However, concerns were raised that the previous use of Bardwell Park as a landfill may have led to contamination of the groundwater resource in this location. The Proponent has indicated that this is unlikely and consequently does not propose to treat the groundwater for contaminants prior to discharge. The Department considers that the quality of the groundwater in this location should be confirmed and has recommended monitoring prior to discharge as part of the conditions. Should the groundwater be contaminated, the Department has recommended treatment to remove contaminants.

The Proponent has stated that environments for receiving discharges from the operational water treatment plant are 'highly disturbed' ecosystems, which cannot feasibly be returned to a 'slightly to moderately disturbed' condition. Therefore, the water quality triggers used by the Proponent are based on the 'highly disturbed' water criteria, in accordance with the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (Australian and New Zealand Environment and Conservation Council (ANZECC) and Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ), 2000). Where local water quality data was available, the 80^{th} and 20^{th} percentiles values were used to determine trigger levels. Where no local data are available, the Proponent proposes to use the relevant ANZECC trigger for 'slightly disturbed' ecosystems. The Department considers that the Proponent should provide further justification for the use of the lower water quality triggers where existing water quality data is available as monitoring by local government councils indicates that the water quality of the receiving waters is 'fair' and improving, and has consequently recommended a condition to this effect.

The Department has also recommended that unless such justification can be provided, discharges from the water treatment plants should be based on a receiving water quality criterion of 'slightly to moderately disturbed' ecosystem.

The Department considers that groundwater discharges should be seen as a potential resource which should be reused rather than a waste stream which requires disposal. Consequently, the Department has recommended that the Proponent investigate potential groundwater reuse options as a means of reducing water demands.

The operational drawdown of groundwater as a result of the tunnels is predicted to be below 1L/s/km per tunnel. The Proponent has identified a number of environmental measures to minimise the environmental impact from the drawdown and discharge of groundwater. These measures include sprayed waterproof membrane and grouting along section of the tunnel that produce more water. These sections are likely to occur within the vicinity of drainage lines and palaeochannels. The Department is satisfied that these environmental measures and the conditions imposed are adequate to address the impacts associated with the tunnels. Further the Department has recommended that monitoring of the groundwater levels, during construction and operation are required, to track groundwater drawdown

including but not limited to along the alignment of the project tunnels and within and surrounding the GDE communities, occur under the Water Quality Plan and Monitoring Program.

The treatment of the groundwater from the tunnel has strict discharge requirements and monitoring regimes, to ensure no adverse impacts occur to the receiving environment. The Department has required the Proponent provide additional justification as to the use of lower discharge quality, in response to concerns raised in submissions, regarding the ecosystem health of the Cooks River catchment. The Departments recommended conditions aim to improve the health of the Cooks River catchment through the requirements of stricter discharge criteria than provided by the Proponent.

Alexandria Landfill

Concerns were raised in the submissions of contaminated water discharging from the Alexandria Landfill site. As part of the management of the Alexandria Landfill, leachate generated from the site would be contained within the site by manipulating groundwater levels and installing cut-off walls. In addition, the Proponent proposes to construct a new leachate collection and treatment system with the treated leachate being discharged to sewer under a trade waste agreement.

The Department considers that the management of leachate within the Alexandria Landfill site is critical to ensuring that the contaminated groundwater does not impact on other groundwater uses. The Department understands that DPI (Water) has placed an embargo on extraction of groundwater from the Botany Sands aquifer due to contamination. The Department considers that the management strategy for leachate and contaminated groundwater is largely adequate, however no monitoring of the effectiveness of the cut-off wall is proposed. DPI (Water) recommended that as the potential effect around the cut-off wall and the narrow strip of Botany Sands adjacent to the Alexandra Canal are not fully predictable, groundwater flows and levels in other parts of the Botany Sands should be monitored for potential dewatering effects. The Department supports DPI (Water) and has recommended that a network of groundwater monitoring bores be installed both inside and outside the cut-off wall, as part of the Water Quality Plan and Monitoring Program. The monitoring program would be developed in consultation with DPI (Water) and relevant councils.

Ground Settlement

Groundwater movement may result from both tunnelling activities and groundwater drawdown resulting in settlement causing cracking buildings and damage to utility services and infrastructure. The preliminary ground movement investigations carried out by the Proponent indicate the potential settlement may be up to 20 millimetres, causing negligible building damage, for the majority of project extent. The greatest impact would occur at the St Peters interchange eastern tunnel portals, with the settlement being greater than 30 millimetres causing very slight building damage. The Proponent has indicated that the risk of settlement across the rest of the project would be negligible to very slight, and that minor cosmetic damage may be expected, but no structural damage would be likely.

The Department has recommended a condition requiring the Proponent develop a model to assess the predicted settlement, ground movement, stress redistribution and horizontal strain profiles caused by excavation and tunnelling on adjacent property and infrastructure. It has also recommended settlement criteria to minimise settlement impacts. In the event that settlement results in damage to property, services or infrastructure, the Proponent is required to rectify the damage.

Conclusion

Construction and operation of the project would result in impacts on groundwater in terms of drawdown. Groundwater drawdown has the potential to affect the viability of groundwater

bores as well as result in changes to groundwater flows across the project area. The Department considers that these impacts could be acceptably managed through the implementation of the water management framework envisaged in the Department's recommended conditions of approval and the Proponent's environmental management measures. These conditions include 'make good' provisions in the event that licensed bore users are impacted. However, the Department acknowledges that residual risks would occur and has consequently recommended conditions of approval requiring monitoring of groundwater hydrology.

The Department has considered that potential groundwater contamination may come from a number of sources, due to the prior use of a number of sites. To address the potential contamination issues, the Department has agreed with the EPA that consideration be given to expanding the monitoring regime with the Water Quality Plan and Monitoring Program. The Department notes that in the Response to Submissions Report that the Proponent has considered expanding the monitoring regime, and has expanded the regime to include: ammonium; phenols; organophosphorus pesticides; and polychlorinated biphenyls (PCBs). The Department is satisfied with the expanded monitoring regime.

The Department has considered management of contaminated groundwater generated by leachate is largely adequate and should be confined to the Alexandria Landfill site. However, the Department considers that monitoring of the effectiveness of the leachate management is important, and has recommended monitoring be part of the Water Quality Plan and Monitoring Program.

5.6. Soils and Surface Water Hydrology

Issue

Construction of the project includes a range of works that have the potential to result in erosion, sedimentation and surface water impacts including site clearing, demolition activities, excavation works, and piling activities. In addition, tunnelling under waterways could result in the fracturing of the bed of waterways within the construction footprint.

The project has the potential to disturb acid sulfate soils, particularly around the Alexandria landfill site, the Alexandra Canal and at the Arncliffe construction compound (C7). It also has the potential to disturb contaminated soils in Alexandra Canal consequent to the proposed discharge of stormwater into the Canal during operation, resulting in the suspension of bottom sediments. This is addressed in **Section 5.8**.

Submissions

DPI (Water) raised concerns regarding the impact on surface geology of tunnelling beneath Wolli Creek and the Cooks River and recommended that the potential impacts should be assessed in more detail. DPI (Water) noted that works associated with construction compounds C2, C3 and C5 and the motorway operations complexes MOC1 and MOC2 may encroach into riparian land and, if so, recommended that the works is undertaken in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (DPI, 2012). DPI (Water) further recommended that:

- consideration be given to moving the access ways (at MOC1) further north away from the creek to assist improvement of the riparian vegetation;
- riparian land temporarily disturbed by the project be rehabilitated with native species from the relevant local vegetation community;
- where riparian land/vegetation is permanently removed by the project the riparian area is offset either at the work site or elsewhere along the relevant watercourse; and
- decommissioning of the existing water quality pond (WQP-2) in the Wolli Creek catchment should not occur until replacement water quality devices are in operation.

The **City of Canterbury Council, Hurstville City Council** and **Rockdale City Council**, through their consultant Molino Stewart, raised concerns relating to: fracturing and cracking of creek beds, the implications of this and the effectiveness of any potential mitigation measures; water quality data used; treatment of contaminated groundwater prior to discharging into surface water systems; water discharge rates and impacts to receiving environments; identification of sensitive receiving environments; removal of vegetation and works within the riparian zone; and impacts arising from the increase in imperviousness within the catchment.

Hurstville City Council recommended:

- Wolli Creek and Bardwell Creek be considered as sensitive receiving environments;
- the Wolli Creek Riparian Corridor Management Plan should be fully considered and the project impacts assessed in relation to the objectives of the Plan;
- quantification of the increased area of impermeable surfaces and details of where flow paths would be altered should be provided;
- a more thorough investigation into the risks of fracturing or cracking creek beds and the development of mitigation measures to prevent this from occurring; and
- additional details on the extent of clearing and analysis of the impacts of clearing vegetation on water quality.

Rockdale City Council recommended that further investigation into the risks of fracturing or cracking of creek beds should be undertaken and that additional groundwater and surface water quality data be collected to inform the impact assessment. It also recommended that the Wolli Creek Riparian Corridor Management Plan be taken into consideration.

Marrickville Council commented that it was unacceptable that the EIS categorised the receiving environments as being downgraded rather than a resource that could be improved overtime through water-sensitive urban design measures. Council raised a number of possible opportunities for the re-use of treated water from the project, rather than just simply discharging the water.

The **City of Sydney** raised concern that there are no details of how the upgraded roads and intersection would comply with the Botany Bay Water Quality Improvement Plan targets and suggested that the targets should be applied to the whole project footprint within the local government area. The Council noted that there is an opportunity to reuse the non-potable treated water from the St Peters interchange site, through an expanded non-potable water network.

Public Submissions

Key issues raised in the public submissions included:

- potential waterway pollution from road runoff;
- reliability of the water quality data;
- quality of groundwater in the vicinity of Bardwell Park (former landfill site); and
- impacts on the Sydney Park stormwater harvesting ponds.

Department's Consideration

Water Quality Data

A common theme in the council and public submissions was the adequacy of the surface water quality data used in the assessment of water quality impacts. A number of the submissions claimed that the water quality data was out of date and inaccurately portrays a highly disturbed system, with poor water quality and ecosystem health. The joint submission by Canterbury, Hurstville and Rockdale Councils states that *"in 2015, the Cooks River Alliance Riverhealth project published its 2013-2014 Cooks River report card. This showed that the Mid-Cooks River Estuary had moved from a 'Poor' rating in 2012-2013 to a 'Fair'*

rating in 2013-2014 for both the water quality score and the overall score. Further, in both years while the overall score may be poor for the Cooks River freshwater sites, the water quality score in both years is 'Fair'."

The Department concurs with the councils that there is a need to utilise more recent data in the assessment of the potential water quality impacts of the construction and operation of the project. The Department understands that the Proponent has been collecting water quality data since June 2015. The Department considers that at least 12 months of water quality baseline data should be collected and has consequently recommended a condition to this effect.

Construction Water Discharges

The Proponent has indicated that the following measures would be undertaken to minimise erosion, sedimentation and surface water quality impacts and ensure the effective handling, treatment, and disposal and/or reuse of acid sulfate soils:

- compliance with the principles of *Managing Urban Stormwater: Soils and Construction* (Landcom, 2004);
- preparation of a Construction Soil and Water Quality Management Plan;
- stabilisation and/or rehabilitation of disturbed areas as soon as practical;
- installation of sedimentation ponds at some ancillary facilities to intercept runoff;
- works near waterways carried out in accordance with NOW guidelines;
- application of the *Acid Sulfate Soils Assessment Guidelines* (Ahern et al, 1998) and *Acid Sulfate Soils Manual* (Acid Sulfate Soils Management Advisory Committee, 1998); and
- capture and treatment of leachate from acid sulphate soils.

The Department considers the above measures as suitable for managing impacts to surface waters.

Concerns were raised about the potential of rock fracturing beneath the streams, as a result of the tunnelling operations. Stream-bed cracking would result in surface water flowing into the substrate through fissures and cracks in the rock and being lost from the affected waterway. This in turn would have implications for aquatic flora and fauna and waterway geomorphology. The Proponent considers that the risk of fracturing of stream beds is minor. However, the Department has recommended that the Water Quality Monitoring Program and Management Plan incorporate monitoring of stream beds during tunnelling and detail the contingency measures that would be implemented in the event of fracturing.

Impacts on Riparian Lands

The Department acknowledges that construction activities within riparian areas have the potential to impact not only on riparian vegetation but also embankment stability and water quality. Consistent with the recommendations of DPI (Water), the Department has recommended conditions of approval requiring the Proponent to undertake works in riparian zones in accordance with the *Guidelines for Controlled Activities on Waterfront Land* (DPI, 2012) and rehabilitate riparian lands temporarily impacted by construction with native species. The Department has also recommended that any rehabilitation works take into consideration the Wolli Creek Riparian Corridor Management Plan.

Operational Water Quality Management

Although the Proponent claims that the increase in impervious area resulting from the project would be minimal part of the entire catchment, the local impacts on the receiving stormwater systems and waterways could be more significant. The Department notes that this infrastructure has limited capacity and is unlikely to be able to effectively convey the additional stormwater created by the project. This concern has been reiterated by most councils, as was the need to be consulted with during the design of any upgraded

stormwater infrastructure. The Department has recommended a condition requiring the Proponent to undertake further hydrological and hydraulic modelling based on the detailed design of the project to determine the ability of the receiving drainage systems to effectively convey pavement drainage and to assess the impacts of the stormwater drainage on the receiving environment and for the results to be detailed in a Stormwater Drainage Report.

The potential reuse of non-potable water (groundwater and stormwater) was raised in both Marrickville Council and the City of Sydney submissions. Both councils suggested that non-potable water should be considered prior to using potable water, for uses such as irrigation of open space, including Sydney Park. The Department supports the potential reuse of groundwater as it would not only reduce the demand for potable water but it would also reduce the amount of groundwater and surface water discharged into local waterways. Consequently, the Department has recommended a condition requiring the Proponent to investigate all potential reuse options for non-potable water.

DPI (Water) raised concerns regarding the decommissioning of the existing water quality pond (WQP-2) within the Wolli Creek catchment, and recommended that this not occur until replacement water quality devices are operational. The Department supports this position and has recommended a condition that the pond not be decommissioned until replacement water quality devices are operational. The details of the replacement water quality devices are to be outlined in the Construction Soil and Water Quality Management Plan as decommissioning is likely to occur during the construction period.

Conclusion
While the Department is satisfied with the Proponent's proposed environmental management measures for managing potential erosion and sedimentation impacts and adverse effects on surface water quality, it remains concerned with the use of old and potentially out-dated water quality data in establishing baseline conditions and discharge criteria. The Department acknowledges that the Proponent is currently collecting additional water quality data and considers that this data and other more recent publicly available data collected by organisations and authorities should be used in determining baseline conditions and discharge criteria for the project.

The Department sees the benefit in the reuse of non-potable water, and has recommended the condition that the use of non-potable water be considered prior to the use of potable water. The Department has also recommended conditions relating to the management of riparian lands, spoil and the management of operational water discharges to minimise the potential impacts of the project on soils and water.

5.7. Flooding and Drainage

Issue
The project corridor traverses relatively flat urbanised land within the Cooks River catchment and the Wolli Creek, Alexandra Canal and Eastern Channel sub-catchments. The project intersects a number of waterways and drainage networks. These catchments have limited capacity and currently experience localised and mainstream flooding during rainfall events with a 20 year and 100 year average recurrence interval (ARI) (refer **Appendix L**). Modelling by the Proponent indicated that construction works and ancillary facilities may increase 100 year ARI flood levels and alter flooding behaviours across the project corridor in the vicinity of the surface works.

Construction of the project would result in loss of catchment capacity resulting in increases in flooding impacts. The loss of 12,000 m^3 of flood storage capacity associated with the construction of the Arncliffe motorway operations complex (MOC3) would lead to an increase of about 10 millimetres in flood levels during the 100 year ARI event at seven

residential properties located on the northern side of Marsh St, Arncliffe. A floor level survey would be required to determine whether inundation would be above floor level.

In addition, seven residential properties along Elouera Street and Kirrang Street, Beverly Hills are likely to experience an increase in the peak flood level of between 0.45 to 0.95 metres during the Probable Maximum Flood (PMF). Inundation of previously flood free land would generally be confined to the landscaped portion of five of the properties. Floodwaters would inundate the land bordering the other two properties (50 and 52 Elouera Street, Beverly Hills) which would experience the highest increase in flood levels at between 0.90 and 0.95 metres. A flood level survey would be required to determine if the inundation would be above floor level.

The widening of the existing M5 East at Kingsgrove is predicted to increase the peak of the 100 year ARI flood on the northern side of the M5 by 380 millimetres. Widening of the existing M5 East would also lead to an increase in flood levels in the vicinity of the Canterbury Golf Course, Beverly Grove Park and around Tallawalla Street, Beverly Hills. The commercial/industrial properties to the south of the M5 would experience minor increases in flooding, in the order of 0.02 millimetres and 0.12 millimetres during a 100 year ARI and PMF, respectively.

The raising of the Campbell Road/Burrows Road intersection at St Peters would impact local flooding patterns, leading to an increase in peak 100 year ARI flood levels by about 30 millimetres at two commercial/industrial properties, as well as in a recently upgraded section of TransGrid's Beaconsfield West Substation.

The loss of floodplain storage resulting from the construction of the Arncliffe motorway operations complex, the St Peters interchange and local road upgrades in combination with the effects of the two new road bridges across Alexandra Canal would result in an increase in peak PMF flood levels across a large portion of the lower Cooks River floodplain. While increases in peak PMF levels would generally be in the range of 10 to 50 millimetres, increases of greater than 100 millimetres would occur in an existing commercial/industrial development located on the western overbank of the Alexandra Canal immediately upstream of the Campbell Road bridge. The Proponent advises that the resulting increase in peak PMF flood levels would not translate into a significant increase in the extent of flood prone land.

Peak flood levels would generally be increased in the range of 10 to 50 millimetres on the lower Cooks River floodplain, with greater increases to occur immediately upstream of the new Campbell Road bridge (generally in the range of 20 to 200 millimetres).

Figure 21 – Figure 23 shows the predicted flood inundation due to the operation of the project.

The discharge of pavement drainage emanating from the project into local stormwater drainage systems also has the potential to result in localised flood impacts during storm events. This may occur within the upper Wolli Creek floodplain, around the Southern Western Suburbs Outfall Sewer where it crosses Cooks River at Arncliffe, along Marsh Street opposite the proposed Arncliffe motorway operations complex, and around the St Peters interchange. In particular, additional pavement areas from the widening of Campbell Street and adjoining streets at St Peters would cause a large increase in runoff within the catchment draining to Camdenville Park. The increase in runoff would be offset through provision of additional detention storage within and adjacent to Camdenville Park.

Submissions

OEH indicated that there is a need to consider the drainage design of the tunnels to ensure that they do not flood during minor rainfall events as currently occurs in the M5 East tunnels.

OEH raised concerned that sea level rise impacts on flooding have only been considered for the design life of the tunnel (until 2070) and recommended that consideration be given to the climate change related flood risks during detailed design.

Sydney Water raised that works around Alexandra Canal would require site specific environmental and heritage safeguards, which may not be currently covered by the Conservation Management Plan for the canal.

The **Heritage Council NSW** raised concerns regarding the proposed drainage discharge points into Alexandra Canal, a heritage listed item and made recommendations in regards to how works within or adjacent to the canal should be undertaken.

The **City of Canterbury Council, Hurstville City Council** and **Rockdale City Council** engaged Molino Stewart to review the EIS. The review raised concern that there is no quantification of the increase in impermeable areas or details on where overland flow paths would be altered. In addition, there is insufficient analysis of the potential for bedrock fracturing and/or subsidence within waterways.

Rockdale City Council also engaged WMAwater Pty Ltd to review the flooding and drainage aspects of the project. Issues of concern included the choice of flood model, infrastructure included in the model, and the impact of some excluded pieces of infrastructure on the predictions. The need to address the hydraulic impacts of both sea level rise and rainfall increases for 2050 and 2100 during detailed design was also raised. Council recommended that justification should be provided for the choice of model used and that the model should be rerun to include impacts associated with predicted 2050 and 2100 sea level rises, infrastructure that may alter overland flows, and current updates to Australian Rainfall and Runoff regarding climate change increases in design rainfall intensities.

Hurstville City Council noted that it had recently commissioned a draft *Hurstville Local Government Area (LGA) Overland Flow Flood Study* which defined the flood behaviour under both historical and existing floodplain conditions, while addressing possible future variations in flood behaviour. Hurstville Council recommended that the flood assessment should take into consideration the draft Hurstville Overland Flood Study.

The **City of Botany Bay Council** noted that flooding is already experienced in Gardeners Road, Ricketty Street, Bourke Street, Ossary Street, Kent Road and Coward Street at Mascot and that flood protection measures need to be integrated into the design of the project to minimise additional flooding. Council raised concern that stormwater generated from the project would drain into Council's stormwater network. However, this network would not be capable of coping with the increased flow and consequently it was recommended that the Proponent invest in the upgrade of the stormwater system.

Marrickville Council raised concern that detailed modelling of flooding impacts was not undertaken around Campbell Street and May Street, St Peters, and over the proposed increase in the size of the Camdenville Basin from six megalitres to 17 megalitres.

The **City of Sydney** raised concerns regarding quality and quantity of stormwater entering Botany Bay via Alexandra Canal and that these impacts should be assessed. It recommended that all discharges into the canal should meet the Botany Bay Catchment water quality standards. It also suggested that consideration be given to relocating the bio-retention pond at the Euston Road edge of the St Peters Interchange to free up land for active recreation uses.

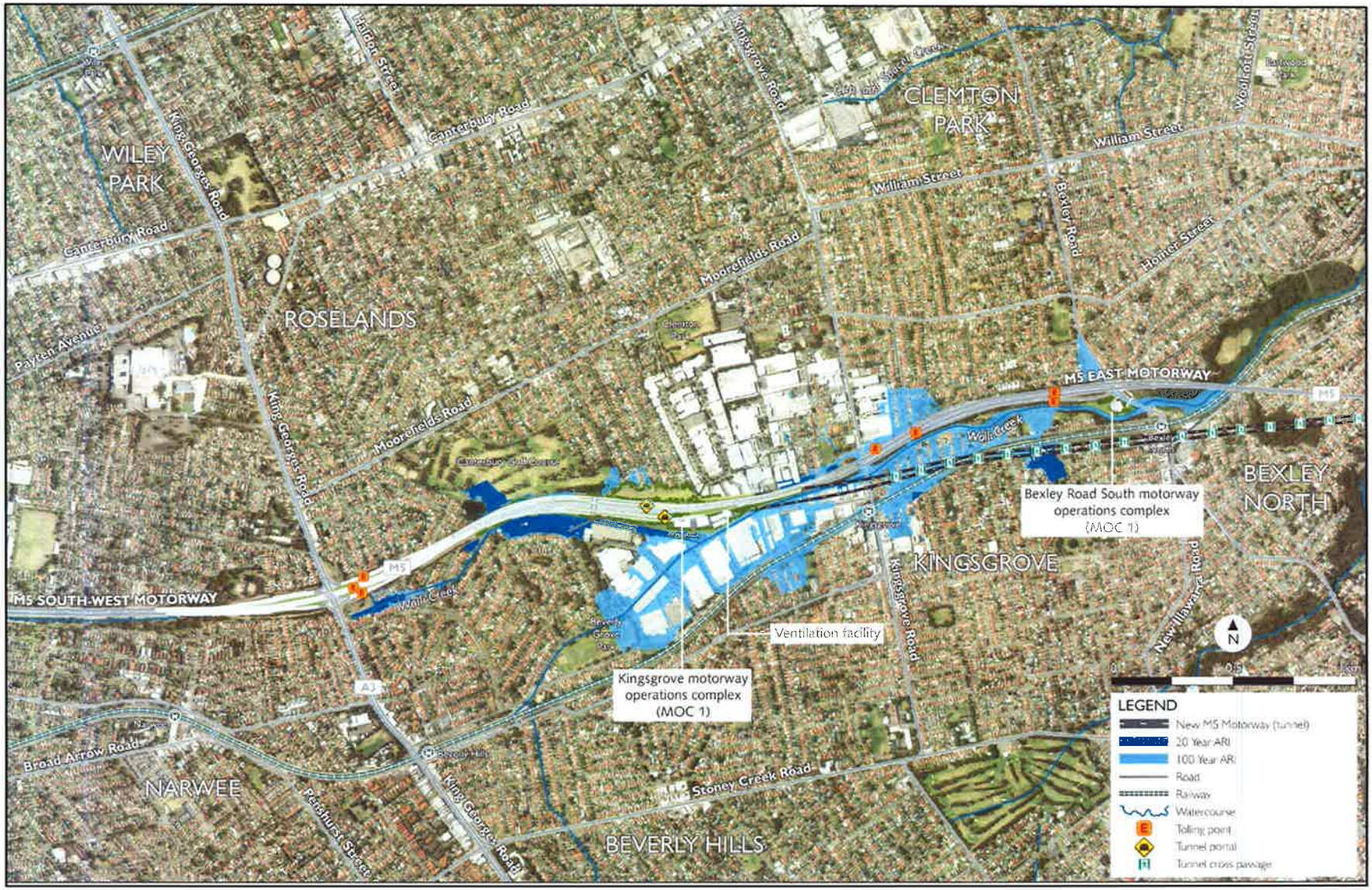

Figure 21: Impact of the Project on Flooding Behaviour in the Upper Wolli Creek for the 20 year ARI and 100 year ARI (Source: EIS)

Figure 22: Impact of the Project on Flooding Behaviour in the Lower Cooks River Floodplain for the 20 year ARI and 100 year ARI (Source: EIS)

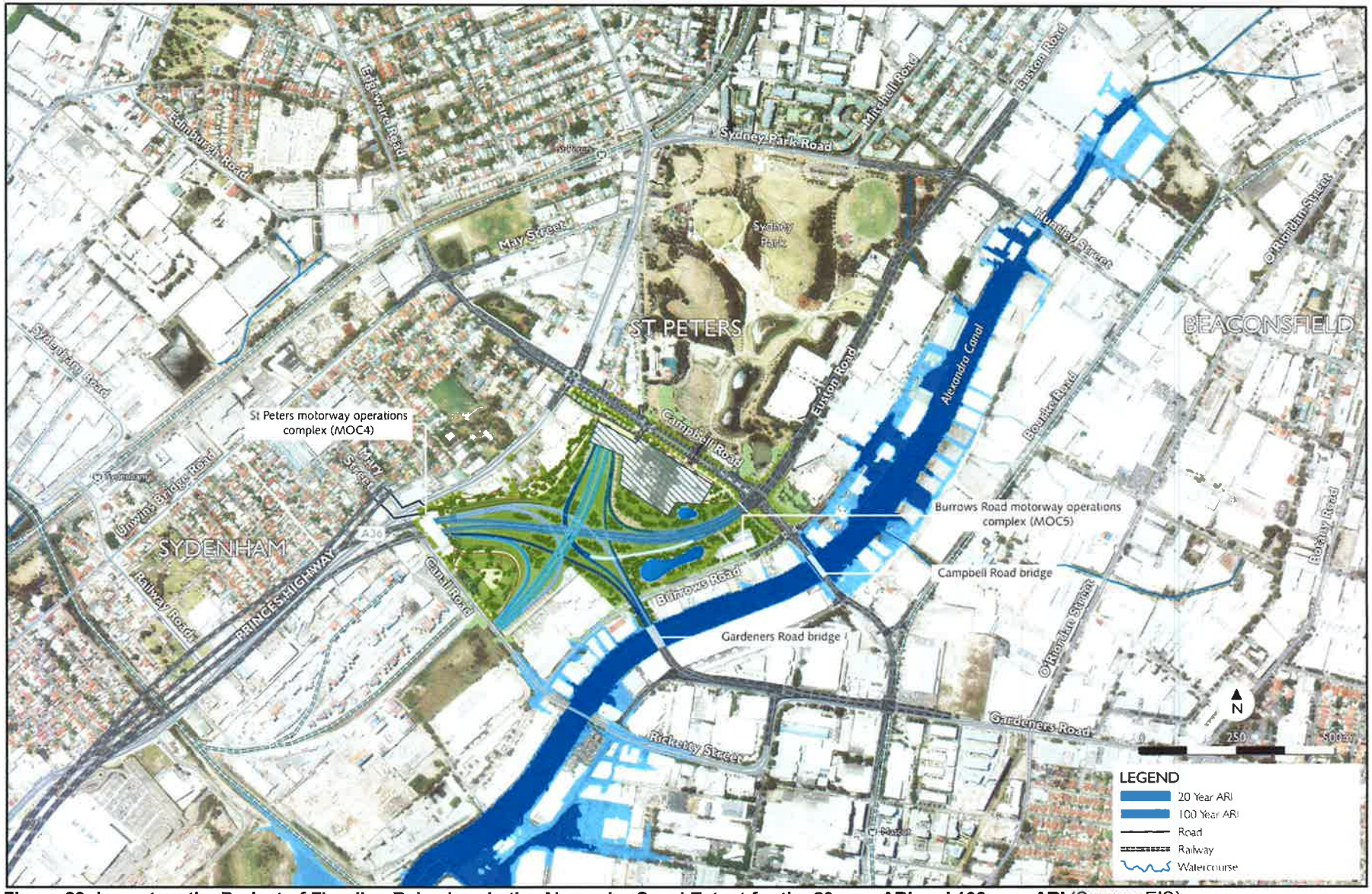

Figure 23: Impact on the Project of Flooding Behaviour in the Alexandra Canal Extent for the 20 year ARI and 100 year ARI (Source: EIS)

Public Submissions

Key issues raised in the public submissions included:

- the methodology used to assess the potential operational flooding and drainage impacts;
- flooding impacts on local streets, including Campbell Street, St Peters, Coulson Street and Mitchell Road, St Peters and Maddox Street, St Peters;
- flooding impacts around St Peters and Bexley;
- potential flooding risks to properties;
- impacts to the Camdenville Park detention basin; and
- impacts of increased stormwater flow to existing stormwater infrastructure.

Department's Consideration

The Department has considered the concerns raised in submissions regarding the use of a new flooding model. The Department has no objection to the use of a model that specially considers the elements of the project and consequent flooding impacts over an existing flood model.

As noted above, the project would result in flood impacts on 14 residential premises and a number of commercial/industrial premises as well as recreational land uses. In regards to the residential and commercial/industrial premises, the Department notes that the Proponent has not confirmed whether inundation would be above floor levels. Consequently, the Department has recommended a condition that a floor level survey be undertaken to verify if inundation would be above floor levels, prior to construction works commencing in the affected areas.

The Proponent has indicated that no measures are proposed to mitigate the impact of the project on properties that would be affected by increased flooding from the project, as all properties would continue to lie above the residential flood planning level adopted in most local environmental planning instruments, being the 100 year ARI event flood plus an allowance of 0.5 metres for freeboard.

The Department does not accept this position and is of the opinion that measures should be implemented to ensure that flooding is minimised at existing properties that were not previously flood impacted. The project should not result in increases in the level of inundation at properties where floor levels are currently inundated nor should it cause inundation of floor levels that are not currently inundated. Consequently, the Department has recommended that the Proponent prepare and implement a Flood Mitigation Strategy to ensure that the project does not worsen the existing flooding characteristics in the vicinity of the project during construction and operation. The Strategy would include the outcomes of the floor level survey. As part of the Flood Mitigation Strategy the Proponent must reconsider the proposed flood storage along Marsh Street boundary and consider incorporating the flood storage requirements into the larger Cooks Cove site and so ensure that the Marsh St roadside/frontage can be useable for potential future development

The Department has recommended a condition requiring the Proponent to assess actual flood impacts against predictions once the project is operational and to present the results in a Flood Review Report. In the event that the level and extent of flooding exceeds the Proponent's predictions, the Proponent would be required to identify and implement measures to reduce the level of flooding.

The Camdenville Park detention basin is proposed to be upgraded to provide additional capacity for increased stormwater runoff resulting from road widening works at St Peters. The Proponent has committed to preparing a drainage strategy during detailed design. In light of the concerns raised by Marrickville Council regarding the size of the detention basin, the Department has recommended that the Proponent consult with Marrickville Council

during the detailed design of the upgraded stormwater drainage and that the strategy be incorporated into the Flood Mitigation Strategy.

The Department notes OEH's and councils' concerns that the flood modelling did not adequately assess climate change increases in rainfall intensities on flood levels and durations or the impacts of infrastructure (such as noise barriers) on flooding patterns. The Department agrees that these factors should be taken into account to more accurately predict flooding impacts and has therefore recommended that the Flood Mitigation Strategy include further modelling and consideration of the climate change related runoff and flood risk from the project as well as all project-related infrastructure that may impede or alter overland flows.

Conclusion
The Department acknowledges that the project would increase flooding impacts in a number of locations adjacent to the surface infrastructure associated with the project and is of the opinion that measures should be implemented to minimise any increases in flood levels, particularly at residential and commercial/industrial premises. Consequently, the Department has recommended that the Proponent prepare a Flood Mitigation Strategy and verify flood predictions in a Flood Review Report.

The Department has also recommended that the Proponent undertaken further hydraulic modelling of the existing stormwater systems that would convey drainage from the project and document the findings in a Stormwater Drainage Report. The report would detail measures for increasing the capacity of the stormwater drainage network, as required.

5.8. Contamination

Issue
A Phase 1 Environmental Site Assessment (ESA) was undertaken by the Proponent to assess contamination risks associated with the project. It focused on five key areas where surface works would potentially disturb existing contaminated lands, as shown at **Figure** 24. The following areas were assessed as part of the Phase 1 ESA:

- western surface works, extending from west of King Georges Road, Beverly Hills to Kingsgrove Road, Kingsgrove (Project Area 1);
- Kingsgrove Road surface works (Project Area 2);
- Bexley Road surface works, located near the Bexley Road and M5 East Interchange (Project Area 3);
- Arncliffe surface works at Kogarah Golf Course (Project Area 4); and
- St Peters Interchange and local road upgrades in St Peters, Alexandria and Mascot (Project Area 5).

Sites located within Project Areas 1, 3 and 5 were identified as having a medium to high risk of contamination.

Four areas of potential contamination concern were identified within Project Area 1 including: the M5 Linear Park (noise mounds); 27-31 Garema Circuit at Kingsgrove; and 30A and 32 Commercial Road at Kingsgrove. Potential contamination included fill containing asbestos, previous and current commercial and industrial uses, market gardening, laundering and public utility works sites.

Project Area 3 included a former ammunition storage site used during World War II with the potential to contain unexploded ordinance and heavy metals, a vacant RMS owned site (forming part of the M5 Linear Park) and Kingsgrove Avenue Reserve which have the potential to contain asbestos waste, heavy metals and hydrocarbons.

Project area 5 includes several known contaminated areas including the Alexandria Landfill site and 5/5A Canal Road, St Peters and the Alexandra Canal (refer **Figure 25**).

Contamination at the Alexandria Landfill is a result of current and past activities including use as a quarry and brickworks between 1908 and 1988 and solid waste landfill between 1988 and 2002. The site has more recently operated as a waste storage and recycling facility from 2002. Contaminants of concern include lead, asbestos, polycyclic aromatic hydrocarbons (PAHs), dioxins and total recoverable hydrocarbons (TRHs).

Land at 5/5A Canal Road, St Peters adjoins the southern boundary of the Alexandria Landfill and was formerly used as a metal smelter and waste recycling facility before being filled. The Phase 2 ESA found the fill to be contaminated with heavy metals, asbestos, PAHs, polychlorinated biphenyls (PCBs), dioxins and TRHs. Soils were also assessed as likely to contain potential acid sulfate soils. The land identified at 5/5A Canal Road is included in the scope of the draft Landfill Closure Management Plan provided in the EIS.

The Alexandra Canal is a declared remediation site due to the presence of organochlorine pesticides, PCBs and metals in the bed sediments. A Remediation Order under the *Contaminated Land Management Act 1997* was issued to the landowner, Sydney Water on 10 May 2004 and requires a plan to be submitted to the EPA for approval prior to the commencement of any works which would result in the disturbance, or future disturbance, of bed sediments.

Submissions
No State Government agencies raised contamination as an issue of concern.

City of Sydney Council noted that there are numerous possible contaminated sites within the project footprint that require further investigation.

Marrickville Council recommended that the Proponent to undertake a more detailed contamination assessment prior to approval of the project.

Public Submissions
The public submissions primarily raised concern regarding the removal and transportation of contaminated land from the Alexandria Landfill site, particularly the disposal of asbestos contaminated sediments.

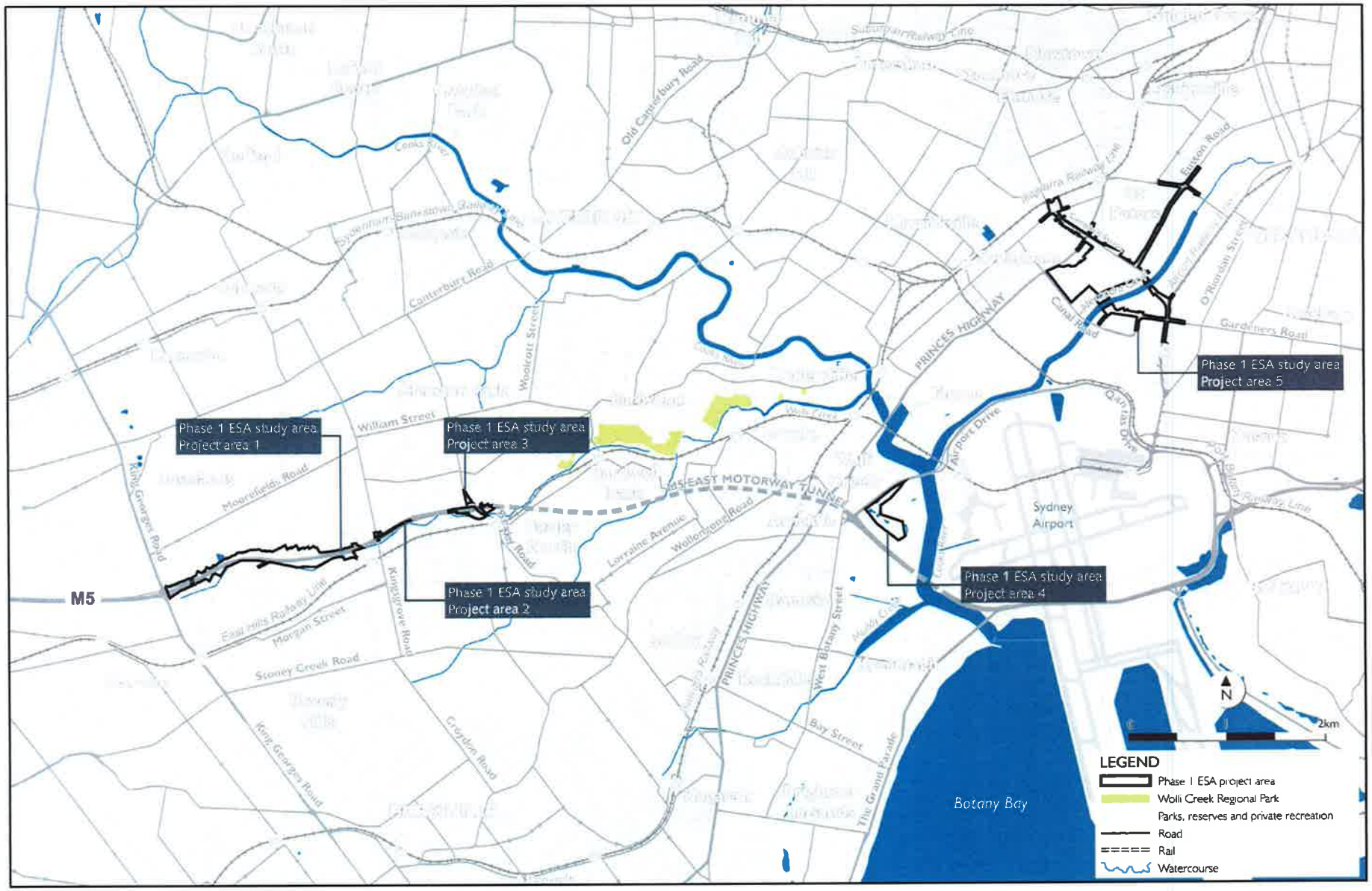

Figure 24: Phase 1 Environmental Site Assessment Study Areas (Source: EIS)

Figure 25: Contaminated Sites within Project Area 5 (Source: EIS)

Department's Consideration

The Department acknowledges the public health and safety concerns raised by the public with regards to the removal and disposal of asbestos wastes and other contaminated material from the Alexandria Landfill. The EPA is the responsible authority for the regulation and remediation of contaminated sites. The Alexandria Landfill site was acquired by the Proponent in December 2014 and is operating the site in accordance with existing EPL No's. 4627 and 12594 and conditions of consent issued by the City of Sydney Council and Marrickville Council. A draft Landfill Closure Management Plan has been prepared for the site as part of the EIS (in consultation with the EPA) and provides details on the environmental management and monitoring frameworks to be implemented during and after landfill closure. The plan would be finalised at the detailed design stage. A Phase 2 ESA (carried out by AECOM in 2015) concluded that the site did not meet the proposed motorway land use criteria. However, it was determined that the site could be made suitable for this use if appropriate remediation and management measures were implemented.

The Alexandria Landfill site, including land at 5/5A Canal Road, St Peters, would consist of road infrastructure with areas of passive open space as part of the project. The Proponent has committed to preparing a site-specific management plan as part of its environmental management measures to manage excavation activities during construction. The plan would detail mitigation measures to treat landfill gas emissions, extract and treat leachate within excavations, manage asbestos contaminated waste and protect construction personnel from exposure to potential biological, chemical and physical hazards.

An accredited Site Auditor has been engaged by the Proponent and a further Site Auditor would be engaged by the contractor to certify different stages of the closure and future management of the landfill site. The Department is satisfied with this approach and has recommended the finalised Landfill Closure Management Plan be provided to the Department prior to any construction works commencing.

The Department recognises the potential for further discovery of contaminated land across the project area during surface excavation and construction works. Consequently, the Department has recommended that the Proponent prepare a detailed Soil Contamination Report prior to work commencing which must outline the extent and type of contamination in areas identified as contaminated in the Phase 1 ESA as having a moderate to high risk of contamination. The Report is to include appropriate measures for the handling and management of contaminated soils, materials and groundwater. Should the Report determine that a remediation strategy is required, a Remediation Action Plan must be prepared outlining measures to ensure environmental and human health risks are appropriately managed. If remediation is required, the Soil Contamination Report must be accompanied by a Site Audit Statement(s) prepared by an accredited site auditor verifying that the disturbed area has been or can be remediated to a standard consistent with the intended land use. The final Site Audit Statement(s) are required to be provided to the Department and the relevant council.

It is also recommended that a Construction Contamination Management Plan incorporating an unexpected finds procedure be prepared as part of the CEMP to manage contaminated material that may be uncovered in areas not identified in the Soil Contamination Report. The Department has also recommended that the Construction Contamination Management Plan detail measures for the handling, treatment and management of hazardous and contaminated material.

New stormwater discharge outlets into the Alexandra Canal are likely to disturb contaminated bed sediments in the canal. The Department considers any impacts can be adequately managed under the existing Remediation Order which requires a plan to be prepared detailing the measures to be implemented to minimise disturbance and migration

of contaminated sediments. The plan must be approved by the EPA prior to the commencement of works, and all works must be performed in accordance with the approved plan. The Department has further recommended a requirement that the Construction Contamination Management Plan detail methodologies and contamination management measures for minimising sediment mobilisation in Alexandra Canal. The management measures must satisfy the requirements of the existing Remediation Order.

Subject to the above, the Department is satisfied the EIS provides adequate information with regards to the known presence of contamination and prior contaminating processes that have occurred. The Department's recommended conditions would ensure the project area is effectively remediated for the project's intended use and that any further contamination finds can be appropriately managed.

The Department's considerations regarding the management of leachate and landfill gas are addressed in **Sections 5.5** and **5.3**, respectively.

Conclusion
A number of known contaminated sites exist where surface works are proposed as part of the project. There is also the risk of encountering further contaminated land not previously identified in the Phase 1 ESA during construction. The Department considers the Proponent's proposed environmental management measures, the recommended conditions of approval and existing regulatory licences and approvals would adequately reduce the risk of adverse environmental and human health impacts arising as a result of exposure to contamination during both construction and operation of the project.

5.9. Urban Design and Visual Amenity

Issue
The design of the project has been informed by the principles established in the *WestConnex Urban Design Framework*, which include:

- leading edge environmental responsiveness;
- connectivity and legibility;
- place making;
- memorable identity and a safe pleasant experience; and
- a new quality benchmark.

The design of the project has been overseen by an Urban Design Review Panel, which is chaired by the NSW Government Architect. The Proponent suggests the project was designed to integrate with its surrounds whilst providing open space, landscaping and connectivity. Residual lands (primarily in the St Peters area) have been identified as open space for sites where there are no ongoing operational requirements.

Concept designs identify over 6 hectares of open space would be provided as part of the project; however, much of the space as presented is fragmented, inaccessible, and has limited strategic value.

Ventilation Facilities
The design of the ventilation facilities is influenced by technical ventilation and air quality requirements, but also external factors, such as the proximity of Sydney Airport. Building envelopes based on conservative parameters have been identified. These would be subject to detailed review and architectural treatment. Consultation would be undertaken with councils and the community on the final design, which is supported by the Department.

Western Surface Works
This area is characterised by low density residential housing with the M5 lined by industrial uses of varying scale and the M5 Linear Park at Kingsgrove. Widening of the motorway would extend into a large landscaped noise mound adjoining Beverly Grove Park, which is highly valued by the local community; the Kingsgrove motorway operations complex would be located adjoining an industrial area south of the existing motorway.

The design of the operations complex is consistent with surrounding development. Impacts to the M5 Linear Park are proposed to be mitigated with upgraded landscaping and shared paths and would integrate with the King Georges Road Interchange Upgrade project. Further consultation with the community would be undertaken in relation for the potential to reinstate the landscaped noise mounds and the application of transparent noise walls.

The existing Kindilan M5 corridor pedestrian underpass is to be extended from 26 metres to 77 metres. This extension would provide opportunity for new murals to complement the existing. However, the extension of the underpass would introduce safety and security concerns.

Bexley Road South Motorways Operations Complex
This area is characterised by existing M5 East facilities, low density residential dwellings and marks the eastern extent of the M5 Linear Park. The emergency smoke extraction facility would be located on existing parklands, but is of a relatively low scale and would have finishes consistent with surrounding development.

Arncliffe Motorways Operations Complex
This area is characterised by recreational facilities (including Kogarah Golf Club) and a mix of low and high density residential and hotel development. The area is subject to ongoing land use change associated with redevelopment of lands to the north (Gertrude Street and Innesdale Road) and the future redevelopment of the Kogarah Golf Club (Cooks Cove). The operations facilities would generally present as a three storey structure and is separated from adjoining development by a widened Marsh Street and the existing M5 Motorway and would be screened by landscaping along Marsh Street thus minimising the visual impact (refer **Figure 26**).

Figure 26: View to Arncliffe Motorway Operations Complex from the Corner of Flora Street and Marsh Street, ten years after opening (Source: EIS)

St Peters Interchange
This area is characterised by a mix of land uses including the former Alexandria Landfill and Sydney Park (itself a former landfill). This highly valued inner urban area is undergoing urban renewal and therefore an increased resident, worker and visitor population is expected. This requires consideration of the future land uses for the area and the increased delivery of recreational facilities.

The proposed St Peters Interchange is a significant visible element and the design strategy reflects this significance by adopting a number objectives to mitigate its impacts, including returning surplus land to the community as public open space, the provision of public art, and providing extensive vegetation (an urban forest) to soften the interchange and to provide a counterpoint and extension of the green open space and form of Sydney Park (refer **Figure 28**).

To further guide the design a master plan has been prepared by RMS. The implementation of the master plan would be staged with potential future projects including the M4-M5 link and Sydney Gateway. As a consequence, the majority of proposed publicly accessible open space would not be immediately available as part of this project.

The Canal Road complex has been designed to be compatible with surrounding development and does not dominate the landscape or the adjoining 'Dynamo' building. However, the Burrows Road motorways operation complex whilst not visually intrusive does not provide a compatible form with surrounding development, being suburban rather than urban in scale.

Local Road Upgrades
The local road upgrades in proximity to the St Peters Interchange to the south are in areas dominated by industrial land uses. To the north of the interchange there is an increased mix of residential development, particularly along Euston Road, Sydney Park Road and Campbell Street.

The project would result in both direct and indirect impacts to adjoining lands, including the loss of open space in Sydney Park, and the widening of local roads including Campbell Road/Street and Euston Road. To address these impacts the Proponent proposes to incorporate local streetscape landscaping (refer **Figure 27**).

Figure 27: Euston Road, with Sydney Park to the right, ten years after opening (Source: EIS)

The new Campbell Road and Gardeners Road bridges over the Alexandra Canal have been designed to respect the heritage significance of the canal by ensuring a clear span over the waterway.

Figure 28: Overview of the Proposed St Peters Interchange (Source: EIS)

Pedestrian and Cycle Access

The western surface works would result in cyclists being unable to use the motorway shoulders, which would be diverted to parallel shared paths. New and upgraded cycle and pedestrian facilities are to be provided around the St Peters interchange, with a focus on improving east west connectivity across Alexandra Canal connecting the Bourke Street cycleway to St Peters and Unwins Bridge Road. At approximately 540m, the Campbell Road pedestrian and cycle bridge would be one of the longest bridges in NSW, with resultant potential access, urban design and functionality constraints (refer **Figure 29**). This bridge and the adjoining pedestrian and cycle bridge also has the potential to introduce visual and overshadowing impacts to dwellings on Campbell Road.

Figure 29: Campbell Road Pedestrian and Cyclist Bridge, ten years after opening (Source: EIS)

Temporary pedestrian and cycle access diversions during construction are to be managed through a Construction Traffic Management and Safety Plan.

Submissions

Community submissions raised a range of concerns in relation to the scale and associated visual impacts of civil and support infrastructure. In this respect, the impact of the St Peters interchange and associated road works were identified as having significant urban design and landscape impacts, including impacts to Sydney Park and landscape character impacts on adjoining areas and villages. Landscaping and vegetation impacts at Beverly Grove Park were also identified.

Council submissions identified the poor integration of the project with surrounding areas and land uses. Of particular note is that the design of the St Peters interchange and support facilities is inefficient in its delivery of useable and accessible open space and that consideration should be given to other land uses of community benefit. The impact of significant road infrastructure surrounding open space has also been raised, particularly in relation to health and amenity impacts.

The **Heritage Council** considers that the design could have been more sympathetic in its response to the scale of the current urban setting and existing patterns of development.

In response to submissions the Proponent identified that it would consult with the NSW Heritage Office in relation to the Alexandra Canal bridge crossings and the St Peters interchange; and that opportunities to minimise overshadowing and visual impacts to the Campbell Road terraces would be further explored during detailed design.

Whilst submissions noted the provision of enhanced cycle and pedestrian facilities, they identified the lack of strategic planning and assessment of pedestrian and cyclists needs. Submissions raised concern about the safety and efficiency of proposed facilities and the impact of significant road infrastructure on pedestrian and cyclists safety and amenity. In

response to submissions a number of cycling and pedestrian facility changes were made, including the provision of a continuous separated pedestrian and cycle path between Mascot Town Centre to Camdenville Park.

Department's Consideration

As part of its assessment, the Department engaged urban design and engineering specialists form ARUP to inform and review the Department's assessment of the urban design and landscaping aspects of the project. The ARUP review identified key interventions to address both strategic and local needs and impacts. These interventions have been considered by the Department in its assessment and are addressed as part of this consideration and the development of recommended conditions. In addition, ARUP identified broader considerations, which while not forming part of the project, have been considered in the Department's assessment. The full review report is provided in **Appendix M**.

With the exception of the St Peters interchange (and the adjoining local road network) and the western surface works, the Department considers that the design of civil infrastructure and support infrastructure has been located and is of a scale that would not have a significant impact on adjoining areas. However, the Department does recommend that detailed design reduce the footprint of structures where possible. It also acknowledged that the design would be further refined (including ventilation facilities) and informed by the expertise of an enhanced and multi-disciplined Urban Design Review Panel, which would include Council representation, and be undertaken in consultation with the community.

The Department has considerable concerns with the proposed access, landscaping and open space and land improvements that are to be delivered by the project. The design lacks an integrated land use and transport approach and strategic foresight in addressing the impacts of the project and instead has delivered a project that provides open space in a retrospective and fragmented manner. The project fails to fulfil its design principles, limits good urban and community outcomes and long term urban renewal opportunities.

Regardless, the Department considers that the project can be amended to integrate into the landscape with improved public benefits by:

- improving the quality, accessibility and functionality of public open space;
- better connecting regional active transport networks through the public realm; and
- making more likely the future activation and renewal of adjoining areas.

Western Surface Works

The key issue from operation are the impacts to parks and recreational areas that provide a buffer between the M5 East motorway and neighbouring developments. The area is also visually delineated by the existing noise mound between the motorway and recreational spaces.

The EIS identified impacts to this area and to receivers associated with Glamis Street and adjoining park users to be low. The Department does not agree and considers that impacts would be high due to a reduction in park size (10.7 ha), the removal of the noise mound and the significant impacts on the Beverly Grove Bushland. Whilst the Department acknowledges the impacts would be partly addressed through landscaping, it considers that the Proponent has not adequately addressed these impacts, particularly at a local level, where the loss of recreational parkland and landscaping of high visual value has not been addressed.

In response, the Department recommends the implementation of a M5 Linear Park Enhancement Sub-Plan which would consider park users and their needs, measures to enhance active uses and the recreational value of the park (such as the provision of exercise equipment), and enhanced landscaping. This would be prepared in consultation with

affected communities and local councils. In addition, the Department has recommended that the Proponent, during detailed design, minimise land take impacts where feasible, which would reduce impacts associated with the footprint of the operations facility at Kingsgrove. This condition would apply to the whole project.

The Department also queries the value of providing transparent noise walls in this vicinity, which are not visually consistent with the existing noise mound and landscape character of the area (refer **Figure 30**). The Department notes that noise walls in this area would be subject to further consultation with the community and considers that the road user experience should not compromise the local landscape character and has recommended a condition to this effect.

Figure 30: Proposed Transparent Noise Walls (Source: EIS)

While the Department agrees that the visual impact at the Kindilan underpass is moderate, it is concerned that the safety risks associated with extending the underpass from 22m to 77m have not been appropriately considered. The Proponent states that all publicly accessible parts of the project have been designed with the aim of ensuring safety and security; however, the Department considers that the underpass should be subject to further design refinement in relation to Crime Prevention Through Environmental Design principles, and in particular measures to activate the space and the provision of active surveillance.

Bexley Road South Motorways Operation Complex
The complex is located in an area that is compartmentalised by Wolli Creek and large infrastructure elements, including the M5. The visually affected area is primarily restricted to Bexley Road, Wolli Creek and Gilchrist Park, with direct impacts restricted to a relatively isolated and screened grassed area, which forms part of the M5 Linear Park. Accordingly, the greatest visual impacts are to pedestrians and cyclists using the Park pathway (current access arrangements would be maintained).

The site would be transformed from a 'green gateway' to the M5 Linear Park to a relatively small entry point. Whilst the Department notes this impact, it is satisfied that the design of the complex, its location in a relatively screened area and the proposed landscaping would reduce the impact. Whilst the loss of the parkland and passive recreation use has not been addressed at a local level, but this would be addressed in the recommended M5 Linear Park Enhancement Package.

Arncliffe Motorways Complex
The complex is located within Kogarah golf course. Views across the site are limited due to the relatively flat topography and screening from vegetation and noise barriers associated with the M5 East corridor. Views of the project are available from the high density residential development to the north of the site, development which also provides context to the height of the ventilation facilities. However, these views are not significantly impacted and the

Department is satisfied that urban design impacts can be appropriately addressed through the detailed design process established in the Urban Design and Landscape Plan.

St Peters Interchange and local road upgrades
The Department acknowledges that the interchange is located in an existing industrialised area and has been designed so that its visual impacts are minimised through the shielding of adjoining development, proposed landform and landscaping. However, the adopted design is not reflective of an inner urban environment and does not address the projects impacts on the productive use of land, place, community amenity and demand for usable open space and recreational facilities (refer **Figure 31**).

The Proponent has argued that a significant benefit of the project in this area is the provision of open space. However, the Department notes that the Proponent has not comprehensively considered the quality, safety and function of the open space, or sufficiently acknowledged the land use interface impacts with adjoining major road infrastructure.

Figure 31: Widened Campbell Road Showing Severance and Interface Impacts to Sydney Park (Source: EIS)

The quality and function of open space can be influenced by a range of factors, and as part of its assessment, the Department has considered both the accessibility, safety and useability of open space. A large portion of the proposed open space is not easily publicly accessible or functional and as a result it is argued that the project would not result in a gain of useable open space.

Improvement to address both project and strategic land use planning needs are required, which would see greater accessibility and open space demand from surrounding urban renewal and associated land use change. This need is consistent with the objectives identified in the City of Sydney's Southern Employment Lands Strategy, including improving the public domain and the provision of public infrastructure (open space, footpaths, cycle ways).

The ARUP advice identified a range of interventions that would address these strategic and local impacts, and which would assist in addressing the challenges of public open space quality, accessibility and the delivery of public benefit. The Department has considered these interventions and combined with its own considerations, has recommended the following actions (and those associated with pedestrian and cycle access) be undertaken by the Proponent:

1. The provision of a land (park) bridge over Campbell Road to connect open space. The land bridge would connect the existing southern portion of Sydney Park with the identified open space area located to the north of the St Peters Interchange. The land bridge would assist in presenting Sydney Park as continuous open space over a significantly widened Campbell Road, would address severance impacts, improve the

accessibility to and use of open space, improve community amenity and the final quality of the open space.

The ARUP report recommends a land bridge be provided at 100-120m wide. A land bridge of this width would allow the open space on the northern side of the St Peters Interchanges to be experienced as an extension of Sydney Park, would allow for a greater increase in the overall size of the open space to be provided and allow for a greater diversity of landscaping and plantings improving the park environment.

However, the Department is also aware that the public benefit of such a structure needs to be considered against its cost and the relative isolation of the southern section of the proposed parklands, which would predominately remain surrounded by an industrial environment and the motorway interchange. The Department also acknowledges the need for additional active recreational facilities in the region, and considers that these would form an appropriate use for the parkland to be provided south of Campbell Road, reducing the need for the provision of contiguous open space.

The Department has therefore recommended the provision of a land bridge through a Campbell Road Crossing Sub-Plan that provides access to the active recreational facilities including associated amenity facilities. The final design of the land bridge must satisfy a number of specific design objectives and parameters related to the quality and accessibility of the space. The land bridge must also be set back at least 35m to the west to the remaining terrace houses in Campbell Road and be not less than 20m in width.

The Department acknowledges concerns from the City of Sydney about air quality at the proposed playing fields. The Department is satisfied that the predicted air quality concentrations at the site are appropriate for recreational uses.

These recommendations will be considered through the development of a Campbell Rd Crossing Sub-Plan and a St Peters Interchange Recreational Area Sub-Plan, which will be prepared in consultation with council and the community. However, it should be noted that these areas are designated as potential construction sites for Stage 3 M4-M5 Link. The conditions therefore allow for implementation to occur up to four years after operations begin for this project;

2. Create an enhanced green link between Sydney Park, Simpson Park and Camdenville Park. This would facilitate a more legible and navigable open space network and the provision of safer and quicker access to Sydney Park for the St Peters community. This would involve maximising the provision of open space and landscaping to the northern side of the Campbell Street, and improving the quality and functionality of pedestrian and cycle facilities. It would also provide an opportunity to rationalise and enhance replacement parking provision. These matters would be addressed in the proposed Campbell Street Green Link Sub-Plan.

3. Minimise lane widths to reduce the land use take of adjoining lands, particularly along Euston Road thus allowing for an enhanced pedestrian and cycle route along Euston Road through separation and landscaping improvements.

4. The Department notes the need to maintain access to properties along Albert Street, Alexandria but considers that the provision of this street be reviewed and rationalised to improve the provision and servicing of proposed open space, including active recreational areas.

5. To enhance Sydney Park, the Department also requires that the Proponent work with the City of Sydney in updating its Plan of Management including a focus on the eastern edge of the Park along Euston Road.

These recommendations and associated sub plans are to be addressed in the preparation of a comprehensive Urban Design and Landscape Plan. The Plan would be prepared in consultation with key stakeholders, Councils, and the community and would be approved by the Secretary.

The timing and provision of these enhancements will be influenced by the future construction requirements of associated projects and future potential stages of WestConnex. Whilst the Department acknowledges the need to use this space, it considers that the proposed and recommended works are associated with impacts of this project and be undertaken under this SSI approval. A condition to this effect has been recommended.

The Department acknowledges the design benefits identified by the City of Sydney in relocating the motorways operations facility to the south west corner of the site, fronting the Princess Highway. The relocation would also assist in minimising fragmented open space, including space that potentially presents as a user safety risk. However, the Department also acknowledges the cost and engineering constraints associated with the relocation of the facility.

To address safety concerns relating to the poorly observed and isolated open space, behind development fronting Princess Highway, the Department has recommended that this area not be accessible and be appropriately landscaped.

Pedestrian and Cycle Facilities

The Department considers that both this project and the King Georges Road upgrade would have a detrimental effect on the M5 cycle corridor and the project does not adequately address these impacts at a regional level. The Proponent has not delivered the Wolli Creek pedestrian and cycle route, which formed part of the M5 East approval, due to an inability to access the rail corridor. Consequently, the Department considers it reasonable that the Proponent reinvestigate the delivery of the M5 East Green Link between Kingsgrove and Mascot. It is noted that the cycle ways between King Georges Road and Bexley Road are to be upgraded as part of the King Georges Road intersection upgrade project.

The Department considers that proposed pedestrian and cyclist facilities should be reviewed as part of a broader strategy that would inform the final design and extent of facilities. It is required that this strategy be consistent with local and regional cycle and pedestrian plans, current design and safety standards. A condition to this effect has been recommended.

In the Campbell Street and Campbell Road corridor, the Proponent has proposed a significant pedestrian and cyclist east west bridging structure. While this structure is a response to a highly motorised environment, it lacks connectivity, particularly in relation to future pedestrian and cycle connections along Alexandra Canal and Burrows Road. Accordingly, the Department has recommended connecting the bridge via the land (park) bridge and providing at grade connections at Burrows Road and to the Alexandra Canal. The Department also considers that any elevated structure should also be designed to address safety, access, network and useability constraints.

Significant traffic increases outside of the project footprint, including along Euston Road, would further degrade the cycling and pedestrian environment. The Proponent should improve its response to these impacts, particularly in relation to cycle safety, connectivity and facilities. As part of the recommended cycle and pedestrian review, the Proponent would be required to upgrade cycle facilities identified in cycle strategies and urban renewal plans

within 1000 m of the St Peters interchange. This would include additional facilities to address project impacts.

To address pedestrian amenity impacts associated with the increased traffic affecting streets adjacent to the project, the Department also recommends that pedestrian facilities along arterial roads within 1000 m of the St Peters Interchange be upgraded.

Construction Impacts
The primary construction impacts of the project relate to construction areas and compounds that are in close proximity to residential receivers and which impact on open space, in particular the Kingsgrove North construction compound and the Sydney Park construction compound. Impacts relate to temporary loss of open space, visual barriers created by hoarding, noise walls and compound facilities, and the impacts of lighting. To address these impacts the Proponent has recommended a comprehensive suite of environmental management measures, which the Department supports. However, the Department has concerns in relation to privacy of adjoining residences and the safety of pedestrians and cyclists on relocated and confined paths and has recommended conditions to address these matters.

Conclusion
While the Department acknowledges that the Proponent has attempted to minimise the impacts of the project from an urban design and landscape perspective, the approach lacks integration particularly in relation to urban uses, access, safety and the provision of functional open space. To address this, the Department has sought changes to the project, which would assist in addressing these impacts and maximise the public benefit of the project. This includes actions that:

- improve the quality, accessibility and functionality of public open space;
- better connections of local and regional pedestrian and cycle networks; and
- future activation and renewal of adjoining areas.

These actions are focused in surface work areas, particularly at Kingsgrove and St Peters, including improvements to pedestrian and cycle access and, the M5 Linear Park and Sydney Park. To improve the community input into the detailed design process, it is also recommended that the proposed Urban Design Review Panel include council representation and that detailed urban design plans be undertaken in consultation with stakeholder groups and the community.

5.10. Land Use, Social and Economic Considerations

Issue
The linear nature of the project would result in socio-economic impacts to a range of local communities, social infrastructure, open spaces and businesses. The majority of these impacts would occur within the immediate vicinity of surface construction works and operational infrastructure at Kingsgrove, Arncliffe and the proposed St Peters Interchange. A summary of the key socio-economic impacts is presented in **Table 22.**

The project would generate 4,390 full-time equivalent jobs (direct and indirect) during construction. The project would also contribute $679 million to the Gross State Product (GSP) with an anticipated $1.8 billion estimated total benefit per year of construction as a result of construction expenditure.

Economic benefits are also expected during operation with the creation of 116 full-time equivalent jobs (direct and indirect). Monetary benefits during operation include a total value

contribution to the GSP of $18 million with an anticipated $44 million total economic benefit (direct and indirect) per year of operation.

Submissions
NSW Health raised the human health and social concerns as a result of property acquisition and noted further support services should be implemented.

City of Botany Bay Council raised issues relating to pedestrian and cycle path connectivity, impacts on the Mascot Town Centre Precinct and proposals to alter land uses in the vicinity of the project. It also raised concerns with intended uses of residual land, discrepancies in identified social facilities such as child care centres, the need for the Sydney Gateway link, parking impacts, and amenity impacts due to traffic generation.

City of Sydney Council identified a number of issues of consultation with impacted communities, the impacts of local traffic changes and the impacts to Sydney Park including the proposed City Farm at the southern end of the park.

Marrickville Council noted that it is liaising with RMS and SMC regarding alterations to the King Street and Sydney Park Road intersection (King Street Gateway project) to improve traffic conditions along King Street and suggested such alterations should be completed prior to operation of the project. In addition, it raised issues with the level of consultation and consideration of issues such as equity, change management and sustainability.

Leichhardt Council's submission focused predominantly on the strategic justification for the proposed project and raised the lack of public transport alternatives, impacts on land uses such as the future Bays Precinct urban renewal project and the economic costs of the proposed project.

Public Submissions
Key issues raised in the public submissions included:
- adequacy of social and economic impact assessment and financial justification;
- compulsory acquisition, demolition of properties and displacement of residences and businesses;
- social impacts to remnant communities and overall health and wellbeing impacts resulting from acquisition and amenity impacts;
- impacts to property values and structures;
- impacts to social facilities, amenity, accessibility and local connectivity; and
- impacts to sense of place and culturally significant locations and loss of open space.

Department's Consideration
The Department acknowledges that a major motorway in an established urban context would cause social and land use impacts and can inhibit the development and preservation of a community's sense of place. The majority of the project would be below ground and as a result most of the social and land use impacts are limited to the surface works, minimising the long-term impacts of the project. In this regard, the Department considers a tunnel to be an optimal design outcome by providing road transport infrastructure with the least impacts on land use and socio-economic outcomes.

Methodology
Highly urbanised inner-city environments, such as those along the alignment of the project, contain diverse and overlapping communities and land uses that cannot be adequately captured through the study of the statistical areas presented. The fine grained definition of impacted precincts or study areas, coupled with comprehensive consultation with affected communities is best practice for social and economic impact assessment and assists in

understanding the impacts to respective communities. As such, the Department has recommended the Proponent prepare and implement a Community and Social Management Plan which requires the Proponent to undertake further spatial precinct-based analysis of social impacts, including comprehensive consultation with affected communities and stakeholders. The preparation and implementation of this Plan would ensure further spatially-relevant social and economic impacts are identified, in consultation with affected stakeholders and targeted and appropriate mitigation can be provided and their effectiveness monitored. The Plan is also to be prepared in consultation with the relevant Council.

Land Use and Acquisition

Residential and Business Acquisition

While land acquisition is an unavoidable outcome of linear transport projects in urbanised environments, the use of a tunnel design with relatively limited surface footprint is the best approach. Regardless, the surface acquisition required for the project is substantial and would result in significant social and economic impacts to the local community and businesses.

The Department has identified that approximately 15-20 per cent of the residential properties to be acquired are rentals and that all displaced residents and tenants have had access to the "WestConnex Assist" help line, which provides support services to people impacted by acquisition processes and relocation. The Proponent's environmental management measures set commitments to manage acquisition impacts, including access to financial advice, independent social support, assistance in identifying alternative properties and first language support where required. The Department is satisfied with these proposed management measures, however has recommended that the WestConnex Acquisition Assistance Line remain operational for a period of six months following completion of the final acquisition to ensure any residual issues are resolved.

Remnant Houses on Campbell Road

The Department has considered the issues raised by City of Sydney regarding remnant properties not being acquired on the northern side of Campbell Road near its intersection with Euston Road. Based on its assessment, the Department considers that the change in impacts is not considered significant enough to warrant additional acquisition of these properties. The Department considers the amenity that Sydney Park offers to the rear of these buildings would continue to remain desirable. The Department is reluctant to generate additional acquisition for this project where current levels of acquisition, and its social impacts, have and would continue to be experienced by acquired residents and the community.

Table 22: Summary of Potential Social, Economic and Land Use Impacts During Construction and Operation of the Project

Issue	Construction Impact	Operational Impact
Noise and Vibration	• Proximity of receivers to construction works.	• Improvements between Beverly Hills and Kingsgrove. • Potential increased impacts in areas adjacent to St Peters Interchange.
Access and Traffic	• Access and local traffic re-configurations. • Temporary road closures. • Removal of approx 620 on-street and 71 off-street parking spaces. • Temporary relocation of 2 bus stops. • Temporary closure of 3 bus stops.	• Improved network performance and travel times. • Permanent loss of 340 on-street and 16 off-street parking spaces. • Provision of 34 on-street and 26 off-street parking spaces on Campbell Street west of the Princes Highway in addition to the reinstatement of 280 on-street and 55 off-street parking spaces. • Access changes to business premises. • Reinstatement of all bus stops relocated/removed during construction.
Air Quality	• Increased dust next to construction works.	• Air quality compliant with standards.
Property Acquisition	• Acquisition of 69 residential properties (66 full acquisition and three partial acquisition). • Acquisition of 47 commercial properties (23 full acquisition and 24 partial acquisition). • Full acquisition of two utility provider's land. • Partial acquisition of four utility provider's land.	• Displacement of an approximately 130 to 200 residents, with the greatest impact around Campbell Street/Road. • Opportunities to return residual land in the future.
Access to Public Spaces and Community Facilities	• Temporary acquisition or leasing of open space at the M5 Linear Park (2.6 ha), Sydney Park (0.55 ha), May Street Reserve (0.09 ha) and Camdenville Park (1.05 ha). • Access and local traffic conditions altered. • Connectivity to public spaces may be temporarily impaired.	• Permanent acquisition of open space at M5 Linear Park (10.7 ha); Sydney Park (0.2 ha); May Street Reserve (0.09 ha) and Camdenville Park (0.15 ha).
Connectivity and Cohesion	• Severance of communities around surface infrastructure. • Restrictions to pedestrian and cyclist access around surface works.	• Severance of communities around surface infrastructure or where roads are widened or intensified such as Campbell Street, west of Princes Highway and Euston Road, north of Sydney Park Road. • Pedestrian and cyclist connectivity improvements along Campbell Street, east of Barwon Park Road through to Bourke Road. • Improved regional connectivity and network efficiency for commuters and freight tasks within the Greater Metropolitan Sydney Region.
Retail and Business	• Temporary alterations to business access. • Reduction in on- and off-street parking adjacent to or in areas servicing commercial and/or industrial land uses.	• Reduction in passing trade. • Loss of on-and off-street parking.
Amenity	• Reduced amenity around surface construction activities.	• Adverse visual, noise and traffic impacts for residents adjacent to surface infrastructure or where road usage intensifies.

Economic Impact and Business Property Acquisition

The Department accepts that there would be economic benefits experienced as a result of construction activities and resourcing which would aid specific sectors of industries and communities. It is also anticipated that road efficiency gains would improve freight and commuter transit times delivering additional operational economic benefits to the Sydney region and the State. The Department considers that the mitigation measures committed to by the Proponent, including the facilitation of business stakeholder forums to inform detailed design, would provide substantial consultation frameworks and management of impacts to businesses, particularly in regards to accessibility and amenity.

The Department considers there is scope to improve the amenity and access to Sydney Park which would benefit residents in the local area. To achieve this, the Department has recommended the Proponent investigate the potential to integrate land that is current occupied by businesses along Euston Road into Sydney Park.

Residual Land Management

The Department notes the Proponent's intention to return residual or surplus acquired land once construction is completed. This return of land would present opportunities for redevelopment and enhancement of land uses along the project corridor, including the provision of additional open space. The return of residual land is strongly encouraged, however a decision making framework is required to manage the return. The Department has recommended that the Proponent prepare and implement a Residual Land Management Plan which identifies all residual land, provides timelines for its return, and identifies the proposed uses for that land.

Alexandria Landfill

The Department considers the change in land use at the landfill site is an acceptable transition away from waste management to transport usage. The change in use provides an opportunity for the contaminated site to be remediated, capped and managed. This would further assist in creating optimal use of land improving overall amenity and connectivity.

Sydney Park

The Department acknowledges the issue raised by City of Sydney regarding the proposed City Farm in Sydney Park. The use of this section of the park for inner-city urban farming and education should be protected as much as is possible. However, as discussed in **Section 5.9**, the Department has recommended the Proponent be required to provide a land bridge across Campbell Road at the southern end of Sydney Park. Such a provision may impact the planned location of the City Farm. The Department considers the strategic benefits of providing such an accessibility improvement to Sydney Park, as well as additional open space, would provide significant benefit. Consultation protocols as provided through the recommended Urban Design Review Panel and the Urban Design and Landscape Plan would provide sufficient channels for the Proponent and Council to seek mutual delivery of both projects or other agreeable outcomes.

Kogarah Golf Course

Kogarah Golf Course is private open space and it would experience a reduction from 18-holes to a 9-hole course during construction and operation which would reduce the golf course's capacity as a social facility. However, the Department is aware a mutually acceptable agreement has been entered into between the Proponent and the owners of the golf course.

Existing Planning Proposals

The Department acknowledges the concerns of the City of Botany Bay in regards to impacts to the Mascot Town Centre Precinct and other existing planning proposals in the LGA. The City has indicated potential increases in apartments and car parking spaces by 2,643 and

4,028, respectively. The Department is cognisant of the growth and development pressure being experienced by City of Botany Bay and other local councils in the area and this is reflected in the number of medium to high density residential developments currently proposed or being constructed.

The Department has considered the City of Botany Bay's concerns regarding land subject to a planning proposal (PP-2015-BOTANY-003-00) to the north west of the Mascot Town Centre Precinct and has reviewed the relevant documentation for the proposal. The Department does not consider there to be any substantial direct impacts from the New M5 project. Although the project may result in increased road traffic to and from the locality.

The Department notes the concerns of the City of Botany Bay regarding the potential increases in traffic demand and intensification along both Gardeners Road and Ricketty Street, both of which move through the Mascot Town Centre Precinct. In acknowledging the commitments already made by the Proponent, the Department seeks to bolster the approach by recommending the Proponent prepare and implement an Operational Road Traffic Network Performance Review Plan to ensure a balanced integration between land use and transport planning is achieved while managing impacts caused by the proposed project.

Cohesion and Amenity

Submissions received during the exhibition period indicate strong cohesion amongst resident communities along the project alignment. The Department notes the concerns raised regarding social impacts on the remaining communities once acquisition and property demolition is complete. The Department has recommended the Proponent investigate opportunities to implement community cohesion programs as a part of the Community and Social Management Plan including local grants, active community involvement and enhancement of open space.

The Department also acknowledges the concerns raised by City of Sydney, the Newtown Precinct Business Association and the local community regarding potential increases in the use of King Street for rat-running or for the potential implementation of clearways and other traffic flow enhancing measures should they be required in the future.

The Department acknowledges the King Street Gateway project is currently being discussed between RMS, Marrickville Council and the City of Sydney. The King Street Gateway project has not advanced to a point that the Department can recommend immediate inclusion into the New M5 infrastructure at this stage. As such, the Department has recommended the Proponent ensure the construction of the New M5 integrates with the King Street Gateway project and that consultation with the relevant councils is undertaken. The Department is satisfied that the mutual delivery of these two projects, as well as the requirements of the Road Network Performance Review Plan would ensure any impacts to King Street are managed.

The Department considers the proposed increase in capacity and traffic flows on Euston Road to be substantial and would impact on the community cohesion and the amenity of residences adjacent to this road. However, the emphasis of this north-south corridor catalysed by the interchange design would provide amenity improvement opportunities to surrounding areas. The Department is satisfied that the provisions within the Community and Social Management Plan, as well as the Urban Design and Landscape Plan, would identify any opportunities to offset these amenity impacts in direction consultation with affected communities.

The Department recognises the significant impact to the amenity of residents located in Kingsgrove adjacent to the proposed C1 Construction Compound for up to four years during

construction. While the location and intensity of use of this compound is necessary, the Department considers there is scope to provide additional protection to the amenity of this community and has recommended that access to the compound via Rosebank Avenue, Armitree Street, Glamis Street or Garema Circuit be prohibited.

In addition, the Department has recommended a condition that operational noise attenuation measures be applied prior to the commencement of construction activities at this site and others. Noise, vibration, stockpile and dust management would also be strictly controlled through the recommended construction environmental management sub-plans. The Department is satisfied that the operational impacts to the amenity of residents at this location can be effectively managed through ongoing consultation regarding the design outcomes.

Social Infrastructure/Facilities

The Proponent's assessment has indicated that direct impacts to any social facilities are not expected as a result of the proposed project except for open space including Sydney Park, M5 Linear Park, Camdenville Park and May Street Reserve. The Department's consideration of open space impacts is presented in **Section 5.9** of this report. However, the Department acknowledges the community and local council concerns regarding the impacts to social facilities such as child care centres and local schools.

The dominant forms of impacts to these social facilities are likely to be changes in parking and access and amenity impacts. The Department is satisfied that the construction environmental management sub-plans would provide adequate processes and safeguards to effectively manage impacts to accessibility and amenity of these facilities.

The Department notes the collaborative approach being undertaken between the Proponent and Marrickville Council which would result in the provision of a BMX Bike Track for a redeveloped section of Camdenville Park. The Department is supportive of such approaches and encourages the collaboration to continue. The Department has recommended that the provision of such facilities be included in the Community Cohesion Program required as a part of the Community and Social Management Plan.

Parking, Connectivity and Accessibility

On and Off Street Parking

The Department acknowledges the concerns raised regarding parking. As shown in **Table 23**, the project would result in the loss of approximately 620 on- and 70 off-street parking spaces during construction and the permanent loss of approximately 340 spaces during operation. This is considered significant, particularly where local businesses, residents and social facilities (such as schools and child care centres) are dependent on such parking. Availability would be further affected if construction personnel utilise the remaining parking stock during construction to access compounds and surface works.

Residential land uses that may be impacted would include Euston Road north of Sydney Park Road. Industrial and commercial land uses that may be impacted by the loss of parking spaces would be along Euston Road, Burrows Road, Gardeners Road and in Mascot. Loss of parking spaces in these areas may also impact on accessibility and attractiveness of open and green spaces such as Sydney Park. The removal of on-street parking along local roads near their intersections with Campbell Street, west of the Princes Highway, may also impact on accessibility of residents and users of the St Peters Public School and place increased parking pressure on streets surrounding the school. The Department notes that the Proponent intends to provide 34 on-street and 26 off-street parking spaces along this area of Campbell Street which would improve parking accessibility along this road where on-street parking was previously non-existent.

While the Department acknowledges that parking demand in some areas may decrease as a result of property acquisitions or other land use changes, it is of the opinion that a road infrastructure project of this scale and scope should avoid, where possible, significant losses of parking. The Department considers that the net loss of on- and off-street parking during both construction and operation have not been adequately assessed as the Proponent has not determined current usage rates nor have the surrounding streets been analysed to determine whether they could absorb the additional demand due to parking stock loss. The Department has recommended the Proponent prepare and implement a Construction and Operational Parking and Access Strategy which would include:

- parking surveys and consultation in affected areas to determine levels of demand and the affected users;
- details on the measures to be implemented to avoid a significant losses in on- and off-street parking during construction and operation, including strategies for the staged management of measures to ensure that not all temporary losses of parking occur concurrently within a locality;
- measures to avoid significant losses of parking once operation commences (compared to pre-construction stock). These measures should also include a collaborative approach to parking regulation and permits with local councils.

The Department has also recommended measures to reduce construction personnel use of remaining on- and off-street parking stock, as well as the provision of parking facilities at construction compounds, to be implemented as part of the Construction Traffic and Access Management Plan.

Pedestrian and Cycleways

The Department notes City of Botany Bay's, and other local councils', intention to provide cycle ways within the Alexandra Canal area and community sentiment that there is substantial demand for cycling infrastructure in inner Sydney. The Department acknowledges the emphasis the Proponent has placed on Campbell Road/Street for active transport. The Department is supportive of such an approach and considers the connectivity that can be achieved would be of great social benefit to the local population.

As discussed in **Section 5.9,** the Department considers further integration can be achieved with both existing and planned cycleway infrastructure delivery within the locality of the project and as such has recommended that the Proponent be required to undertake a Pedestrian and Cycle Network Review and implement a Pedestrian and Cycle Implementation Strategy.

The Department acknowledges the concerns raised by community groups and community members in regards to the Kindilan Underpass proposed as an extension to the existing pedestrian underpass in Kingsgrove. The Department agrees that the expansion of this pedestrian tunnel to 77 metres would impact on social amenity for pedestrians and cyclists and may act as a deterrent if not designed correctly. In recognising the importance of active transport to these communities, the Department has recommended conditions aimed at ensuring the design outcome of this underpass is of a high standard and in consideration of Crime Prevention Through Environmental Design Principles. These conditions and urban design discussions are further provided in **Section 5.9**.

Property Access

The Department has considered the issues raised in submissions regarding potential impacts to property access during construction and operation. The Department has recommended that access to all properties is maintained throughout construction however it is acknowledged that there may be instances during construction where property access

would be temporarily reduced, diverted or closed. The Department considers that this can be effectively managed through the recommended Construction Traffic and Access Management Plan and has also recommended a condition requiring the Proponent to reinstate any affected access reinstated to at least an equivalent standard unless an agreement is reached with the land owner.

Access to Public Transport

The Department notes the Proponent intends to temporarily and permanently relocate or remove some bus stops near the eastern end of the proposed project. The Department does not consider the social impacts of these changes in bus stop locations have been adequately assessed nor are the mitigation measures proposed considered adequate. However, the Department is satisfied that the relocation of the two bus stops on Euston Road and Princes Highway would be within reasonable walking distances of their existing locations.

The Department notes that the removal of three clustered bus stops along the 305 route at Bourke Street and Gardeners Road in Mascot would cause some inconvenience during construction. However, the Department is satisfied that the removal of these bus stops would not cause there to be unreasonable walking distances to adjacent bus stops and notes the presence of other transport solutions along this corridor including rail.

Notwithstanding, the Department considers additional protections can be provided to public transport patrons and has recommended that existing bus stops are not to be impacted until such time as appropriately distanced replacement or adjacent bus stops are operational, deemed safe and adequate signage to any replacement or adjacent bus stop on the same route is provided. In addition, the Department has recommended a condition requiring the Proponent to reinstate all removed or relocated bus stops to an equal or improved condition, in consultation with local councils, prior to the commencement of operation of the project.

Property Values

The Department acknowledges the issue raised in submissions received from the public regarding the risk to property values as a result of the proposed project. However, it is an established principle that the impact of a project on surrounding property value is not a planning consideration (refer e.g. *Trinvass Pty Ltd and Anor v Council of the City of Sydney* [2015] NSWLEC 151, [89]).

Table 23: Summarised Impacts to On- and Off-Street Car Parking During Construction and Operation of the Project (source: EIS)

	On - Street Parking				Off - Street Parking			
	Construction	Operation			Construction	Operation		
	Lost	Lost	Reinstated	Gained	Lost	Lost	Reinstated	Gained
Campbell Street, between Princes Highway and Unwins Bridge Road	0	0	0	34	0	0	0	26
Albert Street	44	0	44	0	0	0	0	0
Campbell Road, between Barwon Park Road and Burrows Road	111	111	0	0	0	0	0	0
Euston Road, between Campbell Road and Sydney Park Road	112	0	112	0	0	0	0	0
Burrows Road, south-west of Campbell Road	38	8	30	0	0	0	0	0
Burrows Road, north-east of Campbell Road	23	15	8	0	0	0	0	0
Euston Road, north of Sydney Park Road Intersection	24	24	0	0	0	0	0	0
Huntley Street, east of Euston Road	32	28	4	0	0	0	0	0
Barwon Park Road, north of Campbell Road	6	0	6	0	0	0	0	0
Princes Highway	30	18	12	0	0	0	0	0
May Street	50	38	12	0	0	0	0	0
Unwins Bridge Road	39	33	6	0	0	0		0
Brown Street	16	6	10	0	0	0	0	0
Florence Street	16	6	10	0	0	0	0	0
St Peters Street	12	6	6	0	0	0	0	0
Hutchinson Street	10	0	10	0	0	0	0	0
Gardeners Road, west of Bourke Street	10	0	10	0	0	0	0	0
Gardeners Road, between Kent Street and cul-de-sac of Gardeners Road	47	47	0	0	20	0	20	0
Bunning Mascot	0	0	0	0	25	0	25	0
Bourke Road, north of Bourke Street/Gardeners Road intersection	0	0	0	0	26	16	10	0
Total	**620**	**340**	**280**	**34**	**71**	**16**	**55**	**26**

Conclusion

While the Department acknowledges the issues raised by local communities, it is mindful that decisions must be made to ensure access to the city is maintained or improved through a variety of transport solutions. As Sydney's population increases there is a greater need to maintain ease of movement for all members of the community. While the project would result in social and economic impacts to communities located adjacent to surface infrastructure, the impacts to the Sydney region would be more detrimental to a larger number of the population if network capacity is not improved.

Although the social and economic impacts cannot be offset in their entirety, the Department considers the recommended conditions of approval, in conjunction with the Proponent's proposed environmental management measures, would mitigate the level of impact. The recommended conditions include:

- facilitation of the WestConnex Acquisition Assistance Line for at least six months following final acquisition;
- the preparation and implementation of a Community and Social Management Plan including a Community Cohesion Program which is to include the provision or facilitation of BMX tracks and facilities at Camdenville Park in consultation with Marrickville Council;
- consultation with RMS, Marrickville Council and City of Sydney regarding future integration of the New M5 infrastructure with the King Street Gateway Project;
- preparation and implementation of a Construction and Operational Parking and Access Strategy;
- restriction of construction vehicles from using specific local roads;
- implementation of operational noise attenuation measures prior to construction within an area and management of amenity related construction impacts through construction environmental management sub-plans;
- provision of functioning and safe replacement or adjacent bus stops prior to the closure of existing bus stops;
- provision of adequate wayfinding signage to assist commuters in locating replaced or adjacent bus stops;
- reinstatement of all removed or relocated bus stops to an equal or improved condition, in consultation with local councils, prior to the commencement of operation of the project;
- reinstatement and management of changes to property access during construction;
- preparation and implementation of a Residual Land Management Plan; and
- consideration of the City Farm Project's spatial needs within Sydney Park during construction and operation through consultation protocols in the Urban Design and Landscape Plan.

5.11. Historic Heritage

Issue

Heritage Items and Conservation Areas

A total of 53 locally and four State listed heritage items were identified within the vicinity of the project (refer to **Appendix M**). Construction of the project would directly impact eight of the 57 identified heritage items, with three being demolished, three requiring modifications, and two requiring acquisition (**Table 24**)

Table 24: Impacted Heritage Items

Impacted Heritage Item	Location	Heritage Listing	Type of Impact
Alexandra Canal	Alexandria	State – SHR#01621 Marrickville LEP – 1270 City of Sydney – 113 City of Botany Bay – I1 Sydney Water, Section 170 – ID#4571712 -	Modification - construction of two new crossings of the Alexandra Canal
Rudders Bond Store	53-57 Campbell Road	Sydney LEP 2012 I405	Demolished
House	82 Campbell Street	Roads and Maritime s170 #4305643	Demolished
Terrace Group Including Interiors	2-34 Campbell Street	Sydney LEP 2012 I12	Demolished
Goodsell Estate Heritage Conservation Area	Between Illawarra Railway Line, May Street, Bedwin Road and Princes Highway	Marrickville LEP 2011 C16	Partial Acquisition and Modification - local road upgrades and upgrading a stormwater basin
Service Garage	316 Princes Highway	Marrickville LEP 2011 I312	Acquisition
St Peters Brickpit Geological Site	Corner of Princes Highway and Canal Road	ID No 162040 under the Register of the National Estate	Modification - the construction of the interchange including cut and fill

The 49 locally listed heritage items not directly impacted by the project would experience minor or negligible impacts associated with vibration, settlement and visual impacts. These impacts can be managed through standard construction practices.

The heritage values of three heritage conservation areas that would be partially or directly impacted due to acquisition, demolition of residences and works within the conservation areas as follows:

- Goodsell Estate Heritage Conservation Area – partial acquisition and surface works;
- Clemton Park Urban Conservation Area – temporary construction compound; and
- Pallamanna Parade Urban Conservation Area – surface works (noise walls and signage).

Historical Archaeology

The Proponent's historical archaeological assessment identified potential impacts on archaeological relics associated with an air raid shelter and two former brickworks along Euston Road, St Peters.

Excavation at the St Peters interchange area may encounter late 19th and early 20th century refuse deposits and brick wasters from the surrounding bricks works, but are unlikely to be of archaeological significance due to their ubiquitous nature and lack of provenance.

Submissions

The **Heritage Council** expressed concern over the impacts to Alexandra Canal and recommended that it be consulted during finalisation of the Urban Design Landscape Plan and the Construction Heritage Management Plan.

The Heritage Council recommended that the Rudders Bond Store be kept but, if it is removed, sections of the laminated timber should be salvaged and displayed as part of an Interpretation Plan. The Heritage Council also recommended further assessment of the former brickworks site as relics may be present in these areas.

The **City of Sydney Council** raised concerns over the demolition of the Rudders Bond Store and recommended that the laminated timber fabric should be salvage and re-used in the new proposed buildings within the St Peters Interchange. Council also raised concern over the potential for impacts to the Alexandra Canal and the terraces at 2-34 Campbell Road, loss of access to the St Peters Brick Pit Geological site, and impacts of construction vibration on heritage items. City of Sydney Council recommended that the alignment of the proposed pedestrian/cycle bridge be moved further west, to alleviate any additional impacts to the Campbell Road terraces.

Marrickville Council expressed concerns about the direct and indirect impact to heritage items and recommended that the materials from demolished heritage items should be salvaged and disposed of at local retailer/s of second-hand building materials. Council also requested photographic archival record should be undertaken in accordance with the Office of Environment and Heritage policy; an interpretation design be prepared and a Conservation Management Plan for impacted heritage items be prepared.

Public Submissions

Key issues raised in the public submissions included:

- impacts on heritage items and the heritage conservation areas;
- cumulative impacts of removing heritage items within the inner west;
- visual impact on conservation areas;
- accessibility impacts to St Peters Church;
- inadequate assessment of the archaeological features associated with the brickmaking and industrial areas at St Peters; and
- isolation of heritage items due to increased traffic.

Department's Consideration

The Department recognises that local, regional and the State communities benefit through a connection and sense of place provided by heritage items and conservation areas. The buildings and structures in suburbs of Sydney reflect the staged pattern of development and urban spread, with the inner suburbs tending to comprise buildings from the early 1900s through to the current day. Consequently, redevelopment within inner city areas is likely to impact heritage items, conservation areas and archaeology.

Alexandra Canal

The Alexandra Canal is of high historic, aesthetic and technical/research significance as a rare surviving 19th century navigational canal, being one of only two purpose built canals in the State. The project proposes two new road crossings across Alexandra Canal to connect the proposed St Peters interchange with Gardeners Road and Bourke Road, Mascot. The crossings would provide a clear span across the Canal with the abutment piers located one metre from top of the sandstone embankment walls. The Proponent has indicated that construction of the crossings would be managed to ensure there are no direct impacts to the sandstone embankments on either side of the Canal. This would be managed in the detailed design stage.

It is acknowledged that mitigation and management measures would be developed for Alexandra Canal to manage the potential risks to the item due to vibration. These mitigation measures would be included in the Construction Heritage Management Plan for the project which would be finalised during the detailed design stage.

Although the bridges may affect the visual amenity of the Alexandra Canal, the Department considers that this should be considered against the additional public access to the Canal provided through the project. Currently, access to the Alexandra Canal is limited due to the surrounding built form. The bridge designs include adequate clearances on both sides of the bridge structures to facilitate the future Alexandra Canal cycleway.

Although construction of the bridges would not directly impact the Alexandra Canal, stormwater discharge points would require the removal of sections of highly significant Broken Range Ashlar in the embankment walls. The impact and extent of these works would be reduced through the reinstatement of the sandstone blocks and their re-use to finish the discharge points. The Department has recommended a condition requiring the Proponent to compile photographic records prior to and post the stormwater discharge works and for a heritage specialist to oversee the removal and reinstatement works.

The Department has recommended that the Proponent prepare an Alexandra Canal Sub-Plan as part of the Urban Design and Landscape Plan which details the design and integration of the bridges over the Alexandra Canal, taking into account the heritage sensitivity of the setting as set out in the Alexandra Canal Heritage Conservation Plan. The Department has also recommended that the Proponent prepare a Heritage Interpretation Plan which addresses the Alexandra Canal and the industrial heritage of the area (amongst other items), in consultation with the Heritage Council and relevant councils.

Rudders Bond Store

The Rudders Bond Store is located within the St Peters interchange connection to the Campbell Road and Euston Road intersection. The Department acknowledges that the location of the New M5 ramps and connection to the Campbell Road and Euston Road intersection at the St Peters interchange has been positioned to satisfy road geometry requirements and network integration and that it is not possible to achieve the desired traffic and public amenity outcomes if the Rudders Bond Store is retained.

The Department supports the recommendations of the Heritage Council and City of Sydney Council regarding the salvage of sections of laminated timber from the Rudders Bond Store and has recommended a condition to this effect. The Department has also recommended a condition that options for the reuse of the timber within the project at St Peters be assessed and that their reuse is maximised in the operational facilities for the project. Further, the Department has recommended that the Heritage Interpretation Plan for the project include the Rudders Bond Store.

Terraces at 28-44 and 82 Campbell Street

The project would require the demolition of the terraces and houses along south-western side of Campbell Street between Unwins Bridge Road and Church Street, St Peters. The Department accepts that it is not possible to widen Campbell Street without removing the houses. The widening of the road has been determined necessary to meet the project objectives and enable the road network to accommodate the predicted traffic volumes. The Department supports the Proponent's environmental management measure to undertake a full archival recording of 82 Campbell Street and the terrace group at 28-44 Campbell Street and to ensure that this occurs has recommended that archival recordings be undertaken for all heritage items to be demolished. In addition, the Department has recommended a condition requiring the buildings be addressed in the Heritage Interpretation Plan.

Service Garage

The Service Garage at 316 Princes Highway, St Peters, has been identified as holding historic, aesthetic and rarity value. Although there are no direct physical impacts proposed at this stage, it would be acquired and cease operating as a service garage. This is necessary as continued use would pose a safety hazard to pedestrians and cyclists under the changed traffic and access conditions. Retaining the structure is considered appropriate at this time and subject to any further assessment should any works be identified as a result of detailed design.

Other Heritage Items

A number of heritage items are located throughout the project area and could be potentially impacted by vibration associated with tunnelling activities and surface works. Consequently, the Department has recommended a condition requiring that pre- and post-construction dilapidation surveys be conducted for all sensitive structures where blasting and/or vibration are likely to result in cosmetic or structural damage.

Heritage Conservation Areas

The Department considers that the impacts to the Goodsell Estate Heritage Conservation Area would be minimal. Impacts of the project would be limited to the acquisition of the south-western corner of the conservation area for road widening and the temporary occupation of an area of Camdenville Park which is currently a fenced off area providing a depression for the collection of stormwater runoff. The project would result in an amendment to the curtilage of the park and augmentation of the existing stormwater basin. The Department supports the mitigation measures proposed by the Proponent to undertake landscaping, to mitigate the impacts of realigning and widening roads, as well as alterations to the existing stormwater detention basin. This commitment would form part of the Urban Design and Landscape Plan.

The Bexley Road surface works, including construction compounds, are within and adjacent to the Clemton Park Urban Conservation Area. Works within the conservation area would be temporary and in areas previously disturbed by the M5 East Motorway. Permanent infrastructure would be placed within the existing motorway corridor and would be landscaped to minimise any visual impacts to the conservation area. The Department supports the Proponent's commitment to undertake landscaping works to provide screening of the Bexley Road South motorway operations complex from the Clemton Park Urban Conservation Area, once established. This commitment would form part of the Urban Design and Landscape Plan.

The project is located within the curtilage of the Pallamanna Parade Urban Conservation Area. Changes in this area as a result of the project include removal of vegetation, construction compounds, changes to noise barriers and a motorway operations complex. Landscaping would provide screening of the project from the heritage conservation area, once established. These landscaping works will form part of the Urban Design and Landscape Plan.

Historical Archaeology

The Department accepts that a large portion of the St Peters Brickpit Geological Site would be concealed consequent to filling of the site for the St Peters interchange works and that this impact is unavoidable. Concealment of a vast proportion of the site would not destroy its geological heritage value, it would only deny access to the site. The Department has recommended a condition that a photographic and drawn archival recording of the geological features be undertaken prior to construction. Management of construction activities in and around heritage sites would be subject to measures to be developed and detailed in a Construction Heritage Management Plan for the project.

The Department also supports the Proponent's commitment to prepare an Interpretation Plan in consultation with City of Sydney Council. It also supports retaining an exposed section of the fresh shales and siltstones, including features associated with deposition of the sedimentary rocks, and later formed fractures such as joints and faults. The outcomes of this process would be included as part of the final Urban Design and Landscape Plan for the project. The Department also recommends as part of the final Urban Design and Landscape Plan, on site heritage interpretation should be provided.

The Department has also recommended a condition requiring the Proponent to provide accessibility to the exposed sections of the site to allow for greater public knowledge of the geological and palaeontological significance of the site.

Conclusion
Construction of the project would result in irreversible heritage impacts to a limited number of heritage items. The Department has considered the heritage impacts within the context of the benefits of the project overall and existing constraints within an established urbanised area and considers that these are acceptable. However, it is considered that measures should be undertaken to record and interpret impacted heritage items and make the recorded information available to the public so that their historical importance is preserved. The Department considers that its recommended conditions of approval would ensure this occurs.

5.12. Other Issues

Fire and Hazards
A qualitative assessment of hazards associated with the project was undertaken and included:

- accidental releases or improper handling and storage of dangerous goods and hazardous substances in the water treatment facility;
- releases of hazardous substances from vehicles transporting dangerous goods and hazardous substances to and from the water treatment plant in the event of an accident;
- crashes and incidents within the mainline tunnels, on- and off-ramps and surface roads;
- risks from electric and magnetic fields associated with project substations;
- potential risks from bushfires; and
- potential aviation hazards.

Tunnel Operations
The quantities of dangerous and hazardous substances to be transported and stored as part of the project would be within the limits of *State Environmental Policy No. 33 – Hazardous and Offensive Development* (SEPP 33). The Department is satisfied that risks associated with use and storage of dangerous and hazardous substances could be effectively mitigated through the implementation of standard handling measures as committed to in the EIS.

The tunnel would be equipped with a deluge system and smoke extraction system, minimising the potential for a fire to spread throughout the tunnel. The operation of a continuous monitoring system would allow for emergency services to respond to incidents efficiently.

Fire and Rescue NSW recommended a number of conditions of approval relating to fire protection and emergency response. The Department has substantially adopted the Fire and Rescue NSW recommendations to ensure that robust and accepted management systems are in place for operation. The Department also considers that management of critical incidents such as in-tunnel fires are a matter for detailed engineering design and should be resolved by the Proponent and agencies in accordance with best practice and the relevant Australian Standard (e.g. AS 4825-2011 Tunnel fire safety).

Aviation Hazards
Plumes from ventilation outlet facilities have the potential to impact on aviation safety by causing turbulence and affecting aircraft handling. Consequently, the Proponent referred the project to the Commonwealth Department of Infrastructure and Regional Development for

approval under the *Airports Act 1996* and the *Airports (Protection of Airspace) Regulations 1996*. The application sought approval in regards to the intrusion of plume rises from the Arncliffe, Kingsgrove and St Peters ventilation outlet facilities into the 'prescribed airspace' of Sydney Airport. 'Prescribed airspace' includes the airspace above any part of either an Obstacle Limitation Surface (OLS) or Procedures for Air Navigation Services – Aircraft Operations (PAN-OPS) surface for an airport. The Proponent's application was supported by modelling of the plume velocities from all three facilities.

The Commonwealth Department of Infrastructure and Regional Development Department determined that the Kingsgrove ventilation facility is not a controlled activity, and does not require approval. However, the Arncliffe and St Peters ventilation facilities are controlled activities, and require approval under the Act and the Regulations. On 1 April 2016, the Commonwealth Department of Infrastructure and Regional Development approved the Arncliffe and St Peters ventilation facilities subject to conditions. The approval is provided in **Appendix N**.

Other risks

The Department accepts that there is consequently a low likelihood of bushfire events within the project corridor, and acknowledges that the Proponent would develop and implement measures to mitigate and manage bushfire risks would be developed and included as part of site-specific hazard and risk management measures within Construction Environmental Management Plan.

The Department is satisfied that the electrical substations associated with the project would not pose a significant health risk as they would be located distant from occupied residences and commercial and industrial buildings.

Greenhouse Gas Emissions

Construction of the project would generate approximately 473,200 tonnes of carbon dioxide equivalent (t CO_2-e), of which approximately 59 per cent is from indirect upstream or downstream greenhouse gas emissions (i.e. from third party supply chains and road users as a consequence of activity within the boundary of the project). This represents around 0.09 per cent of the Australian National Greenhouse Inventory for the year March 2014 to March 2015.

It is anticipated that by 2031 operational project emissions would be less than those generated from existing roads under the 2031 'do minimum' (without project) scenario by around 229,200 t CO_2-e. This improvement in emissions would result from the benefits of road tunnel usage in urban areas, where travel along a more direct route at higher average speeds results in fewer greenhouse gas emissions being generated by road users, as reduced congestion and stop-start driving reduces the fuel used by vehicles.

It is acknowledged that the annual electricity use for powering tunnel lighting and ventilation, communications systems, control systems, computer and safety systems, the emergency response system, the motorway control centre, electronic signage and other associated electrical systems would generate around 23,321 t CO_2-e indirect emissions per year. While it is anticipated that round 3,332 t CO_2-e indirect emissions would be generated from vehicles utilising the projects per year. Overall the project would generate 26,653 t CO_2-e indirect emissions per year.

To ensure that greenhouse gas emissions are further minimised and that opportunities to use renewable energy sources be explored, the Department has recommended conditions requiring the project to achieve an excellent "Design" and "As built" rating in the Infrastructure Sustainability Council of Australia Infrastructure Sustainability Rating Tool, and review sustainability initiatives and greenhouse gas emissions regularly.

Aboriginal Heritage

An Aboriginal Heritage assessment was undertaken in consultation with the Metropolitan Local Aboriginal Land Council. Field surveys and desktop reviews identified 21 Aboriginal sites and one landscape area within the study area (Wolli Creek Valley Landscape Area). None of the identified sites and landscape areas would be directly impacted by the project. In addition, the project would be located in a highly disturbed and modified landscape. Consequently, the potential impact of the project on Aboriginal heritage is considered to be low.

The proposed bridges across the Alexandra Canal and associated works would be within the vicinity of an Aboriginal artefact site. This site was destroyed during the construction of the Canal, with the associated artefacts collected and currently stored in the Australian Museum. The Department acknowledges that the potential for artefacts to be discovered during the construction of the bridges over the Alexandra Canal is low. Notwithstanding, the Department has recommended a condition that the Proponent engage a suitably qualified archaeologist to undertake test excavations in the vicinity of the bridges to ascertain the potential for Aboriginal archaeological materials.

Based on the outcomes of the vibration assessment, the Department accepts that it is unlikely that tunnelling would cause indirect impacts to Aboriginal heritage sites through subsidence as a result of sediment and vibration.

Temporary Construction Power Enabling Works

The Proponent is proposing to connect the proposed construction compounds to the existing power network with four sections of cabling, ranging from 0.2km to 3 km, along current road reserves and footpaths. The four cabling alignments are located in highly urbanised areas of Rockdale, Canterbury, Hurstville and Marrickville LGAs. The land required for the proposed works is owned by RMS and the relevant Councils.

The proposed works would intersect with a number of bus routes within the inner western and south-western Sydney bus network, and a number of state and local roads. As such, the works would include temporary impacts to the traffic and transport network due to excavation of sections of roads and footpaths along the alignments. The Department notes these works would require partial road closures and short-term changes to the existing traffic and transport network.

The Department considers there would be minimal impacts to the public transport network as the proposed works are unlikely to result in any diversions to bus routes or bus shelters. However, access to residential properties and businesses would be affected in locations requiring excavation of footpaths and roads. Footpath excavation and works at signalised pedestrian crossings would restrict pedestrian movements. To minimise these disruptions, the Proponent has committed to developing appropriate traffic control and pedestrian movement plans and maintaining property and emergency vehicle access at all times. In addition, the Proponent has indicated that the areas will be reinstated as works progress to reduce prolonged impacts to one area. The Department notes these impacts would be localised for the duration of works and is satisfied that the Proponent's proposed mitigation measures would reduce impacts to the traffic and transport network.

The Department notes that the proposed works are located within existing road reserves and footpaths within highly urbanised areas, which may have an impact to adjoining land owners. The majority of the works are proposed to be carried out during standard construction hours, while out of hours work may be required for utility cut-over works and the road asset owner (Council or Traffic Management Centre) may condition a Road Occupancy Licence for the works to be carried out outside standard construction hours.

The proposed works are anticipated to exceed acceptable noise levels at nearby receivers, while sleep disturbance awakening criterion may be exceeded at receivers set at distances of up to around 50 meters from the proposed works. Though the proposed works will have a temporary impact, the Department is satisfied with the Proponents commitment to undertake these works in accordance with the *Interim Construction Noise Guideline* (DECC, 2009) during the standard working hours.

The Departments notes that certain activities (horizontal drilling, pipe jacking and compaction) may generate low-level localised vibrations. However, it is unlikely that building cosmetic and human comfort vibration criteria would be exceeded during these activities. The Department has recommended a condition for properties that are at risk from construction vibration must be notified and incorporated into the Construction Noise and Vibration Management Plan. It is also recommended that a Community Communication Strategy be developed which identifies the potentially affected landowners that are affected by the proposed works. As part of Community Communication Strategy noise and vibration mitigation and management measures will be addressed.

6. CONCLUSIONS AND RECOMMENDATIONS

This section outlines the main benefits the project would provide and how it is justified, the key considerations that were taken into account in the assessment and sets out the Department's recommendations.

Need and Justification

Sydney's road and motorway network supports economic growth across NSW by connecting people to jobs, promoting trade between businesses and providing infrastructure to support freight movements. However, the Sydney road network currently experiences congestion through much of the day costing the NSW economy approximately $5.1 billion each year; a cost which is forecasted to increase to approximately $8.8 billion by 2020 if improvements are not made.

The M5 East Motorway is a key corridor of the Sydney orbital and wider road network linking with other major road corridors including King Georges Road, Cumberland Highway, Hume Motorway and the M7 Motorway. Currently, the M5 East Motorway carries approximately 100,000 vehicles, including 10,000 heavy vehicles per day, moving commuters and freight between south-west Sydney, the CBD, Sydney Airport, Port Botany and Sydney's eastern suburbs. This high volume of traffic has resulted in heavy congestion, slow traffic speeds and unreliable travel times.

WestConnex is identified as a 'missing link' in Sydney's orbital motorway in the Long Term Transport Master Plan (2012) and its development is also consistent with the NSW 2021 Plan (2011) and the State Infrastructure Strategy 2012-2032 (2012).

The proposed WestConnex New M5 is a critical component to achieving the Government's transport policy and objectives and would provide an efficient link in the Sydney orbital motorway network and in the national freight network. The Proponent's traffic modelling has indicated that the project will both provide additional capacity to the alternative corridor and will substantially reduce travel demand on the existing M5 East Motorway. The addition of the New M5 Motorway is also expected to reduce travel times and improve traffic speeds along the M5 East Motorway. Further travel time savings along the M5 corridor are anticipated once the entire WestConnex scheme is operational, pending approval. Modelling has also suggested a decrease in annual average crash costs of 14 per cent.

Key Considerations

Key impacts of the proposal include traffic and transport, noise and vibration, air quality, biodiversity, groundwater, soil and surface water hydrology, flooding and drainage, urban design and visual amenity, land use, social and economic and historic heritage. Other issues raised include fire and hazard risks, greenhouse gas emissions and Aboriginal heritage.

The Department has assessed the merits of the proposal taking into consideration the issues raised in all submissions and is satisfied that the impacts have been satisfactorily addressed in the Proponent's EIS, Submissions and Preferred Infrastructure Report and the Department's recommended conditions of approval. The Department considers that the provision of an essential road transport solution through a tunnel design is an optimal planning outcome that reduces land use conflicts and other impacts associated with road projects in urbanised areas.

Whilst some residual impacts are expected, the Department has recommended a number of conditions that provide social benefit for the locally impacted communities including:

- the development of a land bridge spanning Campbell Road, connection Sydney Park and the open space to be provided at the St Peters Interchange;
- urban design requirements to improve the amenity and community connectivity including active transport;
- management plans for community and social impacts including community cohesion programs;
- Alexandria Landfill closure and monitoring provisions;
- ground and surface water quality and quantity provisions;
- strict and transparent air quality provisions;
- strict biodiversity offset frameworks; and
- a net increase in trees across the project.

The potential environmental impacts associated with the construction and operation of the proposal would be acceptable subject to the implementation of appropriate mitigation measures and the Department's recommended conditions of approval. The proposal would comply with the objects of the *Environmental Planning and Assessment Act (1979)* and with the principles of Ecologically Sustainable Development.

Recommendations

On balance, it is concluded that the proposal's benefits outweigh its potential impacts and that any residual impacts can be managed and would not, subject to conditions, result in any long term adverse or irreversible effects. It is therefore in the public interest that the project proceeds and it is recommended that the project be approved subject to the Department's recommended conditions of approval.

David Gainsford 15/4/16.
Executive Director
Priority Projects Assessments

15/04/2016
Marcus Ray
Deputy Secretary
Planning Services

APPENDIX A ENVIRONMENTAL IMPACT STATEMENT

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6788

APPENDIX B SUBMISSIONS

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6788

APPENDIX C PROPONENT'S RESPONSE TO SUBMISSIONS

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6788

APPENDIX D INDEPENDENT TRAFFIC REVIEW

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6788

APPENDIX E TRAFFIC IMPACTS

Table 1: AM Peak Intersection Levels of Service – St Peters Locality (source: EIS)

Intersection	2014 Base	2021 'without project'	2021 'with project'	2031 'without project'	2031 'full WCX'
Princes Highway / Sydney Park Road	C	B	C	F	C
Princes Highway / May Street	E	B	C	C	A
Princes Highway / Campbell Street	D	C	E	D	F
Princes Highway / Canal Road	E	C	F	F	C
Princes Highway / Railway Road	F	F	F	F	F
Sydney Park Road / Mitchell Road	C	B	D	B	D
Euston Road / Sydney Park Road / Huntley Street	A	A	C	A	C
Unwins Bridge Road / Campbell Street	C	B	C	B	D
Campbell Road / Euston Road	A	A	C	A	D
Campbell Road / Bourke Road*	-	-	C	-	D
Ricketty Street / Kent Road*	-	-	C	-	B
Gardeners Road / Kent Road*	-	-	C	-	C
Gardeners Road / Bourke Road	C	C	D	D	D
Gardeners Road / O'Riordan Street	E	F	F	F	F

Source: AECOM (2015)

* These intersections are either new or substantially changed as a result of the project and so were not reported on in the base or without project scenarios.

Table 2: PM Peak Intersection Levels of Service – St Peters Locality (source: EIS)

Intersection	2014 Base	2021 'without project'	2021 'with project'	2031 'without project'	2031 'full WCX'
Princes Highway / Sydney Park Road	D	F	C	F	C
Princes Highway / May Street	D	D	A	D	A
Princes Highway / Campbell Street	D	C	E	F	E
Princes Highway / Canal Road	F	E	D	F	C
Princes Highway / Railway Road	E	F	D	F	F
Sydney Park Road / Mitchell Road	D	B	D	D	D
Euston Road / Sydney Park Road / Huntley Street	D	A	C	E	C
Unwins Bridge Road / Campbell Street	C	C	D	F	D
Campbell Road / Euston Road	A	A	D	F	E
Campbell Road / Bourke Road*	-	-	B	-	E
Ricketty Street / Kent Road*	-	-	C	-	C
Gardeners Road / Kent Road*	-	-	B	-	C
Gardeners Road / Bourke Road	C	C	D	E	F
Gardeners Road / O'Riordan Street	D	D	F	F	F

Source: AECOM (2015)

* These intersections are either new or substantially changed as a result of the project and so were not reported on in the base or without project scenarios.

Table 3: Comparison between 2021 'without project' and 'full WestConnex and 'Southern extension' mid-block traffic flows (source: EIS)

Location	Direction	AM peak hour			PM peak hour		
		2021 'without project'	2021 'with project'	Change in flow	2021 'without project'	2021 'with project'	Change in flow
		veh/hr	veh/hr	%	veh/hr	veh/hr	%
King Street, south of Alice Street	Northbound	880	800	-10%	830	910	10%
	Southbound	560	620	11%	1,030	1,010	-2%
Railway Road, west of Princes Highway	Eastbound	540	590	9%	640	910	42%
	Westbound	630	730	16%	1,150	1,490	30%
Princes Highway, south of Railway Road	Northbound	2,590	2,580	0%	1,710	1,760	3%
	Southbound	1,060	980	-8%	2,390	2,360	-1%
Euston Road, north of Sydney Park Road	Northbound	1,050	1,950	86%	820	1,280	56%
	Southbound	790	1,110	41%	1,340	1,940	45%
Edgeware Road, west of Edinburgh Road	Eastbound	720	780	8%	1,060	1,090	3%
	Westbound	770	910	18%	830	1,030	24%
Gardeners Road, west of O'Riordan Street	Eastbound	1,230	1,350	10%	1,410	1,570	11%
	Westbound	1,150	1,150	0%	1,060	1,270	20%

Source: AECOM (2015)

Table 4: Comparison between 2031 'without project' and 'full WestConnex and 'Southern extension' mid-block traffic flows (source: EIS)

Location	Direction	AM Peak			PM Peak		
		2031 'without project'	2031 'full WestConnex and Southern extension'	Change in flow	2031 'without project'	2031 'full WestConnex and Southern extension'	Change in flow
		veh/hr	veh/hr	%	veh/hr	veh/hr	%
King Street, south of Alice Street	Northbound	1,100	870	-21%	890	940	6%
	Southbound	450	730	62%	980	1,210	23%
Railway Road, west of Princes Highway	Eastbound	490	650	33%	700	680	-3%
	Westbound	630	990	57%	1,280	1,910	49%
Princes Highway, south of Railway Road	Northbound	2,550	2,180	-15%	1,660	720	-57%
	Southbound	1,150	550	-52%	2,310	2,110	-9%
Euston Road, north of Sydney Park Road	Northbound	990	2,120	114%	780	1,530	96%
	Southbound	970	1,580	63%	1,500	2,160	44%
Edgeware Road, west of Edinburgh Road	Eastbound	760	820	8%	1,030	1,110	8%
	Westbound	830	920	11%	730	1,040	42%
Gardeners Road, west of O'Riordan Street	Eastbound	1,280	1,790	40%	1,560	1,650	6%
	Westbound	1,150	1,410	23%	1,140	1,660	46%

Source: AECOM (2015)

Table 5: Screenline comparison of 2021 Average Weekday Traffic volumes 'with project' and 'without project' (source: EIS)

Direction	Location	2021 'without project'	Share	2021 'with project'	Share	Change
Western Screenline						
Eastbound	Canterbury Road	23,643	22%	25,688	24%	9%
	M5 East Corridor (including M5 East Motorway and New M5)	57,764	54%	50,104	47%	-13%
	Stoney Creek Road	13,549	13%	19,230	18%	42%
	Forest Road / Queens Road	12,218	11%	12,108	11%	-1%
	Total	**107,174**		**107,129**		**0%**
Westbound	Canterbury Road	24,206	22%	25,895	24%	7%
	M5 East Corridor (including M5 East Motorway and New M5)	58,125	52%	48,424	45%	-17%
	Stoney Creek Road	13,496	12%	17,068	16%	26%
	Forest Road / Queens Road	16,513	15%	16,692	15%	1%
	Total	**112,340**		**108,079**		**-4%**
Two-way	Canterbury Road	47,849	22%	51,583	24%	8%
	M5 East Corridor (including M5 East Motorway and New M5)	115,889	53%	98,528	46%	-15%
	Stoney Creek Road	27,045	12%	36,297	17%	34%
	Forest Road / Queens Road	28,731	13%	28,800	13%	0%
	Total	**219,514**		**215,208**		**-2%**
Eastern Screenline						
Eastbound	Princes Highway	36,802	21%	34,788	20%	-5%
	New M5	–	–	14,164	8%	–
	Marsh Street	37,967	22%	31,850	19%	-16%
	M5 East	49,303	29%	42,164	25%	-14%
	General Holmes Drive	47,588	28%	48,817	28%	3%
	Total	**171,660**		**171,782**		**0%**
Westbound	Princes Highway	35,613	21%	33,601	19%	-6%
	New M5	–	–	15,175	9%	–
	Marsh Street	38,012	22%	34,873	20%	-8%
	M5 East Motorway	52,251	30%	38,611	22%	-26%
	General Holmes Drive	47,430	27%	50,889	29%	7%
	Total	**173,306**		**173,149**		**0%**
Two-way	Princes Highway	72,415	21%	68,388	20%	-6%
	New M5	–	–	29,339	9%	–
	Marsh Street	75,979	22%	66,723	19%	-12%
	M5 East Motorway	101,554	29%	80,775	23%	-20%
	General Holmes Drive	95,018	28%	99,706	29%	5%
	Total	**344,966**		**344,931**		**0%**

Table 6: Screenline comparison of 2031 Average Weekday Traffic volumes 'with project' and 'without project' (source: EIS)

Direction	Location	2031 'without project'	Share	2031 'with project'	Share	Change
Western Screenline						
Eastbound	Canterbury Road	28,377	24%	28,900	22%	2%
	M5 East Corridor (including M5 East Motorway and New M5)	59,474	50%	60,223	46%	1%
	Stoney Creek Road	16,694	14%	28,048	22%	68%
	Forest Road / Queens Road	13,233	11%	12,968	10%	-2%
	Total	**117,778**		**130,139**		**11%**
Westbound	Canterbury Road	27,581	23%	28,263	23%	2%
	M5 East Corridor (including M5 East Motorway and New M5)	59,177	49%	58,465	47%	-1%
	Stoney Creek Road	16,126	13%	19,020	15%	18%
	Forest Road / Queens Road	18,832	15%	18,642	15%	-1%
	Total	**121,716**		**124,391**		**2%**
Two-way	Canterbury Road	55,958	23%	57,163	22%	2%
	M5 East Corridor (including M5 East Motorway and New M5)	118,651	50%	118,688	47%	0%
	Stoney Creek Road	32,820	14%	47,068	18%	43%
	Forest Road / Queens Road	32,066	13%	31,610	12%	-1%
	Total	**239,494**		**254,530**		**6%**
Eastern Screenline						
Eastbound	Princes Highway	40,206	21%	38,822	19%	-3%
	New M5	–	–	17,061	9%	–
	Marsh Street	47,061	24%	42,261	21%	-10%
	M5 East Motorway	53,516	28%	49,286	25%	-8%
	General Holmes Drive	51,846	27%	52,339	26%	1%
	Total	**192,630**		**199,769**		**4%**
Westbound	Princes Highway	38,879	20%	36,806	18%	-5%
	New M5	–	–	17,687	9%	–
	Marsh Street	45,744	24%	44,240	22%	-3%
	M5 East Motorway	56,118	29%	45,922	23%	-18%
	General Holmes Drive	52,958	27%	55,895	28%	6%
	Total	**193,698**		**200,549**		**4%**
Two-way	Princes Highway	79,085	20%	75,628	19%	-5%
	New M5	–	–	34,748	9%	–
	Marsh Street	92,805	24%	86,501	22%	-7%
	M5 East Motorway	109,634	28%	95,208	24%	-13%
	General Holmes Drive	104,804	27%	108,233	27%	3%
	Total	**386,328**		**400,318**		**4%**

Table 7: Screenline comparison of 2031 Average Weekday Traffic volumes 'without project' and 2031 'full WestConnex and southern extension' (source: EIS)

Direction	Location	2031 'without project'	Share	2031 'full WestConnex and Southern extension'	Share	Change
Western Screenline						
Eastbound	Canterbury Road	28,377	24%	29,374	27%	4%
	M5 East Motorway Corridor (including New M5)	59,474	50%	46,035	43%	-23%
	Stoney Creek Road	16,694	14%	19,980	18%	20%
	Forest Road / Queens Road	13,233	11%	12,636	12%	-5%
	Total	**117,778**		**108,025**		**-8%**
Westbound	Canterbury Road	27,581	23%	27,426	25%	-1%
	M5 East Motorway Corridor (including New M5)	59,177	49%	44,140	41%	-25%
	Stoney Creek Road	16,126	13%	18,439	17%	14%
	Forest Road / Queens Road	18,832	15%	18,348	17%	-3%
	Total	**121,716**		**108,354**		**-11%**
Two-way	Canterbury Road	55,958	23%	56,799	26%	2%
	M5 East Motorway Corridor (including New M5)	118,651	50%	90,175	42%	-24%
	Stoney Creek Road	32,820	14%	38,420	18%	17%
	Forest Road / Queens Road	32,066	13%	30,984	14%	-3%
	Total	**239,494**		**216,379**		**-10%**
Eastern Screenline						
Eastbound	Princes Highway	40,206	21%	11,350	6%	-72%
	New M5	–	–	36,601	19%	
	Marsh Street	47,061	24%	50,730	26%	8%
	M5 East Motorway	53,516	28%	47,045	24%	-12%
	General Holmes Drive	51,846	27%	49,715	25%	-4%
	Total	**192,630**		**195,441**		**1%**
Westbound	Princes Highway	38,879	20%	13,599	7%	-65%
	New M5	–	–	45,138	23%	
	Marsh Street	45,744	24%	46,833	24%	2%
	M5 East	56,118	29%	39,718	20%	-29%
	General Holmes Drive	52,958	27%	52,008	26%	-2%
	Total	**193,698**		**197,297**		**2%**
Two-way	Princes Highway	79,085	20%	24,950	6%	-68%
	New M5	–	–	81,739	21%	
	Marsh Street	92,805	24%	97,563	25%	5%
	M5 East	109,634	28%	86,763	22%	-21%
	General Holmes Drive	104,804	27%	101,722	26%	-3%
	Total	**386,328**		**392,737**		**2%**

Table 8: 2021 comparison of average travel time and speed for M5 East Motorway between King Georges Road and Foreshore Road (source: EIS)

Direction	2021 'without project'		2021 'with project'	
	Average travel time (min)	Average speed (km/h)	Average travel time (min)	Average speed (km/h)
AM Peak				
Eastbound	20	42	11	76
Westbound	17	49	11	76
PM Peak				
Eastbound	18	47	10	84
Westbound	19	44	12	70

Table 9: 2031 comparison of average travel time and speed for M5 East Motorway between King Georges Road and Foreshore Road (source: EIS)

Direction	2031 'without project'		2031 'with project'		2031 'full WestConnex and Southern extension'	
	Average travel time (min)	Average speed (km/h)	Average travel time (min)	Average speed (km/h)	Average travel time (min)	Average speed (km/h)
AM Peak						
Eastbound	26	32	12	70	11	76
Westbound	23	37	12	70	11	76
PM Peak						
Eastbound	26	32	13	65	10	84
Westbound	27	31	15	56	11	76

Table 10: Indicative Car Parking Loss – St Peters Locality (source: EIS)

Road Section	Indicative Impact
Campbell Street, between Princes Highway and Unwins Bridge Road	Additional of 34 on-street and 26 off-street car parks
Albert Street	Loss of 44 car parks along both sides
Campbell Road, between Barwon Park Road and Burrows Road	Loss of 111 car parks along both sides
Burrows Road, south-west of Campbell Road	Loss of 8 car parks along both sides
Burrows Road, north-east of Campbell Road	Loss of 15 car parks along both sides
Euston Road, north of Sydney Park Road intersection	Loss of 24 car parks along both sides
Huntley Street, east of Euston Road	Loss of 28 car parks along both sides
Princes Highway	Loss of 18 car parks along both sides
May Street	Loss of 38 car parks along both sides
Unwins Bridge Road	Loss of 33 car parks along both sides
Brown Street	Possible loss of up to 6 car parks during integration / tie-in works
Florence Street	Possible loss of up to 6 car parks during integration / tie-in works
St Peters Street	Possible loss of up to 6 car parks during integration / tie-in works
Gardeners Road, between Kent Road and cul-de-sac of Gardeners Road	Loss of 47 car parks along both sides
Bourke Road, north of Bourke Street / Gardeners Road intersection	Loss of 16 off-street car parks

APPENDIX F INDEPENDENT NOISE REVIEW

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6788

APPENDIX G HIGHLY NOISE AFFECTED RECIEVERS

	Number of Highly Noise Affected Sensitive Receivers (>75dB(A)) during construction*									
	Surface Works							Tunnelling		
NCA	Site establishment	Construction compounds	Construction of portals	Road and interchange surface works	Motorway operations complexes	General utility installation and relocation	Construction of toll infrastructure	Site establishment	Construction Compounds	Support site and establishment
1	0	0	0	29	0	0	0	0	0	0
2	0	0	0	12	0	0	0	0	0	0
3	0	0	0	55	0	0	0	0	0	0
4	16	0	0	16	0	11	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0
6	0	0	0	138	0	2	0	0	0	0
7	2	0	2	35	2	2	0	2	0	1
8	1	0	0	21	0	8	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0
11	0	0	0	15	0	0	0	0	0	0
12	0	0	0	0	20	0	0	22	0	0
13	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	2	2	31
16	0	0	0	0	0	0	0	0	0	18
17	0	0	0	0	0	0	0	0	0	0
18	0	0	0	4	0	0	0	0	0	0
19	28	7	30	21	0	26	0	41	7	5
20	0	0	0	35	0	0	0	0	0	0
21	0	0	0	18	0	0	0	0	0	0
22	0	0	0	36	0	0	0	0	0	0
23	0	0	0	61	0	0	0	0	0	0
24	0	0	0	35	0	0	0	1	0	0

	Number of Highly Noise Affected Sensitive Receivers (>75dB(A)) during construction*									
	Surface Works							Tunnelling		
NCA	Site establishment	Construction compounds	Construction of portals	Road and interchange surface works	Motorway operations complexes	General utility installation and relocation	Construction of toll infrastructure	Site establishment	Construction Compounds	Support site and establishment
25	1	0	0	0	0	0	0	1	0	0
26	0	0	0	0	11	0	0	0	0	8
27	0	0	0	3	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0
30	0	0	0	8	0	0	0	0	0	0
Total	48	7	32	542	33	49	0	69	9	63

*Highlighted green cells indicate highest count of highly noise affected receivers for each construction activity

APPENDIX H WORST CASE EXCEEDANCE OF NML

The table below details the worst case exceedance of NML for each scenario of the Project

Activity	Hours	Description	Min Duration	Max Duration	Special
Surface Works Earthworks and site-establishment	Standard	~ Earthworks for the project would run no longer than 6 months into the program depending on the location of the NCA. ~ Power generation at NCA19 would run until permanent power is in place. ~ Remaining sub categories of earthworks as listed in table 36 are non-continuous and would be 2-4 weeks in duration	Installation of environmental controls (5 to 15 days dependant on NCA)	Power generator at NCA19 (approx 6 months to 9 months)	Demolition intensive is non continuous and runs for 1 to 2 months depending on scope. Max exceedance occurs with vegetation clearing (iron bark area) and should be short in month duration (1 - 2 months)
	Out of Hours	Power generator is the only activity causing the exceedances.	N/A	Power generator for approx 6 to 9 months at commencement of works and until mains power is connected	N/A
Surface Works Portals	Standard	Piling for portal construction, earthworks and road tie ins	Piling and road tie in's would be non-continuous, lasting 6 to 18 month period	Earthworks would be continuous lasting than 12 to 18 months at portals	Max exceedance relates to road tie ins which would be a non-continuous activity
	Out of Hours	Works for the sub activity is limited to evening hours and not night hours	Piling and road tie in's would be non-continuous, lasting 6 to 18 months	Earthworks would be continuous lasting than 12 to 18 months at portals	Max exceedance relates to road tie ins which would be a non-continuous activity
Surface Works M5 East Road Widening	Standard	Activities include earthworks (hammering and non hammering) and road tie in's	Piling and road tie in's would be non-continuous, lasting 12 to 18 months	Earthworks would last 27 months in total and be continuous for up to 9 months at portals, and then non	Max exceedances relate to earthworks for daytime and earthworks (non

Activity	Hours	Description	Min Duration	Max Duration	Special
				continuous for 18 months	hammering) for evening
	Out of Hours	Works for the sub activity is limited to evening hours and not night hours No excavation by hammering rock in this period	Piling and road tie in's would be non-continuous, lasting 12 to 18 months	Earthworks would last 27 months in total and be continuous for up to 9 months at portals, and then non continuous for 18 months	
Surface Works St Peters Interchange	Standard	Activities include earthworks (hammering and non hammering) and road tie in's	Piling and road tie in's would be non-continuous, lasting 12 to 18 months	Earthworks would last 27 months in total and be continuous for up to 9 months at portals, and then non continuous for 18 months	Max exceedances relate to earthworks for daytime and earthworks (non hammering) for evening
	Out of Hours	Works for the sub activity is limited to evening hours and not night hours No excavation by hammering rock in this period	Piling and road tie in's would be non-continuous, lasting 12 to 18 months	Earthworks would last 27 months in total and be continuous for up to 9 months at portals, and then non continuous for 18 months	
Surface Works Toll Infrastructure	Standard	Activities include: - Site establishment, - Road works, - Construction of toll gantries	For each activity listed the duration is 6 to 12 weeks. Entire programme would be 6 months		Toll infrastructure is works in and around Bexley on existing roads
	Out of Hours	Activities include: - Site establishment, - Road works, - Construction of toll gantries	For each activity listed the duration is 6 to 12 weeks. Entire programme would be 6 months		

Activity	Hours	Description	Min Duration	Max Duration	Special
Surface Works Local Road Works	Standard	Demolition of structures, earthworks, road tie ins, kerb & drainage works, pedestrian bridge at Campbell Rd and road bridge connecting Gardeners Rd	Demolition of structures would 2 to 4 months. Kerb and drainage would be continuous in areas for 2 to 6 months	Earthworks and bridge construction would be long durations and continuous in areas for 12 months with a non continuous period of 18 to 24 months. Road tie ins would be non continuous, occurring over the 18 month period in areas	Max exceedances occur with the kerbing & drainage and the earthworks. Note that the LRW are staged over the area for the 36 month programme, therefore NCA's would be affected at different times
	Out of Hours	No earthworks or demolition identified in the evening hours	Kerb and drainage would be continuous in areas for 2 to 6 months	Bridge construction would be long durations and continuous in areas for 12 months with a non continuous period of 18 to 24 months. Road tie ins would be non continuous, occurring over the 18 month period in areas	
Surface Works General utility installation and relocation	Standard	Covers services install and relocation only	6 months duration continuous in NCA's with non continuous activity over 12 months.		Max exceedance at NCA19. Continuous with other sub activities
	Out of Hours	Covers services install and relocation only	6 months duration continuous in NCA's with non continuous activity over 12 months.		Max exceedance at NCA19. Continuous with other sub activities
Surface Works Compound and car Park	Standard	Covers general worksite and car parking; and workshop deliveries	Deliveries throughout the 36 month period, although non continuous during the period for times up to 20 minutes per delivery	Car parking non continuous (start and end of shift)	N/A

Activity	Hours	Description	Min Duration	Max Duration	Special
	Out of Hours	Covers general worksite and car parking; and workshop deliveries	Deliveries throughout the 36 month period, although substantially less in numbers compared to standard hours. Non continuous during the period for times up to 20 minutes per delivery	Car parking non continuous (start and end of shift)	
Surface Works Motorway Operations complexes	Standard	Exceedance only relates to construction of the complexes. Other associated activities are car parking and deliveries	Non continuous over a 12 to 18 month period		N/A
	Out of Hours	Exceedance only relates to construction of the complexes. Other associated activities are car parking and deliveries	Non continuous over a 12 to 18 month period with a max exceedance of 2 dB(A)		
Surface Works Tunnelling - Site Establishment	Standard	Activity includes: ~ Demolition ~ Power generation ~ Piling ~ Environmental Controls	Installation of environmental controls (1 to 2 weeks per NCA) as it is an initial set up activity	Power generator at NCA19 (6 to 12 months dependant on 3rd party works)	Demolition intensive, although non continuous for 1 to 2 months depending on scope. Max exceedance occurs with vegetation clearing (iron bark area) and should be short in month duration (1 - 2months)
	Out of Hours		piling and decline excavation would be approx 6 to 9 months across the NCA's in groups of NCA 6 & 7; NCA's 15, 16, 17, 19, 25 & 26		N/A
Tunnelling Support Establishment	Standard	Piling and decline excavation works	2 to 6 months to access main line works (as detailed in tunnelling support site below)		N/A

Activity	Hours	Description	Min Duration	Max Duration	Special
	Out of Hours		3 to 6 months to access main line works (as detailed in tunnelling support site below)		N/A
Tunnelling Compound and Carpark	Standard	Covers general worksite and car parking; and workshop deliveries	Works to be continuous over the 36 month period.		The exceedance at NCA 19 is reflective of the upfront works for the surface works at the site associated with NCA 19. Once tunnelling has commenced, surface works have been completed to enable tunnel works and therefore less impact on NCA 19
	Out of Hours	N/A			
Tunnelling support site	Standard	Activity includes: -tunnel support; - spoil handling; and - tunnel lining.	Support and lining would be variant on which NCA you look at, although for heading excavation and support it runs for approx. 18 - 24 months.	Spoil would run to 24 months across the NCA's	Exceedances are generally low for the activity, raising slightly for the evening works and increasing again for the night time readings
	Out of Hours	Activity includes: -tunnel support; - spoil handling; and - tunnel lining.	Support and lining would be variant on which NCA you look at, through for heading excavation and support it runs for 18 - 24 months.	Spoil would run to 24 months across the NCA's	

APPENDIX I INDEPENDENT AIR QUALITY REVIEW

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6788

APPENDIX J MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

In accordance with the bilateral agreement between the Commonwealth and NSW Governments, the Department provides the following additional information required by the Commonwealth Minister, in deciding whether or not to approve a proposal under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

REQUIREMENTS FOR DECISIONS ABOUT THREATENED SPECIES AND ENDANGERED ECOLOGICAL COMMUNITIES

In accordance with section 139 of the EPBC Act, in deciding whether or not to approve, for the purposes of section 18 or section 18A of the EPBC Act, the taking of an action and what conditions to attach to such an approval, the Commonwealth Minister must not act inconsistently with certain international environmental obligations, Recovery Plans or Threat Abatement Plans. The Commonwealth Minister must also have regard to relevant approved conservation advices.

Australia's International Obligations

Australia's obligations under the *Convention on Biological Diversity* (Biodiversity Convention) include the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding. The recommendations of the Biodiversity Assessment Report (BAR) and this report are not inconsistent with the Biodiversity Convention, which promotes environmental impact assessment (such as this process) to avoid and minimise adverse impacts on biological diversity. The recommended approval requires avoidance, mitigation and management measures, and offsetting for the listed threatened species and communities and all information related to the proposed action is required to be publicly available to ensure equitable sharing of information and improved knowledge relating to biodiversity.

Australia's obligations under the *Convention on Conservation of Nature in the South Pacific* (Apia Convention) include encouraging the creation of protected areas which together with existing protected areas will safeguard representative samples of the natural ecosystems occurring therein (particular attention being given to endangered species), as well as superlative scenery, striking geological formations and regions. Additional obligations include using their best endeavours to protect such fauna and flora (special attention being given to migratory species) so as to safeguard them from unwise exploitation and other threats that may lead to their extinction. The APIA Convention was suspended with effect from 13 September 2006. While this Convention has been suspended, Australia's obligations under the Convention have been taken into consideration. The recommendations are not inconsistent with the Convention which has the general aims of conservation of biodiversity.

The ***Convention*** *on International Trade in Endangered Species of Wild Flora and Faunas* (CITES) is an international agreement between governments which seeks to ensure that international trade in specimens of wild animals and plants does not threaten their survival. The recommendations are not inconsistent with CITES as the proposed action does not involve international trade in specimens of wild animals and plants.

Recovery Plans and Approved Conservation Advices

The applicable recovery plans and approved conservation advices are considered in Sections 2.1.2, 4, 5.2.1 and Appendix G of the BAR. These documents are discussed below.

- Green and Golden Bell Frog *Litoria aurea* (Lesson 1829) Recovery Plan (draft), February 2005, NSW Department of Environment and Conservation

This document forms the draft Commonwealth and NSW State Recovery Plan for the Green and Golden Bell Frog. The recovery plan considers the conservation requirements of the species across its known range and identifies actions to ensure its long term viability. The recovery plan provides information on the habitat requirements, ecology, distribution, conservation status, key threats, management issues, research and monitoring, captive breeding and translocation, and community

education. It also details the responsibilities for the implementation and funding of the plan. The Arncliffe Green and Golden Bell Frog population is identified by the recovery plan as a key population in Sydney and refers to the habitat creation, enhancement and captive breeding measures that were undertaken for the M5 East Motorway. The recovery plan recommends the development of a specific management plan for the Arncliffe population. The Proponent has developed a Green and Golden Bell Frog Management Plan which presents a framework for the construction of the project. The plan of management forms part of the EIS and outlines construction mitigation and management measures, and measures to enhance habitat adjacent to the RTA ponds within the Kogarah Golf Course during construction of the project. The Department supports the measures in the plan. However, the Department is of the opinion that the plan should include additional details on monitoring and has recommended that the plan be updated in consultation with the OEH and submitted to the Secretary for approval prior to commencement of construction at the Kogarah Golf Course (condition B13).

The Proponent has also prepared a Habitat Creation and Captive Breeding Plan (submitted as part of the Submissions and Preferred Infrastructure Report) which involves enhancing the existing breeding ponds adjacent to the Kogarah Golf Course (RTA ponds), implementing a captive breeding program (to create a viable population that can serve as insurance and seeding populations) and creating a new habitat on RMS owned vacant land adjacent to the Marsh Street wetlands. The proposed plan is not inconsistent with the objectives of the draft recovery plan.

- Approved Conservation Advice for *Litoria aurea* (green and golden bell frog)

The Conservation Advice for the Green and Golden Bell Frog was approved by the Commonwealth Minister on 11 April 2014 and identifies the main threats and main potential threats to the species. These include habitat destruction/degradation/fragmentation, predation of eggs and tadpoles by predatory fish, and adults by terrestrial predators (European fox, cats and rats), infection with the Chytrid fungus pathogen, water quality impacts and road mortality. The Conservation Advice identifies local and regional priority actions that could be implemented to support the recovery of the species.

The local priority actions relevant to the Arncliffe Green and Golden Bell Frog population and how the Proponent addresses these are considered below:

- Habitat Loss, Disturbance and Modification – the project will directly impact 7.82 hectares of foraging habitat at the Kogarah Golf Course during the construction of the project (up to four years). Following construction the disturbed area will be restored/rehabilitated, except for a small portion of land adjacent to Marsh Street which will be used for permanent facilities. Supplementary feeding would be provided in the corridor between the RTA ponds and the remainder of the golf course for the duration of construction. The Green and Golden Bell Frog Plan of Management would enhance and manage the existing RTA ponds habitat and create new compensatory habitat at Marsh Street.

- Animal Predation or Competition – the decline of the Green and Golden Bell Frog population at the RTA ponds has been attributed to predation by foxes. The RTA ponds are free of predatory fish, however, the dams and waterways in the Kogarah Golf Course are occupied by predatory fish, including the Plague Minnow. The RTA ponds are currently fenced, however, the condition and ability of the fence to keep terrestrial predators out whilst maintaining frogs access to the golf course foraging area is unknown. The Proponent has committed to provide predator perimeter fencing and frog fencing along the road frontages of the Marsh Street habitat ponds. The eastern fence of the new ponds would allow frogs to access the existing frog habitat areas. The existing and new ponds would be monitored for predatory fish.

- Diseases, Fungi and Parasites – the Proponent regularly undertakes saline (salt water) flushing of the RTA ponds to control the chytrid fungus pathogen. These measures would also be implemented for the new habitat ponds. During construction the Proponent has committed to implement frog hygiene measures in the handling of frogs discovered in the construction zones and in the use of construction vehicles, plant and equipment in the frog habitat area.

The Department considers the BAR has addressed the priority actions outlined in the approved Conservation Advice, and these actions will be required to be developed and implemented through a Construction Flora and Fauna Management Plan (condition D68(d)) and a Green and Golden Bell Frog Plan of Management (condition B13).

- Approved Conservation Advice (including listing advice) for Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion

In 2015, the Commonwealth Minister approved the Conservation Advice for the critically endangered Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion vegetation. The Conservation Advice identifies vegetation clearance as the major contributor to the decline of the ecological community. Other key threats resulting from increasing urbanisation include inappropriate fire regimes, weed invasion, hydrological changes, predation of native fauna and diseases such as *Phytophthora cinnamomi* and myrtle rust (Puccinia psidii s.l.). The Conservation Advice identifies and prioritises conservation actions that could be implemented to assist the recovery of the ecological community. The Conservation Advice has recommended the development of a recovery plan for the ecological community.

The project impacts less than 0.1 per cent of remaining Cooks River Castlereagh Ironbark Forest in the Sydney Basin Bioregion, however, it impacts 78 per cent of the community in the project area. The Proponent acknowledges this is a significant impact but notes that the existing community is highly modified, affected by edge effects from the M5 East Motorway, remote from other stands of the community and affected by nutrient runoff from the Canterbury Golf Course. The Proponent would implement measures in a Construction Flora and Fauna Management Plan to manage the remaining patch of the community. However, the Proponent considers that the long-term viability of the remaining patch requires substantial effort and continuing management to ensure its survival.

Threat Abatement Plans

The Threat Abatement Plans relevant to this action are discussed below and are available at http://www.environment.gov.au/biodiversity/threatened/threat-abatement-plans/approved.

- Threat abatement plan for Infection of amphibians with chytrid fungus resulting in chytridiomycosis

Chytridiomycosis is an infectious disease affecting amphibian populations. The disease is caused by a pathogenic fungus, *Batrachochytrium dendrobatidis,* known as amphibian chytrid fungus. The chytrid fungus occupies a zone in eastern Australia from North Queensland to Melbourne in Victoria. The chytrid fungus can spread independently or with the assistance of amphibians and is endemic in NSW populations of Green and Golden Bell Frogs. The Threat Abatement Plan (TAP) aims to minimise the impact of chytridiomycosis on Australian amphibian populations and has goals to prevent amphibian populations or regions that are chytridiomycosis free from becoming infected and to decrease the impact of infection of the amphibian chytrid fungus on populations that are currently infected.

Strict hygiene protocols would be established for the handling of frogs found in the project area and for construction personnel outside the construction zone and within the Kogarah Golf Course. These controls would be implemented through a Construction Flora and Fauna Management Plan (condition D68(d)) for the project and requirements relating to site establishment works (condition D59). The RTA ponds and the proposed Marsh Street habitat ponds would be subject to regular (six monthly) saline flushing to control the chytrid fungus. This commitment is made in the draft Habitat Creation and Captive Breeding Plan in the Submissions and Preferred Infrastructure Report.

- Threat abatement plan for predation by feral cats and Threat abatement plan for predation by the European red fox (relevant to Cooks River/Castlereagh Ironbark Forest of the Sydney Basin and the Green and Golden Bell Frog)

Foxes and feral cats are significant predators of native fauna in Australia. The Threat Abatement Plans for both predators aim to minimise their impacts on biodiversity by protecting affected threatened species (and ecological communities in relation to the TAP for the fox) and preventing further species and ecological communities from becoming threatened.

The proposed action could facilitate the spread or increase the numbers of feral cats and foxes through the clearance and modification of habitat, however, as the majority of surface works are in previously disturbed areas, the risk of this impact is considered to be low. To minimise predation of the Green and Golden Bell Frog by foxes, the Proponent has indicated that perimeter fencing would

be provided at the proposed Marsh Street habitat ponds. The Department has reinforced the implementation of the Habitat Creation and Captive Breeding Program, which incorporates perimeter fencing at the Marsh Street habitat pond, in its recommended conditions of approval (condition B14).

- Threat abatement plan for disease in natural ecosystems caused by Phytophthora cinnamomi

Phytophthora cinnamomi (*P. cinnamomi*) is a microscopic soil-borne organism that has the ability to cause plant disease and plant death. It is within a group currently referred to as water mould and interferes with the movement of water and nutrients within the roots of plants. It can be spread in water, soil or plant material that contains the pathogen and dispersal is favoured by moist or wet conditions. It can be carried in both overland and subsurface water flows and spread by native and feral animals. Humans however, have the capacity to disturb and transport more soil than any other vector. Most of the large centres of infestation that exist today in southern temperate Australia occurred as a result of human activity, often as a direct result of the introduction of infected soil or road-building materials to vulnerable un-infected areas.

The EIS has no information as to whether the area of Cooks River/Castlereagh Ironbark Forest to be cleared may be affected by *P. cinnamomi*. If present, construction related activities have the potential to introduce or spread the pathogen through: the movement of construction vehicles and use of construction plant and equipment; construction personnel footwear; or the introduction of infected soil or construction material to uninfected areas. The TAP for managing the spread of *P. cinnamomi* identifies actions to minimise its spread to uninfected sites and mitigate impacts at infected sites.

Due to the uncertainty associated with the presence of *P. cinnamomi* on the project site, is the Department has recommended that actions to avoid and mitigate the spread of plant disease are implemented as part of a Construction Flora and Fauna Management Plan (condition D68(d)). Subject to this recommended condition, the Department considers that approval of the proposed action would not be inconsistent with the TAP for disease in natural ecosystems caused by *P. cinnamomi*.

ADDITIONAL EPBC ACT CONSIDERATIONS

Table 1 contains the additional mandatory considerations, factors to be taken into account and factors to have regard under the Act, additional to those already discussed, which the Commonwealth Minister must consider in determining the proposed action.

Table 1: Additional considerations for the Commonwealth Minister under the EPBC Act

EPBC Act section	Considerations	Conclusion
Mandatory considerations		
136(1)(b)	Social and economic matters are discussed in Appendix M of the EIS and section 6 of the BAR	The Department considers that the project would result in a range of benefits to the local community and local and regional economy through improvements in network efficiency.
Factors to be taken into account		
3A, 136(2)(a), 391(2)	Principles of ecologically sustainable development (ESD), including the precautionary principle, have been taken into account, particularly: • The long-term and short-term economic, environmental, social and equitable considerations that are relevant to this decision; • Conditions that restrict environmental impacts and impose monitoring and adaptive management reduce any lack of certainty related to the potential impacts of the project; • Conditions requiring the project to be delivered and operate din a sustainable way to protect	The Department considers that the project, if undertaken in accordance with the recommended conditions of approval, would be consistent with the principles of ESD. The Department's consideration of the project against the principles of ESD is presented in Section 3.7 of this report.

	the environment for future generations and conserving the relevant matters of national environmental significance; • Advice provided within this report reflects the importance of conserving biological diversity and ecological integrity in relation to the controlling provisions for the project; and • Mitigation measures to be implemented which minimise potential impacts of the project on biodiversity within the project area.	
136(2)(e)	Other information on the relevant impacts of the proposed action – the Department is not aware of any relevant information not addressed in this assessment report.	The Department considers that all information relevant to the impacts of the project have been taken into account in this assessment. The Department's consideration on key issues is presented in Section 5 of this report.
Factors to have regard to		
176(5)	Bioregional plans	There is no relevant bioregional plan.
Considerations on deciding on conditions		
134(4)	Must consider: • information provided by the person proposing to take the action or by the designated proponent of the action; and • the desirability of ensuring as far as practicable that the condition(s) is a cost-effective means for the Commonwealth and a person taking the action to achieve the object of the condition.	Documentation is provided by the Proponent in the Biodiversity Assessment Report in Appendix 2H of the EIS (**Appendix A** of the assessment report), and Section 7.1 and Appendices B and F of the Submissions and Preferred Infrastructure Report (**Appendix C** of the assessment report). The Department considers that the proposed conditions are a cost effective means of achieving their purpose.

THREATENED SPECIES AND COMMUNITIES (SECTIONS 18 AND 18A OF THE ACT)

For the reasons set out in Section 6 of the BAR, the Department recommends that the impacts of the action on threatened species and communities will be acceptable, subject to the implementation of the avoidance and mitigation measures described in the EIS, Submissions and Preferred Infrastructure Report, and to the requirements of the recommended conditions of approval.

OTHER PROTECTED MATTERS

The Commonwealth Department of the Environment determined that other matters under the EPBC Act are not controlling provisions with respect to the proposed action. These include listed migratory species, RAMSAR wetlands, Commonwealth marine environment, world heritage properties, national heritage places, nuclear action, Great Barrier Reef Marine Park and a water resource associated with a large coal mining or coal seam development.

APPENDIX K INDEPENDENT GROUNDWATER REVIEW

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6788

APPENDIX L EXISTING FLOODING EXTENTS

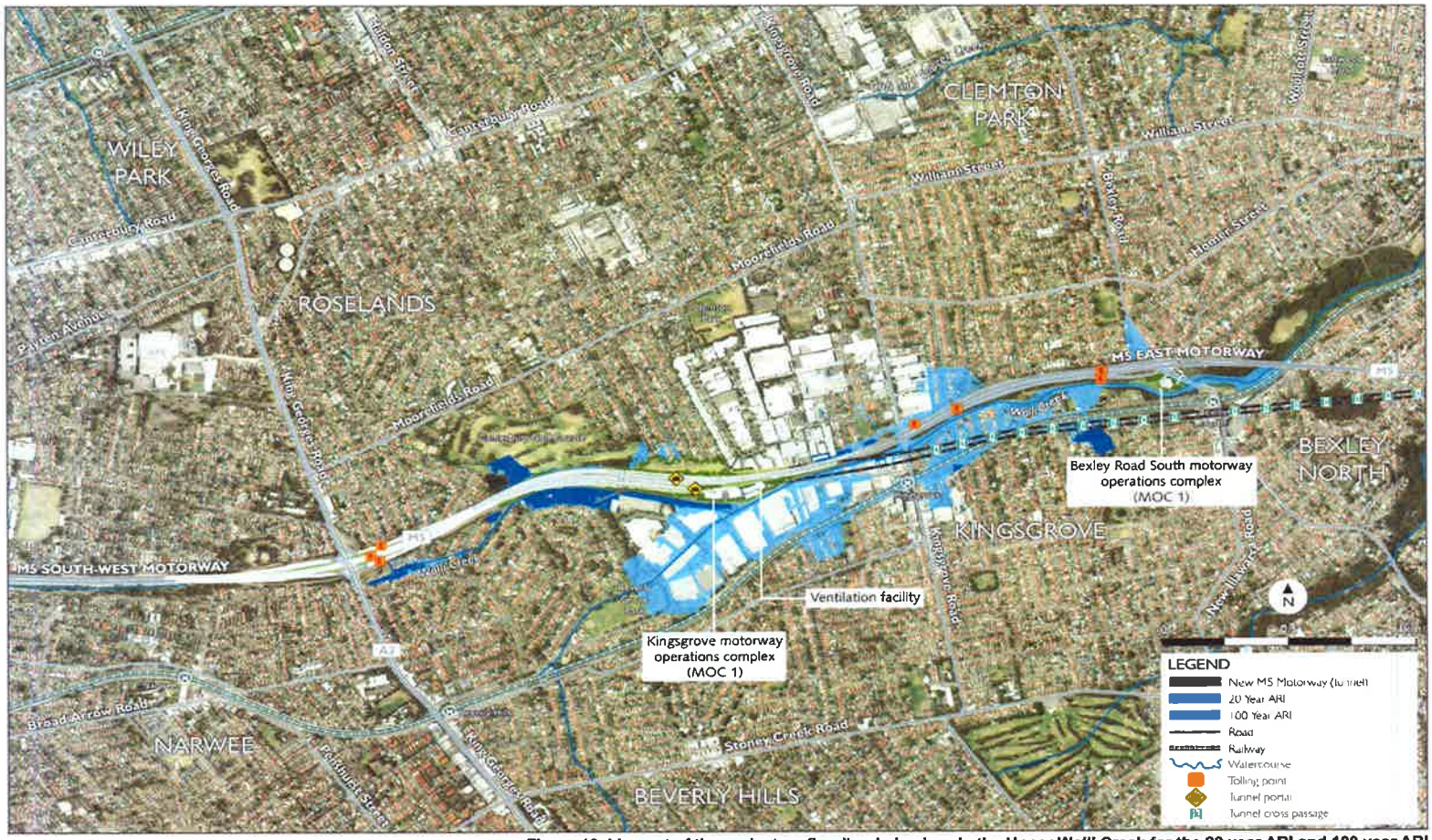

Figure 18-4 Impact of the project on flooding behaviour in the Upper Wolli Creek for the 20 year ARI and 100 year ARI

Figure 18-5 Impact of the project on flooding behaviour in the Lower Cooks River floodplain for the 20 year ARI and 100 year ARI

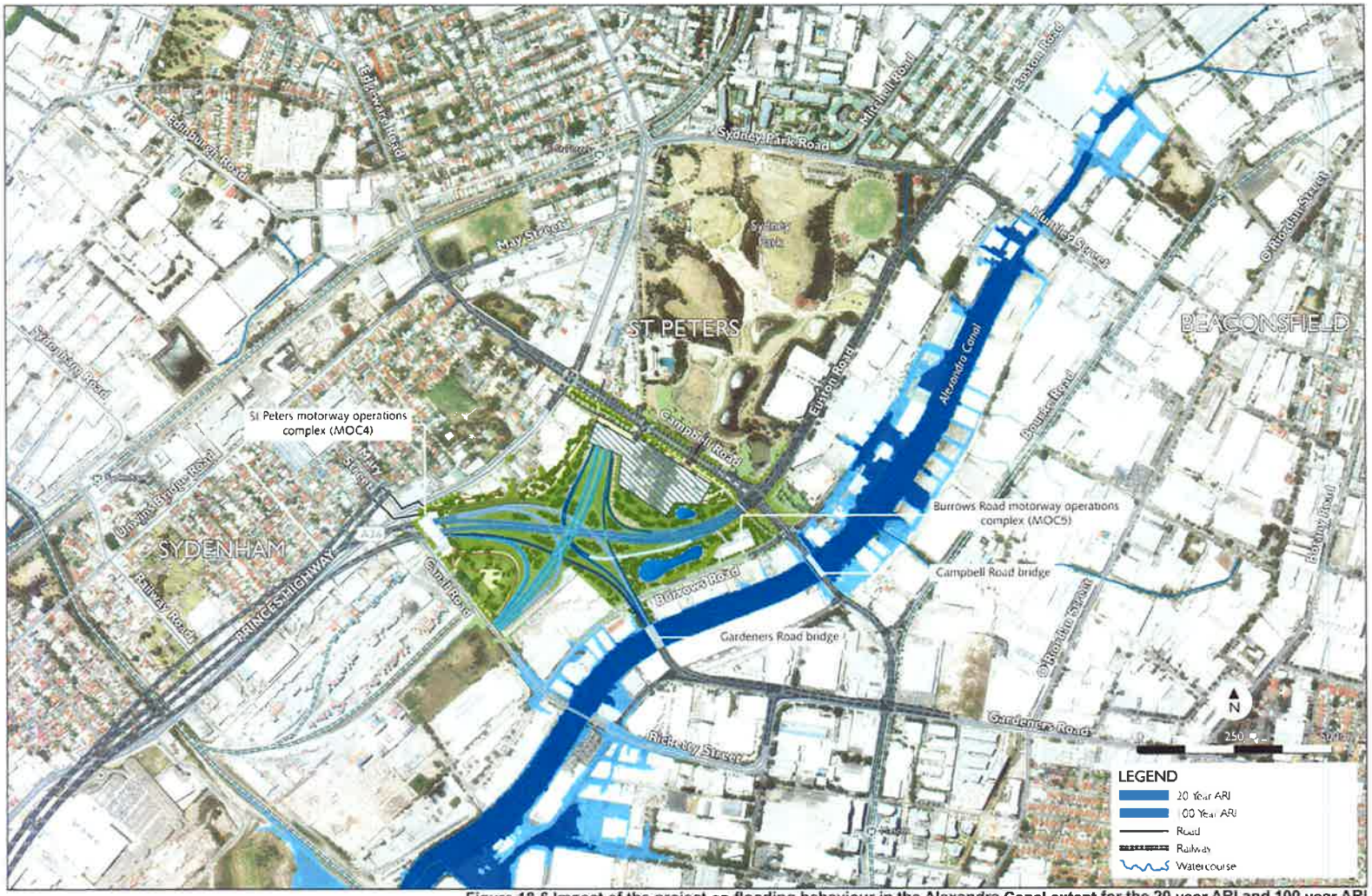

Figure 18-6 Impact of the project on flooding behaviour in the Alexandra Canal extent for the 20 year ARI and 100 year ARI

APPENDIX M INDEPENDENT URBAN DESIGN REVIEW

See the Department's website at
http://www.majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=6788

APPENDIX N HERITAGE ITEMS

Local Government Area	Type, and listed significance level	Number of heritage listed items	Number of heritage items - impact type and impact rating								Number of items by impact rating		
			Demolition	Modification	Acquisition	Heritage area	Acoustic	Tunnel vibration	Surface vibration	Visual	Negligible	Minimum	Significant
Canterbury / Hurstville	Pallamanna Parade Urban Conservation Area	1	0	0	0	1	0	0	1	1	3	0	0
Rockdale	Local	23	0	0	0	0	0	22	2	2	25	1	0
	State	2	0	0	0	0	0	2	1	1	4	0	0
	Clemton Park Urban Conservation Area	1	0	0	0	1	0	0	1	1	2	1	0
	Bardwell Park Urban Conservation Area	1	0	0	0	1	0	1	0	0	2	0	0
	Kingsgrove East Urban Conservation Area	1	0	0	0	1	0	1	0	1	3	0	0
Marrickville	Local	16	2	1	2	1	1	7	9	7	10	17	3
	State	3	0	1	0	0	0	2	2	0	2	0	3
	St Peters Brick Pit Geological Site	1	0	1	0	0	0	0	1	1	0	0	3
	Sydenham Village	1	0	0	0	0	0	1	0	0	1	0	0
Sydney	Local	7	1	0	0	1	1	0	6	6	3	10	2
Totals		57	3	3	2	6	2	36	23	20	55	29	11

APPENDIX O DEPARTMENT OF INFRASTRUCTURE AND REGIONAL DEVELOPMENT - APPROVAL