

Roads and Maritime Services

WestConnex New M5

Environmental Impact Statement

November 2015

Prepared for

Roads and Maritime Services

Prepared by

AECOM Australia

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Document controls

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Signed:	
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Executive Summary

What is proposed?

Roads and Maritime Services (Roads and Maritime) is seeking approval under Part 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) to construct and operate the New M5 (the project); which would comprise a new, tolled multi-lane road link between the existing M5 East Motorway east of King Georges Road and St Peters. The project would also include an interchange at St Peters and connections to the existing road network.

The M5 Motorway corridor (the M5 East Motorway and the M5 South West Motorway) is the main passenger, commercial and freight corridor between Port Botany, Sydney Airport and south-west Sydney. Traffic demands on the M5 East Motorway currently exceed its design capacity and present a significant bottleneck to the M5 Motorway corridor with motorists experiencing heavy congestion and unreliable journey times.

The project is needed to provide additional capacity along the M5 Motorway corridor, allowing for a more robust and reliable transport network.

Key components of the project would include:

- Twin motorway tunnels between the existing M5 East Motorway (between King Georges Road and Bexley Road) and St Peters. Each tunnel would be around nine kilometres in length and would be configured as follows:
 - Between the western portals and Arncliffe, the tunnels would be built to be three lanes wide but marked for two lanes as part of the project. Any change from two lanes to three lanes would be subject to future environmental assessment and approval
 - Between Arncliffe and St Peters, the tunnels would be built to be five lanes wide but marked for two lanes as part of the project. Any change from two lanes to any of three, four or five lanes would be subject to future environmental assessment and approval
- Tunnel stubs to allow for a potential future connection to Stage 3 of the WestConnex program of works (the M4-M5 Link) and a potential future connection to southern Sydney (known as the Southern extension)
- Surface road widening works along the M5 East Motorway between east of King Georges Road and the new tunnel portal at Kingsgrove.
- A new road interchange at St Peters, which would initially provide road connections from the main alignment tunnels to Campbell Road and Euston Road, St Peters and to a new bridge crossing Alexandra Canal and joining to Gardeners Road
- A second new road bridge across Alexandra Canal, linking Campbell Road, St Peters with Gardeners Road and Bourke Road, Mascot
- Closure and remediation of the Alexandria Landfill site, to enable the construction and operation of the new St Peters interchange
- Works to enhance and upgrade local streets and intersections near the St Peters interchange
- Ancillary infrastructure and operational facilities for electronic tolling, signage (including electronic signage), ventilation structures and systems, fire and life safety systems, and emergency evacuation and smoke extraction infrastructure
- A motorway control centre that would include operation and maintenance facilities
- New service utilities and modifications to existing service utilities
- Temporary construction facilities and temporary works to facilitate the construction of the project
- Tolling infrastructure for electronic tolling on the existing M5 East Motorway
- Surface road upgrade works within the corridor of the M5 South West Motorway and M5 East Motorway.

The project is a component of the wider WestConnex program of works to provide a 33 kilometre motorway linking Sydney's west and south-west with Sydney Airport and the Port Botany precinct. The component projects of the WestConnex program of works and their current status are:

- M4 Widening – Pitt Street, Parramatta to Homebush Bay Drive, Homebush (planning approval granted and under construction)
- M4 East – Homebush Bay Drive, Homebush to Parramatta Road and City West Link (Wattle Street) at Haberfield (planning application lodged and subject to planning approval)
- New M5 – (the subject of this EIS)
- King Georges Road Interchange Upgrade (planning approval granted and under construction)
- M4-M5 Link – Haberfield to St Peters (undergoing concept development and subject to planning approval)
- Sydney Gateway (undergoing concept development and subject to planning approval).

Each component will be, or has been, subject to a separate environmental assessment, consultation and planning approval process.

Planning approval for the M4 Widening project was granted on 21 December 2014. Planning approval for the King Georges Road Interchange Upgrade was granted on 3 March 2015.

Planning approval is currently being sought for the M4 East project.

The M4-M5 Link project is in an earlier stage of investigation and would be subject to assessment and approval under the EP&A Act in the future.

In addition, a proposed Southern extension from Arncliffe to Kogarah is currently being investigated by Transport for NSW, and would connect the New M5 to the southern and bayside suburbs of Sydney, and the proposed F6 extension.

The WestConnex Delivery Authority (WDA) was established by the NSW Government to manage the delivery of the WestConnex series of projects for Roads and Maritime on behalf of the State. WDA was a public subsidiary corporation of the Roads and Maritime. Following the achievement of early milestones for the WestConnex program of works, the NSW Government took the opportunity to evolve this early governance model.

On 1 October 2015 the transfer of the project delivery functions of WDA to Sydney Motorway Corporation (SMC) was finalised, forming a single decision-making entity to finance and deliver the WestConnex program of works. SMC is a private corporation, the shareholders of which are the NSW Minister for Roads, Maritime and Freight and the NSW Treasurer, with a majority independent board of nine directors.

Roads and Maritime is the Government client agency for the WestConnex program of works. In that capacity Roads and Maritime will enter into contractual arrangements with SMC subsidiary entities which will design, build, own and operate the motorway on behalf of Roads and Maritime. Roads and Maritime and SMC are working together to manage the planning approval process for the project.

Why is it needed?

The New M5 is part of the NSW Government's commitment to deliver WestConnex for Sydney in response to the recommendations from Infrastructure NSW, its *State Infrastructure Strategy*, the *Long Term Transport Master Plan* and the *State Priorities* announced in September 2015. WestConnex also has the potential to be a catalyst for major urban renewal, as identified in the *Draft Metropolitan Strategy*.

In addition, *A Plan for Growing Sydney* (NSW Government, 2014) presents a vision for Sydney as a strong global city and the nation's economic and financial powerhouse. It emphasises the need to improve access to major employment hubs and global gateways.

The New M5 would deliver on these strategies and plans and would provide benefits including:

- Relieving congestion along the M5 East Motorway
- Reducing travel times and improving reliability
- Providing improvements in road safety.

The investment in the New M5 and other WestConnex projects would facilitate a step change in network performance, enabling delivery of major city shaping improvements and delivering economic growth. As part of the broader WestConnex program of works, the New M5 would support NSW's major sources of economic activity and provide a strategic response to the currently inadequate, and highly congested, road network.

Critically, WestConnex would provide a targeted response to inadequacies in the motorway network that supports Sydney's Global Economic Corridor (which runs from Sydney's Port and Airport precinct through the CBD and North Sydney to Macquarie Park) and south-western Sydney.

Improvements to the transport network, including the New M5, would support these key economic growth areas by supporting domestic and international freight and trade, underpinning a sustainable NSW economy and Sydney's role as a global city.

Integrated land use and transport planning initiatives are a key factor in developing a future where Sydney's growing population can reliably access jobs and services. The New M5 complements a number of other transport and freight based infrastructure initiatives identified in the *Long Term Transport Master Plan*, a combination of which would best address Sydney's needs.

What are the project objectives?

The objectives of the New M5 are to:

- Support Sydney's long-term economic growth through improved motorway access and connections linking Sydney's international gateways and south-western Sydney and places of business across the city
- Relieve road congestion to improve the speed, reliability and safety of travel in the M5 Motorway corridor
- Cater for the diverse travel demands along these corridors that are best met by road infrastructure
- Enhance the productivity of commercial and freight generating land uses strategically located near transport infrastructure
- Fit within the financial capacity of the State and Federal governments, in partnership with the private sector
- Optimise user pays contributions to support funding in an affordable and equitable way
- Provide for integration with other WestConnex projects and the proposed Southern extension, while not significantly impacting on the surrounding environment in the interim period
- Protect natural and cultural resources and enhance the environment through the following key approaches:
 - Manage tunnel ventilation emissions to ensure local air quality meets NSW Environment Protection Authority (EPA) standards
 - Maintain regional air quality
 - Manage in-tunnel air quality to stringent air quality standards
 - Minimise energy use during construction and operation
 - Manage noise in accordance with the NSW Road Noise Policy and realise opportunities to reduce or mitigate noise
 - Provide for improvement of social and visual amenity
 - Minimise impacts on natural systems including biodiversity

- Minimise impact on Aboriginal and non-Aboriginal cultural heritage
- Protect surface and groundwater sources and water quality including management of contaminated areas
- Reduce susceptibility to, and minimise impacts of, flooding
- Integrate sustainability considerations throughout the design, construction and operation of the project, including consideration of the Infrastructure Sustainability Council of Australia (ISCA) Sustainability Rating tool scorecard.

How would the project satisfy the need and project objectives?

The project would provide an alternative and more efficient route for travel between Kingsgrove and St Peters, improving access, connectivity and reliability of traffic movements across the greater Sydney area. The project would also reduce congestion and improve safety along the M5 East Motorway.

The project would:

- Reduce traffic on the M5 East Motorway, improving travel times to and from the airport
- Improve traffic flow and intersection performance
- Reduce congestion, resulting in free-flowing traffic conditions and reduced vehicle emissions
- Reduce crash rates
- Improve road safety for pedestrians, cyclists and motorists
- Improve pedestrian and cyclist connectivity in and around St Peters by providing new and improved cycle, pedestrian and shared paths
- Improve the quality of cycle facilities in Kingsgrove
- Improve travel times and reliability for motorists
- Improve transport amenity along the M5 East
- Provide a net gain in new green space for the community
- Facilitate the closure of the Alexandria landfill.

As part of the WestConnex program of works, the project would contribute to the completion of the entire 33 kilometre WestConnex program providing a seamless motorway-standard journey from Parramatta to the CBD, Sydney Airport, the Port Botany precinct and the M5 Motorway in south-west Sydney, free of traffic signals.

The project is an important component of the WestConnex program which when fully constructed, would:

- Cut forecast travel times between Parramatta and Sydney Airport by up to 40 minutes
- Cut forecast travel times between Kingsgrove and St Peters by up to 25 minutes
- Effectively halve bus travel times between the Inner West and the CBD
- Remove through traffic from local areas, improving amenity and quality of life
- Deliver more than \$20 billion in economic benefits to NSW, which directly and indirectly includes:
 - Travel time saved by freight and passenger users
 - Travel time reliability improvements
 - Reductions in vehicle operating costs
 - Reductions in road crash costs
 - Reductions in regional air pollution, greenhouse gas emissions and noise pollution
 - Foregone local road maintenance

- Benefits that other transport users derive from an expansion in the road network
- Reductions in travel times and congestion costs on surrounding road links used by other users
- Benefits that neighbouring businesses derive from better access to their businesses.

What is the approval process for the project?

Clause 94 of the *State Environmental Planning Policy (Infrastructure) 2007* (Infrastructure SEPP) provides that development for the purpose of a road or road infrastructure facilities may be carried out by or on behalf of a public authority without consent on any land. The project is characterised as being for the purpose of a road and road infrastructure facilities, and is to be carried out by Roads and Maritime. As such, the project is permissible without development consent under the EP&A Act.

Clause 14(1) of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP) declares development to be State significant infrastructure (SSI) if the development is permissible without consent under the EP&A Act and is a type of development specified in Schedule 3 of that SEPP. Schedule 3 of the SRD SEPP includes any activity for which the proponent is also the determining authority and would, in the opinion of the proponent require an environmental impact statement (EIS) to be obtained under Part 5 of the EP&A Act.

Roads and Maritime has formed the opinion that the project is likely to significantly affect the environment. On this basis, the project is State significant infrastructure (SSI) under section 115U(2) of the EP&A Act by reason of the operation of clause 14 and clause 1 of Schedule 3 of the SRD SEPP.

Accordingly, the project is subject to assessment under Part 5.1 of the EP&A Act and requires the approval of the Minister for Planning.

What alternatives were considered?

In 2009, the first study into options to improve travel times and reliability in the M5 corridor was completed with the publication of the *M5 Transport Corridor Feasibility Study* (Roads and Traffic Authority, 2009a). A number of other studies and reports have also identified and assessed options.

Alternatives

Strategic alternatives assessed as part of the project have included:

- The base case or 'do minimum' (no project)
- Optimising the performance of existing infrastructure
- Investing only in public transport and rail freight improvements
- Managing demand
- Constructing the New M5 as part of the WestConnex program of works.

Constructing the New M5 as part of the WestConnex program of works was identified as the preferred option as it would best meet the following project objectives:

- Supports Sydney's long-term economic growth through improved motorway access and connections linking Sydney's international gateways, south-western Sydney and places of business across the city
- Relieves road congestion so as to improve the speed, reliability and safety of travel in the M4 and M5 corridors
- Caters for the diverse travel demands along these corridors that are best met by road infrastructure

- Enhances the productivity of commercial and freight generating land uses strategically located near transport infrastructure
- Fits within the financial capacity of the State and Federal governments, in partnership with the private sector.

Motorway alignment options

Three early tunnel alignment options were considered for the project, including:

- The southern alignment, which was generally based on Roads and Maritime's 2009 strategic concept design for the M5 East Duplication. It mostly followed existing road reserves and corridors and provided connectivity from south-western Sydney to Sydney Airport and Port Botany
- The central alignment, which was located north of the southern alignment, and extended further north than the southern alignment, under Gough Whitlam Park, Tempe and along Princes Highway. The eastern portals for the central alignment option were located south-east of the Princes Highway between the Port Botany Rail Line and Canal Road
- The northern alignment, which comprised twin two-lane tunnels with the western portals located either side of the existing M5 East tunnels at Bexley Road and eastern tunnel portals located near Bayview Avenue on land adjacent to Wentworth Park, Undercliffe.

Following the release of the WestConnex business case, further analysis of the three alignment options was undertaken to identify opportunities to optimise the alignment of the New M5.

The three early alignment options were heavily influenced by the desire to exploit the favourable geology, shorter tunnel length, and reduced interface with the existing M5 East Motorway offered by alignments north of the existing tunnels.

In 2014, the *Rebuilding NSW - State Infrastructure Strategy* highlighted a Southern extension, linked to the WestConnex program of works. Development of the three early alignments did not consider a connection to this extension.

The NSW Government endorsed the *State Infrastructure Strategy* and, as a result, the alignment of the New M5 was reconsidered and a compromise was sought between geological constraints, overall length of the mainline tunnel, and constructability of the future Southern extension tunnels. This optimisation process resulted in a mainline tunnel alignment that is further south than the three early alignment options.

Following selection of the preferred alignment, a number of options were considered in development of the preferred design including different approaches to: the tunnel corridor; interchange locations; ventilation system design and locations; excavation methods; and construction compound locations.

The preferred design would provide a combination of benefits compared with other options assessed, including improved access, minimised impacts on properties and minimised impacts on future development potential.

How did the community participate in selecting the preferred project?

Consultation on the New M5 concept, as part of the broader WestConnex program of works, has been underway since 2013.

Project-specific consultation began in November 2014 following announcement of the project and the commencement of EIS preparation. To date, community and stakeholder consultation for the project has included:

- Community events and information sessions held at appropriate stages in project development, giving stakeholders an opportunity to ask questions. The project team collected feedback at these events to inform the development of the design options
- Consultation with government agencies including the NSW Environment Protection Authority, Department of Primary Industries, NSW Health, NSW Office of Environment and Heritage, NSW Office of Water, Department of Planning and Environment, Transport for NSW, UrbanGrowth NSW and Heritage Council of NSW

- Consultation with Federal Department of Infrastructure and Regional Development, the Civil Aviation and Safety Authority and Sydney Airport Corporation Limited
- Meetings with Canterbury City, Hurstville City, Rockdale City, Marrickville, City of Sydney and Botany Bay City councils both individually, and through Council Reference Groups established for the project
- Briefings with State and Federal members of parliament
- Meetings with services and utility providers
- Presentations and meetings with key stakeholders such as local schools, industry, local environmental groups, community groups and business groups
- More than 20 interactive sessions to convey community feedback and values to three consortia shortlisted to design and construct the New M5 for consideration in design development
- Distribution of community updates, fact sheets and 'letters to the householder' regarding technical field investigations, project progress and milestones as well as community involvement opportunities
- Development of the New M5 Project Overview which was made available online and at community events
- Phone, email and written correspondence
- A dedicated New M5 section on the WestConnex website, which is regularly updated with developments in the project
- Advertisements promoting consultation events and email broadcasts to subscribers
- Door knocks, phone calls, one-on-one meetings with interested community members
- Door knocks, phone calls, one-on-one interviews and acquisition notifications addressed to owners of properties potentially required for full or partial surface acquisition for the project. Acquisition notifications outlined potential property impacts, property owners' rights and the property acquisition process and timing
- Staffed WestConnex information kiosks at shopping centres across the project corridor.

Community and stakeholder consultation is ongoing, and will continue during the display of the EIS and detailed design and construction to capitalise on opportunities to further minimise project impacts.

What are the environmental issues associated with the project?

Traffic and transport

The New M5 would significantly increase the capacity of the M5 East Motorway Corridor, resulting in travel time savings and improving travel reliability. Local streets and intersections around the St Peters interchange would be upgraded to ensure safe and efficient connections to the New M5, and to cater for future traffic growth.

The traffic and transport assessment was undertaken to assess impacts during the construction and operation of the project.

Regional-scale traffic forecasting was undertaken by a joint Roads and Maritime and SMC team, with traffic operational modelling undertaken by AECOM, to characterise the existing and likely future traffic and transport conditions and road network performance with and without the project.

Traffic modelling assessed the following scenarios:

- Existing traffic conditions (2012)
- Construction (2016 peak)
- 2021 and 2031 with and without the project
- 2031 with the full WestConnex program of works and a future Southern extension.

Construction traffic

To minimise construction traffic impacts, the project's construction compounds that provide tunnelling support (and would therefore generate the most construction traffic), have been strategically located to maximise direct access to and from major arterial roads and the M5 East Motorway.

Construction compounds around the western surface works, at the Kingsgrove surface works and at the Bexley Road surface works are predicted to generate a maximum of about 110 heavy and 80 light vehicles per hour in the AM and PM peak hours spread over six construction compounds. The Arncliffe tunnel works compound is predicted to generate a maximum of about 60 heavy and 20 light vehicles per hour in the AM and PM peak hours, while the construction compounds around the St Peters interchange and tunnel works are predicted to generate a maximum of about 125 heavy and 155 light vehicles per hour in the AM and PM peak hours spread over seven construction compounds.

Operational traffic

In 2021, the New M5 is predicted to accommodate two-way average weekday traffic (AWT) of around 29,500 vehicles per day. By 2031, the New M5 is predicted to accommodate a two-way AWT volume of about 34,500 vehicles per day with the project. By 2031, with the full WestConnex program of works and a future Southern extension (if constructed), the New M5 is predicted to accommodate 81,500 vehicles per day. Vehicles using the New M5 between the King Georges Road and St Peters interchanges are forecast to have an average travel time of between nine and 10 minutes at a speed of 68 kilometres per hour in both directions during the morning and afternoon peak.

Two-way 2021 future year AWT on the M5 East Motorway is predicted with the project to decrease from about 116,000 to about 69,000 vehicles per day at the western end and from about 101,500 to about 81,000 vehicles per day at the eastern end of the M5 East Motorway. By 2031, the M5 East Motorway is predicted to accommodate two-way AWT of about 84,000 and 95,000 vehicles per day with the project at the western and eastern end of the M5 East Motorway respectively. By 2031, with the full WestConnex program of works and a future Southern extension constructed, the two-way AWT is predicted to be about 61,000 and 87,000 vehicles per day at the western and eastern end of the M5 East Motorway respectively.

Average peak hour travel times on the M5 East Motorway are forecast to reduce from about 20 minutes (without the project) to 10 minutes (with the project) in 2021, and from about 25 minutes to about 13 minutes in 2031. With the completion of the entire WestConnex program of works and a future Southern extension, the forecast reduction in traffic on the M5 East Motorway in 2031 is reflected in a small forecast reduction in travel time of a minute or two.

Traffic is forecast to divert off the motorway network to use other routes (in particular Stoney Creek Road) outside the peak traffic periods to avoid the proposed toll. Two-way 2021 AWT on Stoney Creek Road is predicted to increase by around 35 percent with the project. By 2031, two-way AWT on Stoney Creek Road is forecast to increase by around 43 percent with the project, dropping to a 17 percent increase with the full WestConnex program of works and a future Southern extension constructed.

In the St Peters local area, total 2021 traffic demand using the modelled St Peters road network is predicted to increase from about 23,800 vehicles to 25,300 vehicles in the morning peak hour and from about 24,800 to 26,300 vehicles in the evening peak hour, a six percent increase in each peak hour. Travel time through the modelled St Peters network is forecast to reduce from about nine minutes to about eight minutes in the morning peak and about seven minutes to about six and a half minutes in the afternoon peak in comparison with a future scenario with no project.

In 2031 with the full WestConnex program of works and the Southern extension, total traffic demand using the modelled St Peters road network is predicted to increase from about 27,000 vehicles to 34,500 vehicles in the morning peak hour and from about 27,600 to 36,700 vehicles in the evening peak hour, a 28 percent increase in the morning peak and a 33 percent increase in the afternoon peak. Travel time through the modelled St Peters network is forecast to reduce from about nine minutes to about eight minutes in the morning peak and about 10 minutes to about seven minutes in the afternoon peak.

Public transport

With regard to impacts on public transport, there are currently 22 bus services crossing the St Peters area, including several Suburban-tier strategic routes, identified in *Sydney's Bus Future* as among the city's most important bus corridors. Of these services, six PM peak services are forecast to experience a travel time improvement of approximately 20 percent or better for the sections of the route running through the area, when compared to a future scenario with no project. Three services are forecast to have their AM peak travel time through the area increased by approximately 20 percent or more, while two services are forecast to be similarly affected during the PM peak period.

The project offers a flexible design which does not preclude bus priority measures being included in the future. Roads and Maritime and TfNSW will continue to work together to deliver *Sydney's Bus Future*, which may be extended to this area in due course, at which point the surface road network can be adapted to include measures identified at that time.

Active transport

Regionally significant cycleway routes would be created as part of the project to provide east-west connectivity across Alexandra Canal connecting the Bourke Road cycleway to St Peters at Unwins Bridge Road. Such infrastructure would increase active transport links for existing populations and the growing populations of Mascot and the Ashmore Estate in Erskineville.

Operational traffic review

An operational traffic review would be undertaken to confirm the operational traffic impacts of the project on surrounding arterial roads and major intersections 12 months after the commencement of operation of the project.

Air quality

The NSW Advisory Committee on Tunnel Air Quality – chaired by the NSW Chief Scientist and Engineer and including representatives from the NSW Environment Protection Authority, NSW Health, Roads and Maritime and NSW Department of Planning and Environment (DP&E) – was consulted during development of the air quality assessment methodology.

The assessment was based on the 2021 and 2031 'do minimum' (no project), 'do something' (with project) and 'do something cumulative' (with whole WestConnex scheme plus Southern extension) scenarios.

Assessment of Air Quality Impacts

Overall the project has little net impact on air quality however there is a small redistribution in pollutant concentrations as a result of changes in the traffic volumes and hence emissions on the surface road network. Emissions from the tunnel ventilation outlets have little impact on air quality outcomes. The project will result in:

- Increased traffic along King Georges Road to the south of the M5 East Motorway, Stoney Creek Road, Bexley Road to the south of the M5 East Motorway, Harrow Road, Bay Street, Forest Road, and around the southern perimeter of Sydney Park
- Decreased traffic and pollutant concentrations along the M5 East Motorway, both to the east and west of the M5 East tunnel and General Holmes Drive.

For annual average PM_{2.5} the relevant criteria is 8 µg/m³. In 2021, the project will result in:

- A small increase in concentration at 63 percent of receptors within the project study area. This increase will be less than 0.5 µg/m³ at 99.96 percent of these receptors, with the largest predicted increase of 1.2 µg/m³. The potential health impacts associated with this change in air quality was found to be low
- A small decrease in concentrations at 37 percent of receivers, with the largest predicted decrease 3.5 µg/m³
- A maximum increase in concentration due to the ventilation outlets of 0.08 µg/m³.

Mitigation of Air Quality Impacts

Construction

Potential impacts on local air quality from dust produced during construction was assessed using a risk-based approach, which determined that standard management measures would be sufficient to mitigate the effects of construction work on local air quality and the community.

In-tunnel

The project ventilation system has been designed and would be operated to achieve stringent in-tunnel air quality criteria. The project design elements to reduce pollutant emissions within the tunnel will include:

- Minimal gradients, the main alignment tunnels would have a maximum uphill gradient of four percent
- Large main line tunnel cross-sectional area (90 square metres).

The ventilation system would be automatically controlled using real-time traffic data covering both traffic mix and speed, and feedback from air quality sensors in the tunnel, to ensure in-tunnel conditions are managed effectively in accordance with the agreed criteria.

Specific ventilation modes will be developed to manage breakdown, congested and emergency situations.

Ambient

The design of the ventilation system will ensure zero portal emissions.

The ventilation outlets will be effective at maintaining local air quality. Ambient air quality monitoring will be conducted pre-and post-operation to demonstrate that emissions from the ventilation outlets will have no detectable impact on local air quality.

Human health

The human health risk assessment followed national guidelines and addresses requirements from key government agencies and councils, such as NSW Health, in relation to air quality, noise and vibration and social aspects.

In relation to air quality, the project is expected to result in a small decrease in total pollutant levels in the community. The project is expected to result in a redistribution of impacts associated with vehicle emissions. This will result in a small improvement (or decreased concentrations and health impacts) for some areas, and a small increase in pollutant concentration in other areas. Potential health impacts associated with changes in air quality (specifically nitrogen dioxide and particulates) are low and essentially negligible.

Future development of land (including re-zonings) in the vicinity of the ventilation facilities that may involve multi-story buildings would need to consider the air dispersion performance of the New M5 facilities.

In relation to noise and vibration, potential impacts during construction and operation have been considered. During construction, potential impacts from noise and vibration on the local community would require management and / or mitigation through the implementation of a range of measures. During operation of the project, a number of properties have been identified where specific mitigation measures are required to reduce impacts and protect the health of occupants. These mitigation measures include low noise pavement, noise barriers, and / or at-property acoustic treatment. The mitigation measures would ensure that the levels of road traffic noise experienced by residents would be reduced to as low as feasible and reasonable.

Changes in the urban environment associated with the project have the potential to result in both positive and negative impacts. Negative impacts may occur as a result of traffic changes during construction, property acquisitions, visual changes, noise impacts and changes in access / cohesion of local areas. These may result in increased levels of stress and anxiety. In many cases, the impacts identified are either short-term, or mitigation measures have been identified to minimise the impacts on the community. Positive impacts on the community include traffic improvements, better connectivity and accessibility, improvements in pedestrian and cycle access, increased public open space following the closure of Alexandria Landfill and improved local amenity at many locations.

Noise and vibration

A noise and vibration assessment was carried out by AECOM to evaluate and predict the potential impact of the construction and operation of the project,

The existing environment is generally dominated by road traffic noise at the western end of the project, and both road and airport noise at the eastern end of the project.

Construction Noise

Where possible, construction sites have been designed and planned to minimise noise and vibration impacts to sensitive receivers. This includes, wherever possible, selection of construction site locations and positioning of vehicle entrances and exits to facilitate quick access to arterial roads in order to minimise impacts to residential and other noise-sensitive receivers.

In accordance with the Interim Construction Noise Guidelines (DECC, 2009), the majority of surface construction would be carried out between 7:00am and 6:00pm Monday to Friday and 8:00am and 1:00pm Saturdays. Some surface works will need to be conducted out of hours to minimise traffic disruptions or for safety or operational reasons, such as design and quality requirements. Tunnelling activities and tunnel support activities, including spoil removal, would be conducted 24 hours a day, seven days a week.

Construction noise levels would exceed the criteria in most of the noise catchment areas for work activities undertaken including earthworks, demolition of existing structures, site establishment road tie-in works and road and intersection modifications. The most affected receivers are located at both the Western surface works (NCA19 and NCA23) and St Peters interchange (NCA6 and NCA7).

The main alignment tunnels would be progressively excavated through a 'heading and bench' process, which involves use of road headers to excavate the top part of the main alignment tunnels and then relatively small scale blasting to remove the lower part of the tunnels (or bench).

The road header excavation would typically progress at around a maximum of seven metres a day subject to local geology. Ground-borne noise from night time road header activity is expected to impact about 370 properties in total, mostly at the western end of the tunnel and at the St Peters end of the tunnel. It is likely that the road headers may be perceptible in the evening and during the night for up to about five days at each affected receiver as the road header passes them, with exceedances of ground-borne noise goals likely for up to about two days. Road header advance rates would reduce to two to five metres a day around the portals, which may increase the duration of exposure for receivers in these areas. Road headers used for tunnelling are also expected to result in temporary vibration above the preferred vibration dose value during the night time, with no exceedances of the maximum vibration dose value. While vibration may be perceptible to some individuals, the vibration levels are predicted to be well below the level that could result in structural damage to property.

Blasting would be restricted to the daytime, six days a week and to one blast per day per receiver. Blasting has the potential to generate airblast (the pressure wave transmitted through the air as a result of the blast) and vibration. Airblast and vibration from blasting would be managed to achieve acceptable limits by designing of the blast charge and blast configuration.

Construction noise impacts would be managed using reasonable and feasible mitigation and management measures including scheduling of works, noise reduction measures for plant and equipment and provision of respite periods for sensitive receivers. Construction contractors will be required to minimise time and duration of impacts to sensitive receivers and keep them proactively informed of likely timing and impacts of noisy activities.

Temporary noise walls or solid hoarding will be used for construction compounds where required to minimise noise impacts to residential receivers. Acoustic sheds would be installed over the tunnel shaft and spoil stockpile areas within the Kingsgrove North (C1), Commercial Road (C3), Bexley Road North (C4), Bexley Road South (C5) and Arncliffe (C7) construction compounds to minimise noise generated by tunnelling support activities.

Operational Noise

The project has been designed to include traffic noise mitigation measures where feasible and reasonable. In the western surface works area existing noise barriers will be relocated where the existing M5 lanes are to be realigned for the construction of new ramps into the tunnel.

One receiver at the western end of the project and a total of 144 receivers in the St Peters area and two buildings within the St Peters Public School have been identified as being eligible for consideration of feasible and reasonable architectural noise mitigation treatment as a result of increased traffic noise.

Operational plant and equipment, including the ventilation outlets will be designed so that noise levels meet the appropriate criteria.

Visual impact and urban design

Urban design and visual impacts differ during construction and operation phases of the project. The completed project would introduce new operational elements and ancillary infrastructure including noise walls, signage, lighting, ventilation and control facilities, as well as new streetscapes, open space and active transport connections. Where long term visual impacts would be negative, mitigation measures including landscape screening would be utilised where feasible to reduce these impacts.

During construction the main visual impacts relate to construction compounds, construction infrastructure and work areas. These are located in proximity to residents at the western surface works, Kingsgrove and the Bexley and Arncliffe construction compounds and in the St Peters / Alexandria area. To minimise impacts construction compounds would be screened through a combination of hoardings and structures such as acoustic sheds.

Where possible existing vegetation would be retained to assist in screening construction compounds and permanent built structures would be designed consistent with the objectives and design principles set out in the *WestConnex Urban Design Guidelines* and RMS design guidelines.

The urban design and landscape component of the project would include new and upgraded footpaths and cycleways and the creation of new open space and landscaping prepared in accordance with urban design guidelines.

Land use and property

The project has been designed to minimise land acquisition and to limit the severance of private properties. The project would impact 159 properties.

Construction of the project would result in temporary changes in land use for the establishment of construction compounds. Construction of the project would temporarily impact 30 properties. Of these 30 properties, 16 only have temporary impacts, while the other 14 have both temporary and permanent impacts. These properties, or partial properties, would be temporarily acquired to allow for construction of the project, including access to and from, and use of construction compounds. Of these 30 directly impacted properties, five are already owned by Roads and Maritime. The remaining 25 properties that would be temporarily acquired include:

- Four properties owned by other NSW Government agencies
- Fifteen properties owned by Local government
- Six privately owned commercial / industrial properties.

Properties, or partial properties temporarily acquired for construction would generally be rehabilitated at the end of construction and returned for potential development for permissible uses under existing land use zoning provisions. There would be some short-term property access impacts during construction of the project; however, these are not expected to be significant.

The project would permanently impact 143 properties to accommodate the project alignment and operational ancillary facilities, including the five motorway operations complexes. This figure includes the 14 properties that have both temporary and permanent impacts. Of the 143 directly impacted properties, 39 are already owned by Roads and Maritime. The remaining 104 properties would be permanently acquired, and comprise:

- Six properties owned by other NSW Government agencies
- Seventy-six privately owned properties comprising 28 commercial / industrial properties and 48 residential properties
- Seventeen properties owned by Local government
- Five properties owned by utility provider

Properties that would require permanent acquisition to accommodate the operational footprint of the project would be acquired prior to the beginning of construction to facilitate construction.

During operation, there would be changes to the way some properties are accessed; however, all properties would have their access maintained and this would not significantly differ from the existing situation.

Soil and water

The project would take place within the Cooks River catchment. The quality of waterways within this highly urbanised catchment is generally poor. However some waterways, including the Wolli Creek sub-catchment, are considered to be sensitive receiving environments.

During construction, exposed soils could potentially be eroded into waterways or moved by wind. In addition, potential accidental leaks or spills of chemicals, fuels, oils and / or greases from construction plant and machinery, may pollute receiving waterways.

These potential construction impacts to soil and surface water would be managed through the implementation of standard construction site mitigation measures, including using water to suppress dust, and using secure bunding arrangements for chemicals and fuels.

During construction temporary water treatment plants would be established at five locations to treat water used during construction and groundwater encountered during tunnelling. With these controls in place, the project would not significantly impact on soils and surface water during its construction.

A permanent water treatment plant and stormwater treatment wetland located at Arncliffe would control groundwater, stormwater, wash down, fire testing, hydrant and deluge water during operation before discharging treated water to the Cooks River.

Water would be treated and returned to the receiving environment to ensure it meets the project's water quality reference criteria, as well as the stormwater pollution reduction targets from the Botany Bay and Catchment Water Quality Improvement Plan, and the project-specific Environment Protection Licence.

Flooding and drainage

Flooding impacts were modelled based on the Upper Wolli Creek floodplain and the Lower Cooks River floodplain.

The modelling considered annual recurrence interval (ARI) flooding events, the Probable Maximum Flood (PMF), events such as a partial blockage of a bridge structure, and impacts predicted due to climate change.

Portions of the project, including several proposed construction compound locations, lie within the existing floodplain for a 20 year ARI flooding event. The assessment determined that the application of standard mitigation measures and refinements during detailed design would be sufficient to mitigate potential mainstream flooding impacts during construction.

During operation, flooding and drainage impacts could occur due to localised and mainstream flooding. To mitigate this, additional drainage infrastructure would be installed to manage localised flooding impacts. During detailed design approaches to minimise impacts to mainstream flooding would be further investigated.

Groundwater

A groundwater model was developed to simulate existing groundwater conditions, predict future groundwater conditions and understand the project's potential impacts to groundwater.

The modelling predicted inflows of 1,115 cubic metres per day of groundwater into the project tunnels during operation. This equates to an inflow rate of 0.63 litres per second along each kilometre of eastbound (shallower) tunnel and 0.67 litres per second along each kilometre of the westbound (deeper) tunnel. Both tunnels would experience inflows below the one litre per second per kilometre design criterion established for the project.

The assessment determined that there is only one registered bore that intersects the Hawkesbury Sandstone within a one kilometre radius of the project. The registered bore is 186 metres deep and the predicted drawdown is 5.7 metres. It is considered that this impact could be adequately mitigated by lowering the pump in the borehole by five to 10 metres.

Ground support measures may be implemented around the western and eastern portals to control ground movement and limit surface settlement. The risk to individual structures from ground movement resulting from the tunnelling works is anticipated to be negligible (potential cosmetic damage only) for the majority of properties above and around the project tunnels.

Mitigation and management measures would be implemented to reduce or eliminate the risks posed by the project to the existing groundwater regime. These environmental mitigation measures would include monitoring groundwater values and engineering solutions to control and minimise potential groundwater impacts.

Non-Aboriginal heritage

The project has been designed to minimise impacts on heritage items however some impacts have been unavoidable.

Statements of Heritage Impacts have been prepared for the following heritage items where a significant impact would occur:

- Rudders Bond Store, St Peters (Sydney LEP)
- Terraces and houses on Campbell Street, St Peters (Roads and Maritime Heritage and Conservation Register)
- Alexandra Canal, Alexandria (State Heritage Register)
- St Peters Brickpit Geological Site, St Peters (Register of National Estate)
- Service garage, St Peters (Marrickville LEP)
- Goodsell Heritage Conservation Area, St Peters (Marrickville LEP)

In all cases mitigation measures have been proposed to ameliorate impacts or in the case of demolition, undertake archival recordings (Rudders Bond Store, terraces and houses on Campbell Street).

Biodiversity

Biodiversity investigations and impact assessments were conducted by Ecological Australia.

The proposal will have the following impacts:

- Direct clearance of around 10.76 hectares of vegetation, including 3.31 hectares of native vegetation and 7.45 hectares of urban native and exotic vegetation
- Direct clearance of 1.4 hectares of the nationally and NSW listed endangered ecological community, Cooks River Castlereagh Ironbark Forest endangered ecological community
- Ongoing indirect impacts arising from habitat fragmentation (principally increased weeds) on remaining Cooks River Castlereagh Ironbark Forest endangered ecological community
- Direct clearance of approximately 7 hectares of foraging habitat and historically active breeding habitat for the nationally and NSW listed endangered Green and Golden Bell Frog habitat
- Temporary (during construction) indirect impacts arising from construction (including noise, dust, light) on artificial breeding habitat Green and Golden Bell Frogs at Arncliffe
- Minor indirect impacts on a Grey Headed Flying Fox camp at Turella.

The impacted Green and Golden Bell Frog breeding habitat was artificially created at Arncliffe by RMS as a consequence of the construction of the M5 East, which partially cleared the original breeding habitat of the species at the nearby Marsh Street wetlands. The species is now locally extinct from this location and survives in the artificial breeding habitat created by RMS. As such the population is of significant conservation and community concern.

The EIS identifies an avoid, mitigate, offset hierarchy of management measures as described below:

- Project design and construction planning to avoid and minimise impacts including avoiding all direct impacts on the main breeding ponds for the Green and Golden Bell Frog on the Kogarah Golf Course
- Mitigating impacts by all available means including minimising the construction footprint, strict construction protocols to remove individual frogs from the construction zone, and to prevent their return using frog proof fencing along with a captive breeding and habitat creation program to provide further artificial habitat for the species on RMS land at Marsh Street and to augment remaining foraging habitat on the Kogarah Golf Course
- Providing commitments to offset all remaining significant impacts including the loss of foraging habitat for the Green and Golden Bell Frog and the Cooks River Castlereagh Ironbark Forest endangered ecological community at Beverly Grove consistent with the *Biodiversity Offsets Policy for Major Projects* which requires proponents to buy biodiversity 'credits' using the BioBanking Scheme to offset impacts.

Social and Economic

During construction of the project, there is the potential for a boost in the economy due to construction expenditure in the region. Local business would benefit from this expenditure through purchases made by construction businesses as well as purchases made by the workforce required to build and support the development of the project. Economic benefits associated with the project support the ongoing or improved economic vitality of the area, which is valued by the community and local government.

Employment opportunities would grow in the region through the potential increase in business customers and through the increase in demand for construction workers. The increase in demand for labour may increase wages in the region, particularly for construction workers, who would be in high demand.

It is estimated that construction expenditure would directly and indirectly contribute an estimated \$1.8 billion of output, \$400 million of household income, around 4,390 annual full-time equivalent jobs and \$670 million value added to the NSW economy per average year of construction.

Operational expenditure was estimated to contribute a total of \$44 million in output, around \$10 million in household income, 116 full-time equivalent jobs and \$18 million in value added to the NSW economy per year of operation.

As a significant volume of traffic currently using the Princes Highway would be diverted into the New M5 tunnel, businesses that are reliant on passing trade may be affected by the project. It has been estimated that there could be an annual reduction of around \$0.4 million in output and around two full-time equivalent jobs lost due to a loss in passing trade. This equates to a loss of 2.5 percent of total output and full-time equivalent employment of the businesses reliant on passing trade. Reductions in passing trade would potentially be offset to some degree by improved amenity and accessibility for the businesses affected.

Changes to parking are not anticipated to have a significant impact on business activity, as most businesses within the area can accommodate off-street parking. Additional on-street and off-street parking provided on Campbell Street and Venice Street as part of the project would help to alleviate impacts associated with the removal of parking in other nearby areas.

The project has the ability to connect residential communities with locations of employment as a result of reduced congestion and decreased travel times. The project would also provide increased road capacity along the M5 Motorway corridor, which would indirectly benefit movement of freight between Sydney Airport and Port Botany, and the western and south-western suburbs of Sydney and commercial vehicle movements between major centres. This benefit is in line with community aspirations and is anticipated to have a positive impact on the local community's sense of connectedness and community cohesion.

Cumulative impacts to the economy and businesses are most likely to result from the concurrent operation of the wider WestConnex program of works. The freight industry will benefit greatly by enabling the efficient movement of traffic between western and south-western Sydney and interstate and international markets through connections with the wider National Land Transport Network, Sydney Airport and Port Botany.

Contamination

The project corridor includes mixed commercial / industrial, residential and open space areas with a mixed site usage history.

Some areas within the project corridor have a long history of heavy industrial land use, particularly in the vicinity of Tempe, Alexandria and St Peters. Accordingly, during construction there is the potential to encounter contamination around surface disturbance areas.

Contamination investigations have included Phase 1 and Phase 2 assessments. A Phase 1 assessment was completed for surface areas anticipated to be disturbed during construction of the project, including areas associated with tunnel entry and exit points, ventilation facility locations, construction compounds and potential disturbance areas within the Alexandra Canal. Phase 2 assessments have been undertaken for the Alexandria Landfill and a former metal smelter site at 5/5A Canal Road, St Peters. Potential contaminants identified include asbestos, heavy metals, hydrocarbons and landfill gases.

All potentially contaminated sites and activities that have the potential to generate and disturb existing contamination would be subject to detailed investigation, remediation and / or management to ensure that risks to the environment, people and future land uses are minimised. In particular the project would impact the contaminated sites at Alexandria Landfill and the RMS Canal Road site.

A key component of the project is the closure and remediation of the Alexandria landfill to enable construction and operation of the new St Peters interchange. The Landfill Closure Management Plan (included in the EIS) provides a landfill closure and environmental management framework to be implemented both during and post landfill closure.

While contamination is not considered to present an imminent risk of harm to human health or the environment, it would require appropriate management during construction. Waste management plans will include procedures for legal handling, storage and disposal of potentially contaminated materials. The Construction Environmental Management Plan (CEMP) would also include an unexpected finds protocol for any latent contamination, groundwater, waste and acid sulfate soils. Site specific asbestos management plans will also be prepared where the presence of asbestos is identified.

An EPA Accredited 3rd Party Contaminated Site Auditor will be engaged to ensure that additional investigations, remediation action plans, validation reports and suitability for the proposed land use at both the Alexandria Landfill and the RMS Canal Road site meet the requirements of the EPA.

Greenhouse gas

The project has been designed to reduce energy and resource requirements, and therefore greenhouse gas emissions would also be minimised.

The assessment demonstrates the benefits of road tunnel usage in urban areas, where travel along a more direct route at a higher average speed results in fewer greenhouse gas emissions being generated by road users, as reduced congestion and stop-start driving reduces the fuel used by vehicles.

The assessment results indicate that the project would reduce annual GHG emissions by around 229,200 t CO₂-e in 2031 for the 'do something' scenario and around 1,874,000 t CO₂-e in 2031 for the 'cumulative' scenario, within the study area assessed. The predicted reduction in greenhouse gas emissions as a result of the project is due to an improvement in vehicle fuel efficiency across the M5 Motorway corridor, as well as the operational efficiency of the project tunnels.

Aboriginal heritage

The project would take place within the boundaries of the Darug (also spelt Dhaŋ-rook, Dharrook, Dhaŋrook, Dharruk and Dharug) Aboriginal linguistic group.

A desktop review of the project area identified four areas of potential archaeological sensitivity, which were used to define the relevant study area for the project. Consultation was undertaken with the Metropolitan Local Aboriginal Land Council as per the *Procedure for Aboriginal Cultural Heritage Consultation and Investigation* (Roads and Maritime 2011a). A representative of the Metropolitan Local Aboriginal Land Council participated in an archaeological survey of the study area, and prepared a cultural heritage survey report for the project.

Archaeological field surveys and desktop reviews identified 21 Aboriginal sites and one landscape area within the study area. For the purposes of the EIS, these were categorised into three broad areas of Aboriginal archaeological and / or cultural heritage significance:

- Wolli Creek Valley Landscape Area, containing archaeological sensitivity and registered Aboriginal heritage sites
- Alexandra Canal and the previous Sheas Creek, which may contain artefacts
- Archaeologically sensitive sandstone overhang sites.

The assessment of potential impacts determined that, with mitigation measures in place, the risk of the project directly and indirectly impacting on items of Aboriginal heritage is low.

The risk of construction and operation of the project impacting on cultural heritage values / landscape values as a result of temporary and permanent changes to the surrounding visual amenity is also considered to be low.

Construction resource use and waste minimisation

The project's construction resource requirements may have a minor and limited impact on resource availability within the local area.

It is anticipated that the local water supply network would have sufficient capacity to accommodate project construction water requirements. A temporary bulk power supply for the roadheaders, tunnel support sites and construction ancillary facilities would be required during construction. The power supply would be sourced from outside the project corridor, through connections to the existing power supply network.

All waste would be managed in accordance with the waste provisions contained within the Protection of the Environment Operations Act 1997 and, where reused off-site, would comply with relevant Environment Protection Authority resource recovery exemptions and requirements.

Spoil would be classified in accordance with the Waste Classification Guidelines and reused on the project site where possible, reused at other approved developments or disposed of lawfully at an appropriate location.

About 80 percent of usable (eg uncontaminated) construction and demolition waste is anticipated to be reused and / or recycled as part of the project.

Climate change and risk adaption

The initial climate change risk assessment identified the potential impacts of climate change on the project during the operation phase and did not identify any risks rated as high or extreme.

Of the 28 risks that were analysed for the project, 13 were identified as being medium. A number of adaptation options for these medium risks would be considered during detailed design.

A detailed climate change risk assessment would be undertaken during detailed design, in accordance with the standard *AS 5334-2013 Climate change adaptation for settlements and infrastructure – A risk based approach*.

Hazard and risk

The project has been designed to inherently minimise the likelihood of incidents and crashes.

A project specific Work Health and Safety Plan (WHSP) would be developed to support and augment the measures and procedures included in the Construction Environmental Management Plan. The WHSP would be supplemented by site-and activity-specific Safe Work Method Statements.

The storage, transportation, handling and use of dangerous goods and hazardous substances would be undertaken in accordance with the *Work Health and Safety Act 2011 (NSW)*, the *Storage and Handling of Dangerous Goods Code of Practice (WorkCover NSW 2005)* and relevant Australian Standards and legislation.

Cumulative impacts

When completed, WestConnex is expected to deliver beneficial cumulative impacts including significant increases in travel speeds through the local road network, increased reliability, and a reduction in average travel times.

Adverse cumulative impacts could be encountered during the construction phases of the different WestConnex schemes. In particular:

- The King Georges Road Interchange Upgrade project is expected to be finished in 2017, and may overlap the construction period of the New M5 project by around six to nine months.
- The proposed future M4-M5 Link is anticipated to commence construction in 2019 resulting in a short term overlap with the New M5 (about six months).

The future M4 East (anticipated to be completed in early 2019) and M4 East Widening (anticipated to be completed by 2017) projects are located further from the New M5 project and have limited potential cumulative impact with the project.

Significant cumulative impacts with other planned developments in the area are not considered likely. However, consultation would be undertaken with local communities potentially affected by the impacts of multiple projects in addition to the New M5 project. Where relevant, proponents of other nearby developments would also be consulted to increase the overall awareness of project timeframes and impacts.

Sustainability

As part of WestConnex, the New M5 would provide the missing link in the motorway network that supports Sydney's global economic corridor. Improvements to the transport network, including this project, support the global economic corridor by enabling domestic and international trade, and therefore underpin a sustainable NSW economy and Sydney's role as a global city.

The WestConnex Sustainability Strategy sets targets to be met by the project, including sourcing at least six percent of the total energy requirements from renewable sources. The strategy describes how sustainability initiatives would be integrated into the design, construction and operation of all WestConnex projects.

The Infrastructure Sustainability Council of Australia administers an Infrastructure Sustainability rating scheme to assess the sustainability performance of infrastructure including design, construction and operation. A target infrastructure sustainability rating of at least 'Excellent' has been set for the design and construction of the project and meeting this target is a requirement of the construction contract.

The WestConnex sustainability objectives and targets would be met through the implementation of a project-specific Sustainability Management Plan, which would be in place before construction.

How will the likely impacts be managed?

The EIS identifies comprehensive mitigation and management measures to avoid, manage, mitigate, offset and/or monitor impacts during construction and operation of the project.

These include best practice construction environmental planning and management techniques, urban design and landscaping treatments and noise mitigation measures. Further mitigation opportunities are likely to be identified during detailed design and construction planning and in consultation with communities and relevant stakeholders.

The design, construction and operation of the project would be undertaken in accordance with extensive environmental management commitments identified in this EIS, as well as any additional measures identified in conditions of approval for the project.

How can I comment on the proposal and / or the environmental impact statement?

The Department of Planning and Environment will make the EIS publicly available for a minimum statutory period of 30 days. During this period, it will be available for inspection at:

- The Department of Planning and Environment website: <http://majorprojects.planning.nsw.gov.au/>
- The WestConnex project website: <http://www.westconnex.com.au>
- Roads and Maritime offices as well as selected local council libraries in the City of Sydney, Rockdale City, Canterbury City, Hurstville City, Marrickville and Botany Bay City Local Government Areas.
- Various staffed displays in the region.

Details of the location and opening hours of staffed displays would be provided through a community update, letters to interest groups who have registered for the project, emails notification to registered stakeholders, information on the project website and advertisements in the local and metropolitan media.

During the exhibition period, community information sessions will continue to be hosted, and a project information line (1300 660 248) and email address (info@westconnex.com.au) will be available to answer questions from the community relating to the project.

To provide feedback on the project, a person may make written submissions to the Department of Planning and Environment during the exhibition period. All submissions received will be placed on the Department of Planning and Environment website. Submissions can be made electronically through the Department of Planning and Environment website (<http://majorprojects.planning.nsw.gov.au>).

Written submissions may also be directed to:

**Director Infrastructure Projects
Planning Services
Department of Planning and Environment
Application number SSI 6788
GPO Box 39
Sydney NSW 2001**

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Volume 2H

Appendix S	Biodiversity Assessment Report
Appendix T	Biodiversity Offsets Strategy
Appendix U	Detailed greenhouse gas calculations
Appendix V	Technical working paper: Aboriginal heritage
Appendix W	Climate change risk assessment framework

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Certification

Submission of environmental impact statement

Prepared under 5.1 of the Environmental Planning Assessment 1979 (NSW).

Environmental impact statement prepared by:

Name: Elizabeth Thornton

Qualifications: Bachelor of Environmental Science (Hons I)

Address: AECOM, Level 21
420 George Street
Sydney NSW 2000

Responsible person: Mark Andrew
A/General Manager Motorway Project
Roads and Maritime Services
Level 9, 101 Miller Street
North Sydney NSW 2060

Address of the land to which the statement relates:

Land within Hurstville, Canterbury, Rockdale, Marrickville, Botany Bay and Sydney local government areas as described within the environmental impact statement.

Description of the infrastructure to which this statement relates:

Construction and operation of a new, tolled multi-lane road link (known as the New M5) between the M5 East Motorway at Kingsgrove and St Peters, including operational ancillary facilities for the control and management of the road. The project would also include an interchange at St Peters and connections to the existing road network.

Environmental impact statement:

An environmental impact statement is attached addressing all matters in accordance with Part 5.1 of the Environmental Planning and Assessment Act 1979 (NSW) and Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (NSW).

Declaration:

I certify that I have prepared this environmental impact statement in accordance with the Secretary's Environmental Assessment Requirements dated 26 August 2015. The environmental impact statement contains all available information that is relevant to the environmental assessment of the infrastructure to which the statement relates. To the best of my knowledge, the information contained in the environmental impact statement is neither false nor misleading.

Signature:



Name: Scott Jeffries

Date: 23 November 2015



Elizabeth Thornton

23 November 2015



Claire Vahtra

23 November 2015

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Glossary of terms and abbreviations

Term	
A	
AAQ NEPM	National Environment Protection (Ambient Air Quality) Measure
Acute exposure	Contact with a substance that occurs once or for only a short time (up to 14 days).
Air Toxics NEPM	National Environment Protection (Air Toxics) Measure
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, song lines and places) cultural practices and traditions associated with past and present day Aboriginal communities.
Aboriginal object	Any deposit, object or material evidence (not being a handicraft made for sale), including Aboriginal remains, relating to the Aboriginal habitation of NSW.
Aboriginal place	Any place declared to be an Aboriginal place under section 94 of the <i>National SEIFAParks and Wildlife Act 1974</i> .
ABS	Australian Bureau of Statistics
ACM	Asbestos containing material(s)
ADT	Average daily traffic
ADWG	<i>Australian Drinking Water Guidelines</i> (National Health and Medical Research Council 2013)
AHD	Australian height datum. A common national surface level datum approximately corresponding to mean sea level
Alignment	The geometric layout (eg of a road) in plan (horizontal) and elevation (vertical).
AM peak period	6:30am to 9:30am
Ancillary	A subordinate part of an element.
ANZECC	Australian and New Zealand Environment Conservation Council
Aquifer	A groundwater bearing formation sufficiently permeable to transmit and yield groundwater
AR5	Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC)
ARMCANZ	Agriculture and Resources Management Council of Australia and New Zealand
Arncliffe construction compound (C7)	Located within the Kogarah Golf Course. The site would be used for civil construction activities and for tunnelling support.
Arncliffe motorway operations complex (MOC2)	Located near the south western corner of the Kogarah Golf Course. Contains operational ancillary infrastructure that is required for operation of the project.
ARTC	Australian Rail Track Corporation
Arterial roads	The main or trunk roads of the State road network.
AS	Australian Standard
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure 1999 (Commonwealth)
Asphalt or asphaltic concrete	A dense, continuously graded mixture of coarse and fine aggregates, mineral filler and bitumen usually produced hot in a mixing plant.
ASS	Acid sulfate soils. Naturally occurring soils, sediments or organic substrates (eg peat) that are formed under waterlogged conditions. These soils contain iron sulfide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulfate soils are benign. However if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulfides react with oxygen to form sulfuric acid.
ASSMP	Acid Sulfate Soil Management Plan

Term	
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
At-grade	A road at ground level, not on an embankment or in a cutting.
Aquifer	An aquifer is an underground layer of water-bearing permeable rock.
Average recurrence interval (ARI)	Average recurrence interval. The average period in years between the occurrence of a flood of a particular magnitude or greater. In a long period of say 1,000 years, a flood equivalent to or greater than a 100 year ARI event would occur 10 times. The 100 year ARI flood has a 1 per cent chance (i.e. a one-in-100 chance) of occurrence in any one year The frequency of floods is generally referred to in terms of their AEP or ARI. In this report the frequency of floods generated by runoff from the study catchments is referred to in terms of their ARI, for example the 100 year ARI flood.
AWT	Average weekday traffic
B	
Background concentration (air quality)	Describes all contributing sources of a pollutant concentration other than road traffic. It includes, for example, contributions from natural sources, industry and domestic activity.
Background noise level	The ambient sound-pressure noise level in the absence of the sound under investigation exceeded for 90 per cent of the measurement period. Normally equated to the average minimum A-weighted sound pressure level.
Bank cubic metres	A measure of volume representing a cubic metre of unexcavated material. Once material is excavated, it expands to varying degrees depending on its constituents.
Bexley Road East construction compound (C6)	Located on the eastern side of Bexley Road, south of the intersection with Wolli Avenue. This site would be used mainly for car parking and administrative support activities.
Bexley Road North construction compound (C4)	Located on the western side of Bexley Road and north of the M5 East Motorway. The compound would be mainly used as a tunnelling support site.
Bexley Road South construction compound (C5)	Located within Kingsgrove Avenue Reserve on the western side of Bexley Road to the south of the M5 East Motorway tunnel portals. The compound would be mainly used as a tunnelling support site.
Bexley Road South motorway operations complex (MOC3)	Located to the south of the M5 East Motorway western portals, adjacent to Bexley Road. Contains operational ancillary infrastructure that is required for operation of the project.
bgl	Below ground level
BH	Borehole
Blasting	Rock blasting is the controlled use of explosives and other methods such as gas pressure blasting pyrotechnics or plasma processes, to excavate, break down or remove rock
BoM	Bureau of Meteorology
Bore	Constructed connection between the surface and a groundwater source that enables groundwater to be transferred to the surface either naturally or through artificial means.
BS	British standard
BTEX	Benzene, toluene, ethylbenzene and xylenes
BTS	Bureau of Transport Statistics
(the) Business Case	WestConnex Business Case Executive Summary (Sydney Motorways Project Office, 2013a)
Burrows Road motorway operations complex (MOC5)	Located at the corner of Burrows Road and Campbell Road, St Peters. Contains operational ancillary infrastructure that is required for operation of the project.

Term	
Burrows Road construction compound (C11)	Located on the south-western corner of Campbell Road and Burrows Road. The site would mainly be used to support civil infrastructure construction activities, including construction of the St Peters interchange and the local road upgrades.
Bus lane	A traffic lane dedicated to buses, but which can also be used by taxis, bicycles and motorcycles.
C	
CAMBA	China-Australia Migratory Bird Agreement
Campbell Road bridge construction compound (C12)	Located on the south-eastern side of Burrows Road, opposite Campbell Road. The site would be mainly used for the construction of a new bridge across the Alexandra Canal as part of the Campbell Road extension.
Campbell Road construction compound (C9)	Located on the southern side of Campbell Road between Woodley Street and Harber Street, St Peters. The site would be mainly used to support construction of the St Peters interchange and local road upgrades.
Canal Road construction compound (C8)	Located within the St Peters interchange site at St Peters. The site would be mainly used to support tunnelling and civil infrastructure construction activities
Canterbury LEP 2012	Canterbury Local Environmental Plan 2012.
Carriageway	The portion of a roadway used by vehicles including shoulders and ancillary lanes.
Catchment	The land area draining through the main stream, as well as tributary streams, to a particular site. It always relates to an area above a specific location.
CASA	Civil Aviation Safety Authority
CBD	Central business district
CCTV	Closed circuit television
CEMP	Construction Environmental Management Plan A site specific plan developed for the construction phase of the project to ensure that all contractors and sub-contractors comply with the environmental conditions of approval for the project and that the environmental risks are properly managed.
CETU	Centre d'Etudes des Tunnels
City Centre Access Strategy	Sydney City Centre Access Strategy (Transport for NSW, 2013d)
Climate change	A change in the state of the climate that can be identified (eg by statistical tests) by changes in the mean and/or variability of its properties, and that persists for an extended period of time, typically decades or longer (CSIRO and BoM 2015a).
Climate projection	A climate projection is the simulated response of the climate system to a scenario of future emission or concentration of greenhouse gases and aerosols, generally derived using climate models. Climate projections are distinguished from climate predictions by their dependence on the emission/concentration/radiative forcing scenario used, which in turn is based on assumptions concerning, for example, future socioeconomic and technological developments that may or may not be realised (CSIRO and BoM 2015a).
CLM Act	<i>Contaminated Land Management Act 1997</i> (NSW)
CNVMP	Construction Noise and Vibration Management Plan
CO	Carbon monoxide.
CO ₂	Carbon dioxide. A naturally occurring gas, also a by-product of burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, of burning biomass, of land use changes and of industrial processes (eg cement production). It is the principle anthropogenic greenhouse gas that affects the Earth's radiative balance (CSIRO and BoM 2015a).
COHb	Carboxyhaemoglobin

Term	
Commercial Road construction compound (C3)	Located on the southern side of the existing M5 East Motorway, within a private property used for commercial business purposes between Tallawalla Street and Commercial Road, Kingsgrove. The compound would be mainly used as a tunnelling support site.
Concept design	Initial functional layout of a road/road system or other infrastructure. Used to facilitate understanding of a project, establish feasibility and provide basis for estimating and to determine further investigations needed for detailed design.
Construction compound	Facilities used to support the operation of a construction site including (but not limited to) tunnelling support, site offices, workshops, delivery areas, storage areas, staff vehicle parking, materials, plant and equipment.
Construction footprint	Area required for the construction of the project. This includes the operational footprint and additional temporary land for construction.
Contributory item	Place within a Heritage Conservation Area that contributes to its heritage significance.
CoPC	Contaminants of Potential Concern
CPAH	Carcinogenic Polycyclic Aromatic Hydrocarbons
CPTED	Crime Prevention Through Environmental Design
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTSMP	Construction Traffic and Safety Management Plan
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact considered alone.
Cut-and-cover	A method of tunnel construction whereby the structure is built in an open excavation and subsequently covered.
Cutting	Formation resulting from the construction of the road below existing ground level, the material is cut out or excavated.
D	
dB(A)	A-weighted decibels A-weighting is applied to instrument-measured sound levels in effort to account for the relative loudness perceived by the human ear, as the ear is less sensitive to low audio frequencies.
DCP	Development Control Plan
DECC	Former Department of Environment and Climate Change (now OEH).
DECCW	Department of Environment, Climate Change and Water (formerly DECC, but now OEH).
Design speed	A nominal speed which determines the geometric design features of a road.
Detailed design	The stage of design where project elements are designed in detail, suitable for construction.
Deviation	An alteration to the alignment of a portion of a road.
Discharge	The rate of flow of water measured in terms of volume per unit time, for example, cubic metres per second (m ³ /s). Discharge is different from the speed or velocity of flow, which is a measure of how fast the water is moving (eg metres per second [m/s]).
DIT	Department of Infrastructure and Transport
Divided road	A road with a separate carriageway for each direction of travel created by placing a physical separation (eg median) between the opposing traffic directions.
DMP	Dust Management Plan
'Do minimum'	A model that does not incorporate the proposed project infrastructure
'Do something'	A model that incorporates the proposed project infrastructure
DP&E	NSW Department of Planning and Environment
DPI	NSW Department of Primary Industries
DPI – Water	Department of Primary Industries – Water
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.

Term	
Drawdown	Reduction in the height of the water table caused by changes in the local environment.
E	
Earthworks	All operations involved in loosening, excavating, placing, shaping and compacting soil or rock.
EC	Electrical conductivity. The measure of a material's ability to accommodate the transport of an electric charge.
EEC	Endangered ecological community
Egress	Exit
EIS	Environmental impact statement
Embankment	An earthen structure where the road (or other infrastructure) subgrade level is above the natural surface.
Emergency management	A range of measures to manage risks to communities and the environment. In the flood context it may include measures to prevent, prepare for, respond to and recover from flooding.
Emissions scenario	A plausible representation of the future development of emissions of substances that are potentially radiatively active (eg greenhouse gases, aerosols) based on a coherent and internally consistent set of assumptions about driving forces (such as demographic and socioeconomic development, technological change) and their key relationships (CSIRO and BoM 2015a).
Enabling works	Works which are required to enable the commencement of the main construction works.
ENMM	Environmental Noise Management Manual (Roads and Traffic Authority 2001)
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPA	NSW Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Act 1999 (Commonwealth)
EPL	Environment protection licence
Erosion	A natural process where wind or water detaches a soil particle and provides energy to move the particle.
ESA	Environmental site assessment
ESD	Ecologically sustainable development.
ESP	Electrostatic precipitator
EU	European Union
Extreme rainfall	There is no consistent global definition for extreme rainfall. It can be defined by either relative rainfall at a location (amount relative to averages), or absolute rainfall amounts (eg over 100 millimetres in a single day). In this EIS, an extreme rainfall event is defined as the wettest day in 20 years.
Extreme temperature	Definitions vary, however this EIS refers to extreme temperature as hot days (days above 35°C) and very hot days (days above 40°C).
F	
FBA	<i>Framework for Biodiversity Assessment</i>
Feasible and reasonable	Consideration of best practice taking into account the benefit of proposed measures and their technological and associated operational application in the NSW and Australian context. Feasible relates to engineering considerations and what is practical to build. Reasonable relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community expectations and nature and extent of potential improvements.
FFDI	Forest fire danger index

Term	
Fire weather	Weather conditions conducive to triggering and sustaining wild fires, usually based on a set of indicators and combinations of indicators including temperature, soil moisture, humidity, and wind. Fire weather does not include the presence or absence of fuel load (CSIRO and BoM 2015a).
Flash flooding	Flooding which is sudden and unexpected. It is often caused by sudden local or nearby heavy rainfall. It is often defined as flooding which peaks within six hours of the rain event.
Flood	Relatively high stream flow which overtops the natural or artificial banks in any part of a stream, river, estuary, lake or dam, and/or local overland flooding associated with major drainage before entering a watercourse, and/or coastal inundation resulting from super-elevated sea levels and/or waves overtopping coastline defences excluding tsunamis.
Flood prone land	Land susceptible to flooding by the probable maximum flood. Note that the flood prone land is also known as flood liable land.
Flood storage area	Those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The extent and behaviour of flood storage areas may change with flood severity, and loss of flood storage can increase the severity of flood impacts by reducing natural flood attenuation. It is necessary to investigate a range of flood sizes before defining flood storage areas.
Floodplain	Area of land which is inundated by floods up to and including the probable maximum flood event (ie flood prone land).
Floodplain Risk Management Plan	A management plan developed in accordance with the principles and guidelines in the NSW <i>Floodplain development manual</i> (DIPNR 2005). Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives.
Footprint	The extent of impact that a development makes on the land.
Fracture	Cracks within the strata that develop naturally or as a result of underground works
Freeboard	A factor of safety expressed in metres above a flood level for flood protective or control works. It is usually expressed as the difference in height between the adopted flood planning level and the peak height of the flood. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour and impacts that are specific event related, such as levee and embankment settlement, and other effects such as “greenhouse” and climate change.
FTE	Full-time equivalent
G	
Gardeners Road Bridge construction compound (C13)	Located on the southern side of Burrows Road, St Peters. The site would be used to service the construction of a bridge over the Alexandra Canal, which would connect the St Peters interchange directly with Gardeners Road, Mascot.
GCCSA	Greater capital city statistical area
GCL	Geosynthetic clay liner
GDE	Groundwater dependent ecosystem. Refers to communities of plants, animals and other organisms whose extent and life process are dependent on groundwater, such as wetlands and vegetation on coastal sand dunes.
GHG	Greenhouse gas
GIS	Geographic information systems

Term	
Global Sydney	As defined in <i>A Plan for Growing Sydney</i> (NSW Government 2014). Global Sydney includes the Sydney CBD, North Sydney CBD, Barangaroo, Darling Harbour, the Bays Precinct, Pyrmont-Ultimo, Broadway and Camperdown Education and Health Precinct, Central to Eveleigh, Surry Hills and City East.
Grade	The rate of longitudinal rise (or fall) with respect to the horizontal expressed as a percentage or ratio.
Grade separation	The separation of road, rail or other traffic so that crossing movements at intersections are at different levels.
GRAL	Graz Lagrangian (dispersion model). Air quality modelling package.
GRAMM	Graz Mesoscale Model
Greenhouse gas	Greenhouse gases are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of terrestrial radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. Water vapour (H ₂ O), carbon dioxide (CO ₂), nitrous oxide (N ₂ O), methane (CH ₄) and ozone (O ₃) are the primary greenhouse gases in the Earth's atmosphere (CSIRO and BoM 2015a).
Groundwater	Water that is held in rocks and soil beneath the earth's surface.
Growing Sydney	<i>A Plan for Growing Sydney</i> (NSW Government, 2014)
GRP	Gross regional product
GSP	Gross state product
H	
Hazard	A source of potential harm or a situation with a potential to cause loss. In relation to the <i>NSW Floodplain development manual</i> (DIPNR 2005) the hazard is flooding which has the potential to cause damage to the community.
HC	Hydrocarbons
HCAs	Heritage Conservation Areas
Heavy vehicles	A heavy vehicle is classified as a Class 3 vehicle (a two axle truck) or larger, in accordance with the Ausroads Vehicle Classification System.
HEC_RAS	Hydraulic modelling software
Heritage Act	Heritage Act 1977 (NSW)
Heritage item	Place listed on a statutory heritage register
HF	Hydrogen fluoride
HHRA	Human Health Risk Assessment
HI	Hazard Index
HIA	Health Impact Assessment
Hurstville LEP 2012	Hurstville Local Environmental Plan 2012.
HV	Heavy vehicle
Hydraulic conductivity	A characteristic of soil that describes how easily water moves through it.
Hydrogeology	The area of geology that deals with the distribution and movement of groundwater in soils and rocks.
I	
IAQM	Institute of Air Quality Management
ICNG	<i>Interim Construction Noise Guideline</i> (Department of Environment and Climate Change, 2009a)
ICOMOS	International Council on Monuments and Sites
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Infiltration	The downward movement of water into soil and rock. It is largely governed by the structural condition of the soil, the nature of the soil surface (including presence of vegetation) and the antecedent moisture content of the soil

Term	
INP	Industrial Noise Policy
Interchange	A grade separation of two or more roads with one or more interconnecting carriageways.
Intrusive item	Place within a heritage conservation area that detracts from its heritage significance.
IPCC	Intergovernmental Panel on Climate Change
ISCA	Infrastructure Sustainability Council of Australia
IRSAD	Index of relative socio-economic advantage and disadvantage
ITS	Intelligent Transport Systems Systems in which information and communication technologies are applied in the field of road transport, including infrastructure, vehicles and users, and in traffic management and mobility management, as well as for interfaces with other modes of transport.
J	
JAMBA	Japan-Australia Migratory Bird Agreement
K	
King Georges Road interchange upgrade (KGRIU)	A component of the wider WestConnex program of works. Planning approval granted on 3 March 2015 and under construction.
Kh	Horizontal hydraulic conductivity
Kingsgrove motorway operations complex (MOC1)	Located to the south of the western project portals and the existing M5 East Motorway. Contains operational ancillary infrastructure that is required for operation of the project.
Kingsgrove North construction compound (C1)	Located on the northern side of the existing M5 East Motorway between Canterbury Golf Course and Garema Circuit, Kingsgrove. The compound would service the construction of the western surface works and would support tunnelling construction.
Kingsgrove South construction compound (C2)	Located to the south of M5 East Motorway within Beverley Grove Park. The compound would primarily be used to service the construction of the western surface works.
Kingsgrove surface works	Located between the western surface works and Bexley road surface works, around Kingsgrove Road. The works would be primary related to the construction and operation of toll infrastructure.
kL	Kilolitres
kL/day	Kilolitres per day
Kv	Vertical hydraulic conductivity
L	
L/s/km	Litres per second per kilometre
LA90	The noise level exceeded for 90 per cent of the sample period. This noise level is described as the average minimum background sound level (in the absence of the source under consideration), or simply the background level.
LAeq	The 'energy average noise level'. It is often expressed with a time period eg 1 hour, 9 hour (to represent the night-time period from 10.00 pm to 7.00 am) or 15 hour (to represent the daytime and evening periods from 7.00 am to 10.00 pm). The LAeq can be likened to a noise dose representing the cumulative effects of all the noise events occurring in the relevant time period.
LAF _{max}	Maximum fast time weighted noise level
Landfill Closure construction compound (C10)	Located on the southern side of Campbell Road and would be used to support closure of the Alexandria Landfill site.
Landscape character	The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features.

Term	
Lane	A portion of the carriageway allotted for the use of a single line of vehicles.
LCMP	Landfill Closure Management Plan
LCZ	Landscape Character Zone
Leachate	Liquid that 'leaches' (drains) from a landfill
LEP	Local environmental plan
LGA	Local government area
Licensed discharge point	A location where a licensed operation discharges water to the environment in accordance with conditions stipulated within the site environment protection licence (EPL).
Localised flooding	Localised flooding occurs when components of the drainage system are undersized or blocked and cannot accommodate the incoming overland surface flows, resulting in the flooding of a localised area
Local road upgrades	Refers to the local roads around the St Peters interchange and the intersection of Campbell Road and Euston Road
LoS	Level of service
LTP	Leachate treatment plant
LV	Light vehicle
M	
m	Metres
m/day	Metres per day
m ²	Square metres
m ³	Cubic metres
M4 East	A component of the wider WestConnex program of works. Located from Homebush Bay Drive, Homebush to Parramatta Road and City West Link (Wattle Street) at Haberfield (planning application lodged and subject to planning approval)
M4 Widening	A component of the wider WestConnex program of works. Located from Pitt Street, Parramatta to Homebush Bay Drive, Homebush (planning approval granted on 21 December 2014 and under construction)
M4-M5 Link	A component of the wider WestConnex program of works. Undergoing concept development and subject to planning approval.
M5 East Motorway	Part of the M5 Motorway corridor. Located between Beverly Hills and Sydney Airport (General Holmes Drive).
M5 Motorway corridor	The M5 East Motorway and the M5 South West Motorway
M5 South West Motorway	Part of the M5 Motorway corridor. Located between Prestons and Beverly Hills.
Main alignment tunnels	The main two tunnels to be constructed as part of the project. About nine kilometres long, with the western tunnel portals located at Kingsgrove and the eastern ramp portals located at the St Peters interchange.
Mainstream flooding	Inundation of normally dry land occurring when water overflows the natural or artificial banks of a stream, river, estuary, lake or dam.
Marrickville LEP 2011	Marrickville Local Environmental Plan 2011.
Mean rainfall	The arithmetically averaged total amount of precipitation recorded during a calendar month or year.
Median	The central reservation which separates carriageways from traffic travelling in the opposite direction.
Methodology	The method for analysis and evaluation of the relevant subject matter.
mg/L	Milligrams per litre
MIC	Maximum instantaneous charge
microSiemens per centimetre	A measure of electrical conductivity. Commonly used to measure the salinity of water.
Mid-block	Section of road between two intersections

Term	
ML	Megalitres
MLALC	Metropolitan Local Aboriginal Land Council
ML/day	Megalitres per day
MKVT	Million vehicle kilometres travelled (MVKT)
MOC	Motorway operations complex
Motorway	Fast, high volume controlled access roads. May be tolled or un-tolled.
MUSIC	Model for Urban Stormwater Improvement Conceptualisation
N	
NARClIM	NSW/ACT Regional Climate Modelling
NATA	National Association of Testing Authorities
National Road Network	AusLink National Land Transport Network
NCA	Noise Catchment Area
NCG	Noise Criteria Guideline
NEPC	National Environmental Protection Council
New M5	The subject of this EIS. A component of the wider WestConnex program of works.
NGA	National Greenhouse Accounts
NGER	National Greenhouse and Energy Reporting
NGER Act	National Greenhouse and Energy Reporting Act 2007 (Commonwealth)
NL	Noise Logger
NMG	Noise Mitigation Guideline
NML	Noise management level
NO ₂	Nitrogen dioxide
NOW	(former) NSW Office of Water (now the Department of Primary Industries – Water)
NO _x	Nitrogen Oxide
NPI	National Pollutant Inventory
NRMA	National Roads and Motorist's Association
NSW	New South Wales
NSW 2021	<i>NSW 2021: A plan to make NSW number one</i> (NSW Department of Premier and Cabinet, 2011)
NWQMS	National Water Quality Management Strategy
O	
O ₃	Ozone
Obstruction Limitation Surface	An invisible level that defines the limits to which objects may project into the airspace around an aerodrome so that aircraft operations may be conducted safely.
OCP	Organochlorine Pesticides
OEH	NSW Office of Environment and Heritage (formerly DECCW)
Off-ramp	A ramp by which one exits a limited-access highway / tunnel.
On-ramp	A ramp by which one enters a limited-access highway / tunnel.
Operational footprint	Areas to be directly impacted by the operational components of the project such as roadways, tunnels and associated facilities (eg motorway operations complex and ventilation facilities).
OPP	Organophosphate Pesticides
OU	Odour Units
Outcrop	Bedrock exposed at the ground surface.
Outside shoulder	The area of pavement outside the traffic lanes that is closest to the 'slow' lane.
Overbridge	Bridge which conveys another road, rail or pedestrians over the described road.
Overland flooding	Inundation by local runoff rather than overbank discharge from a stream, river, estuary, lake or dam.

Term	
P	
PACHCI	Procedure for Aboriginal Cultural Heritage Consultation and Investigation
PAD	Potential archaeological deposits
PAH	Polycyclic aromatic hydrocarbons
PANS-OPS	Procedures for air navigation systems – aircraft operations
Parcel of land	Refers to an individual lot number (lot) and deposited plan (DP)
PASS	Potentially acid sulfate soils
Pavement	The portion of a carriageway placed above the subgrade for the support of, and to form a running surface for, vehicular traffic.
PCB	Polychlorinated biphenyls
PEA Act	Protection of the Environment Administration Act 1999 (NSW)
Peak discharge	The maximum discharge occurring during a flood event.
Peak flood level	The maximum water level occurring during a flood event.
pH	Numeric scale ranging from zero to 14 used to specify the acidity or alkalinity of an aqueous solution. Solutions with a pH less than seven are acidic and solutions with a pH greater than seven are alkaline. Pure water has a pH of seven and is neutral.
Photo-ionisation detector measurements	A measurement of the concentration of volatile organic compounds and other gases within the soil.
PIARC	Permanent International Association of Road Congress
PM	Particulate matter
PM _{2.5}	Particulate matter of up to 2.5 micrometres
PM ₁₀	Particulate matter of up to 10 micrometres
PM Peak	3:30pm to 7:00pm
PMF	Probable maximum flood The flood that occurs as a result of the probable maximum precipitation on a study catchment. The PMF is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation coupled with the worst flood producing catchment conditions. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land (i.e. the floodplain).
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
POEO Regulation 2005	Protection of the Environment Operations (Waste) Regulation 2005 (NSW)
Pollutant	Any measured concentration of solid or liquid matter that is not naturally present in the environment.
Portals	The location at which the underground tunnel motorway meets the surface road.
ppbv	Parts per billion by volume
PPFL	Preliminary peak flood level
PPM	Parts Per Million
ppmv	Parts per million by volume
Prescribed airspace	The airspace above any part of either an Obstruction Limitation Surface or a 'procedures for air navigation systems – aircraft operations' (PANS-OPS) surface for Sydney Airport. The obstacle limitation surface is an invisible level that defines the limits to which objects may project into the airspace around an aerodrome so that aircraft operations may be conducted safely
Probability	A statistical measure of the expected chance of flooding (see annual exceedance probability).
project	New M5 project
Property	Based on ownership, with the potential to contain more than one lot and DP.

Term	
Proponent	The person or organisation that proposes to carry out the project or activity. For the purpose of the project, the proponent is the NSW Roads and Maritime Service.
Q	
R	
RAFTS and DRAINS	Rainfall – runoff modelling software packages
RBL	Rating background noise level
RCP	Representative concentration pathways. Scenarios that include time series of emissions and concentrations of the full suite of greenhouse gases and aerosols and chemically active gases, as well as land use/cover (CSIRO and BoM 2015a).
Residual land	Acquired land not required during operation of the project.
Risk	Chance of something happening that will have an impact. It is measured in terms of consequences and likelihood. In the context of the manual it is the likelihood of consequences arising from the interaction of floods, communities and the environment.
RMS	NSW Roads and Maritime Services
RNP	<i>Road Noise Policy</i> , Department of Environment, Climate Change and Water (DECCW) 2011.
Roads and Maritime	NSW Roads and Maritime Services
Road reserve	A legally defined area of land within which facilities such as roads, footpaths and associated features may be constructed for public travel.
Roadheader	A commonly used machine for excavation in sandstone using pics mounted on a rotary cutter head attached to a hydraulically operated boom.
Road Safety Strategy	National Road Safety Strategy for Australia 2011 – 2020
Roadside furniture	A general term covering all signs, street lights, protective devices for the control, guidance and safety of traffic and convenience of road users.
Rockdale LEP 2011	Rockdale Local Environmental Plan 2011.
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
RTA	(Former) NSW Roads and Traffic Authority (now Roads and Maritime Services)
Runoff	The amount of rainfall that ends up as streamflow, also known as rainfall excess.
RWR	Residential, Workplace and Recreational
S	
SA2	Statistical Area 2
SCATS	Sydney Co-ordinated Adaptive Traffic System
SEARs	Secretary's Environmental Assessment Requirements Requirements and specifications for an environmental assessment prepared by the Secretary of the Department of Planning and Environment under section 115Y of the <i>Environmental Planning and Assessment Act 1979</i> (NSW).
Section 170 register	State Government agency section 170 Heritage and Conservation Register
SEIFA	Social-Economic Indexes for Areas
SEPP	State Environmental Planning Policy
SES	State Emergency Services
Settlement	Refers to how ground can move due to the construction of new infrastructure
Shotcrete	Concrete and mortar that is sprayed onto a surface at high velocity.
Shoulder	The portion of the carriageway beyond the traffic lanes adjacent to and flush with the surface of the pavement.
SMC	Sydney Motorway Corporation
SO ₂	Sulfur dioxide

Term	
Socio-economic	Involving combination of social and economic matters.
Southern extension	Refers to a future motorway extension from Arncliffe to the bayside and southern suburbs of Sydney.
Span	The distance between the centres of adjacent supports of a bridge.
SPOCAS	Suspension Peroxide Oxidation – Combined Acidity and Sulfate
Spoil	Surplus excavated material
SREP 33	Sydney Regional Environmental Plan No.33 – Cooks Cove
SSI	State significant infrastructure
SSROC	Southern Sydney Region of Councils
State Infrastructure Strategy	State Infrastructure Strategy 2012–2032 (Infrastructure NSW, 2012)
State Infrastructure Strategy Update	State Infrastructure Strategy – the State Infrastructure Strategy Update 2014 (Infrastructure NSW, 2014)
St Peters interchange	Located at the former Alexandria Landfill site. In its ultimate configuration (ie in the event the entire WestConnex program of works is completed) it would connect the New M5, the future M4-M5 Link and the future Sydney Gateway with Euston Road, Gardeners Road and Sydney Airport / Port Botany area.
St Peters motorway operations complex (MOC4)	Located near the western corner of the St Peters interchange, adjacent to the Prince Highway / Canal Road intersection. Contains operational ancillary infrastructure that is required for operation of the project.
STM	Strategic Traffic Model
Stockpile	Temporarily stored materials such as soil, sand, gravel, spoil/waste.
Strata	Geological layers below the ground surface.
Stream order	A classification system which assigns an 'order' to waterways according to the number of additional tributaries associated with each waterway, to provide a measure of system complexity.
Structure (soil)	The way soil particles group together to form aggregates.
Stub tunnel	Driven tunnels constructed to connect to the future Southern extension or future M4–M5 Link.
Surface road concentration (air quality)	Describes the contribution of pollutants from the surface road network. It includes not only the contribution of the nearest road at the receptor, but also the net contribution of the modelled road network at the receptor.
Surface water	Water flowing or held in streams, rivers and other wetlands in the landscape.
SVOC	Semi Volatile Organic Hydrocarbons
Sydney Catchment REP	Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005
Sydney's Rail Future	Sydney's Rail Future: Modernising Sydney's Trains (Transport for NSW, 2012b)
Sydney's Bus Future	Sydney's Bus Future: Simpler, faster, better bus services (Transport for NSW, 2013a)
Sydney's Cycling Future	Sydney's Cycling Future: Cycling for everyday transport (Transport for NSW, 2013b)
Sydney's Walking Future	Sydney's Walking Future: Connecting people and places (Transport for NSW, 2013c)
Sydney Gateway	A component of the wider WestConnex program of works. Subject to further investigations by the NSW Government and would be subject to separate planning approval
Sydney LEP 2012	Sydney Local Environmental Plan 2012.
Sydney Park construction compound (C14)	Located on the northern side of Campbell Road in Sydney Park. The site would be used to service the construction of pedestrian and cycling facilities associated with the local road upgrades, including the Campbell Road pedestrian and cycle bridge over Campbell Road.

Term	
T	
TAGG	Transport Authorities Greenhouse Group
TBM	Tunnel boring machine. An excavation machine that 'bores' through soil or rock to create a tunnel with a circular cross section (as opposed to drilling and blasting methods).
TDS	Total dissolved solids
TEC	Threatened ecological community
TEU	Twenty-foot equivalent unit
TfNSW	Transport for NSW
The Blue Book	Managing Urban Stormwater – Soils and Construction Volumes 1 and 2, NSW Government 2004 and 2006
TMC	Transport Management Centre
TMSP	Traffic Management and Safety Plan
Total concentration (air quality)	The sum of the background, surface road and ventilation outlet concentrations. It may relate to conditions with or without the project under assessment.
Toxicity	The degree of danger posed by a substance to human, animal or plant life.
TPH	Total Petroleum Hydrocarbon
TUFLOW	Hydraulic modelling software (flooding)
Transport Master Plan	NSW Long Term Transport Master Plan
TRH	Total recoverable hydrocarbons
TSC Act	Threatened Species Conservation Act 1995 (NSW)
TSP	Total suspended particulate
Tunnel portal	The entrance / exit to the tunnel.
Typical cross section	A cross section of a carriageway showing typical dimensional details, furniture locations and features of the pavement construction.
U	
UFP	Ultrafine Particle
µm	Micrometre
UNFCCC	United Nation Framework Convention on Climate Change
Urban design	The process and product of designing human settlements, and their supporting infrastructure, in urban and rural environments.
USEPA	United States Environmental Protection Agency
V	
VDV	Vibration dose value
VENM	Virgin excavated natural material
Ventilation facility	Facility for the mechanical removal of air from the mainline tunnels, or mechanical introduction of air into the tunnels
Ventilation outlet	The location that tunnel air is expelled
Ventilation outlet concentration (air quality)	Describes the contribution of pollutants from tunnel ventilation outlets.
VKT	Vehicle kilometres travelled
VMS	Variable message signs
VOC	Volatile Organic Compounds
W	
WARR Act	Waste Avoidance and Resource Recovery Act 2001 (NSW)
Waterway	Any flowing stream of water, whether natural or artificially regulated (not necessarily permanent).
WDA	WestConnex Delivery Authority
WestConnex program of works	Proposal to provide a 33 kilometre motorway linking Sydney's west and south-west with Sydney Airport and the Port Botany precinct.

Term	
Western surface works	Connects the New M5 and the existing M5 East Motorway to the M5 South West Motorway through works within and around the King Georges Road interchange.
WHO	World Health Organisation
WHS	Work Health and Safety Plan
WHS Regulation 2011	Work Health and Safety Regulation 2011
WM Act	Water Management Act 2000 (NSW)
WRTM	WestConnex Road Traffic Model

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