Chapter 28

Synthesis of the environmental impact statement

January 2020

28 Synthesis of the environmental impact statement

This chapter provides a synthesis of the findings of the environmental impact statement for the project, in response to the Secretary's environmental assessment requirements issued for the project. The main body of the environmental impact statement and appendices should be referred to for further information.

The Secretary's environmental assessment requirements as they relate to the synthesis of the environmental impact statement, and where in the environmental impact statement these have been addressed, are detailed in Table 28-1.

A summary of the proposed environmental management measures relevant to the project are included in Section 28.4.

Table 28-1 Secretary's environmental assessment requirements –synthesis of the environmental impact statement

Secretary's requirement	Where addressed in EIS
Environmental impact statement	
1. The EIS must include, but not necessarily be limited to, the following: q. a chapter that synthesises the environmental impact assessment and provides:	This **Chapter 28** (Synthesis of the environmental impact statement) provides the following:
- a succinct but full description of the project for which approval is sought;	A full description of the project in **Section 28.1.**
- a description of any uncertainties that still exist around design, construction methodologies and/or operational methodologies and how these will be resolved in the next stages of the project;	A description of any uncertainties related to the design, construction methodologies and/or operational methodologies and their proposed resolution in **Section 28.3.**
- a compilation of the impacts of the project that have not been avoided;	A compilation of the impacts of the project that have not be avoided in **Section 28.4.**
- a compilation of the proposed measures associated with each impact to avoid or minimise (through design refinements or ongoing management during construction and operation) or offset these impacts;	A compilation of the proposed measures associated with each impact to avoid or minimise (through design refinements or ongoing management during construction and operation) or offset these impacts in **Section 28.4.**
- a compilation of the outcome(s) the proponent will achieve; and	A compilation of the outcome(s) the project would achieve in **Section 28.6.**
- the reasons justifying carrying out the project as proposed, having regard to the biophysical, economic and social considerations, including ecologically sustainable development and cumulative impacts.	Project justification and conclusions in **Section 28.1** and **Section 28.7.** **Chapter 27** (Cumulative impacts), **Section 27.2** presents the projects that have been assessed and may have potential cumulative impacts. Potential cumulative impacts are described in **Section 27.3** and **Section 27.4**.

28.1 Overview and key features of the project

28.1.1 Overview of project need

The Sydney Harbour Bridge, Warringah Freeway and Eastern Distributor have been identified as three of Australia's 30 most congested road corridors, generating a congestion cost of $65,000 per day in 2016 (Infrastructure Australia, 2019). These corridors are integral to the economic growth of Sydney's Eastern Economic Corridor. As Sydney's population and economy continues to grow, so will the pressure on access to this corridor. Consequently, improvements to existing transport networks and creation of new transport connections will be essential for Sydney to continue to be a competitive economy.

The Greater Sydney Region Plan – A Metropolis of Three Cities (Greater Sydney Commission, 2018a) identifies the importance of investing in and delivering efficient and effective transport systems including road infrastructure that would relieve congestion, improve travel times, improve road safety and enhance and expand capacity on key road corridors. The project would reduce congestion and improve road network performance and efficiency, enabling sustained growth and productivity across Sydney's Eastern Economic Corridor. The project would also enhance the resilience of the road network across the Eastern Harbour City.

The public transport network connecting the major centres of North Sydney and the Sydney CBD provide many people with direct access to a range of job locations, as well as access to education facilities, health centres and hospitals, and sporting, cultural and entertainment facilities. The project would improve access to major centres and would result in more people having better access to jobs, goods and services.

The Western Harbour Tunnel and Warringah Freeway Upgrade project is identified as a *priority initiative* by Infrastructure Australia's *Australian Infrastructure Plan: The Infrastructure Priority List* in recognition of its importance in addressing urban congestion on Sydney's road network and to provide cross-harbour connectivity. This new harbour crossing would serve through journeys between the south and west of Sydney, including the international gateways of Sydney Airport and Port Botany, and strategic centres north of the harbour including North Sydney, Chatswood and Macquarie Park. Increased network capacity and connectivity as a result of the project would also result in travel time savings for freight movements, further serving the growth of Sydney's Eastern Economic Corridor.

Transport for NSW is seeking approval under Division 5.2, Part 5 of the *Environmental Planning and Assessment Act 1979* to construct and operate the Western Harbour Tunnel and Warringah Freeway Upgrade, which would comprise two main components:

- A new crossing of Sydney Harbour involving twin tolled motorway tunnels connecting the M4-M5 Link at Rozelle and the existing Warringah Freeway at North Sydney (the Western Harbour Tunnel)
- Upgrade and integration works along the existing Warringah Freeway, including infrastructure required for connections to the Beaches Link and Gore Hill Freeway Connection project (the Warringah Freeway Upgrade).

Key features of the project are described in Section 28.1.3.

28.1.2 Project objectives

The project objectives were developed to respond to the current and future network challenges and include:

- Reduce congestion on distributor roads around the Harbour CBD, including the Sydney Harbour Bridge, Western Distributor and ANZAC Bridge
- Create faster and more reliable cross-harbour journeys, particularly for traffic bypassing the Harbour CBD to the west
- Improve productivity along the Eastern Economic Corridor
- Increase the resilience for the critical cross-harbour transport corridor
- Improve traffic performance on the Warringah Freeway to support long-term increased demand
- Improve urban amenity.

28.1.3 Key features of the project

Key features of the Western Harbour Tunnel component of the project would include:

- Twin mainline tunnels about 6.5 kilometres long and each accommodating three lanes of traffic in each direction, connecting the stub tunnels from the M4-M5 Link at Rozelle to the Warringah Freeway and to the Beaches Link mainline tunnels at Cammeray. The crossing of Sydney Harbour between Birchgrove and Waverton would involve a dual, three lane, immersed tube tunnel
- Connections to the stub tunnels at the M4-M5 Link project in Rozelle and to the mainline tunnels at Cammeray (for a future connection to the Beaches Link and Gore Hill Freeway Connection project)
- Surface connections at Rozelle, North Sydney and Cammeray, including direct connections to and from the Warringah Freeway (including integration with the Warringah Freeway Upgrade), an off ramp to Falcon Street and an on ramp from Berry Street at North Sydney
- A ventilation outlet and motorway facilities (fitout and commissioning only) at the Rozelle Interchange
- A ventilation outlet and motorway facilities at the Warringah Freeway in Cammeray
- Operational facilities including a motorway control centre at Waltham Street within the Artarmon industrial area and tunnel support facilities at the Warringah Freeway in Cammeray
- Other operational infrastructure including groundwater and tunnel drainage management and treatment systems, signage, tolling infrastructure, fire and life safety systems, lighting, emergency evacuation and emergency smoke extraction infrastructure, CCTV and other traffic management systems.

Key features of the Warringah Freeway Upgrade component of the project would include:

- Upgrade and reconfiguration of the Warringah Freeway from immediately north of the Sydney Harbour Bridge through to Willoughby Road at Naremburn
- Upgrades to interchanges at Falcon Street in Cammeray and High Street in North Sydney
- New and upgraded pedestrian and cyclist infrastructure
- New, modified and relocated road and shared user bridges across the Warringah Freeway
- Connection of the Warringah Freeway to the portals for the Western Harbour Tunnel mainline tunnels and the Beaches Link tunnels via on and off ramps, which would consist of a combination of trough and cut and cover structures

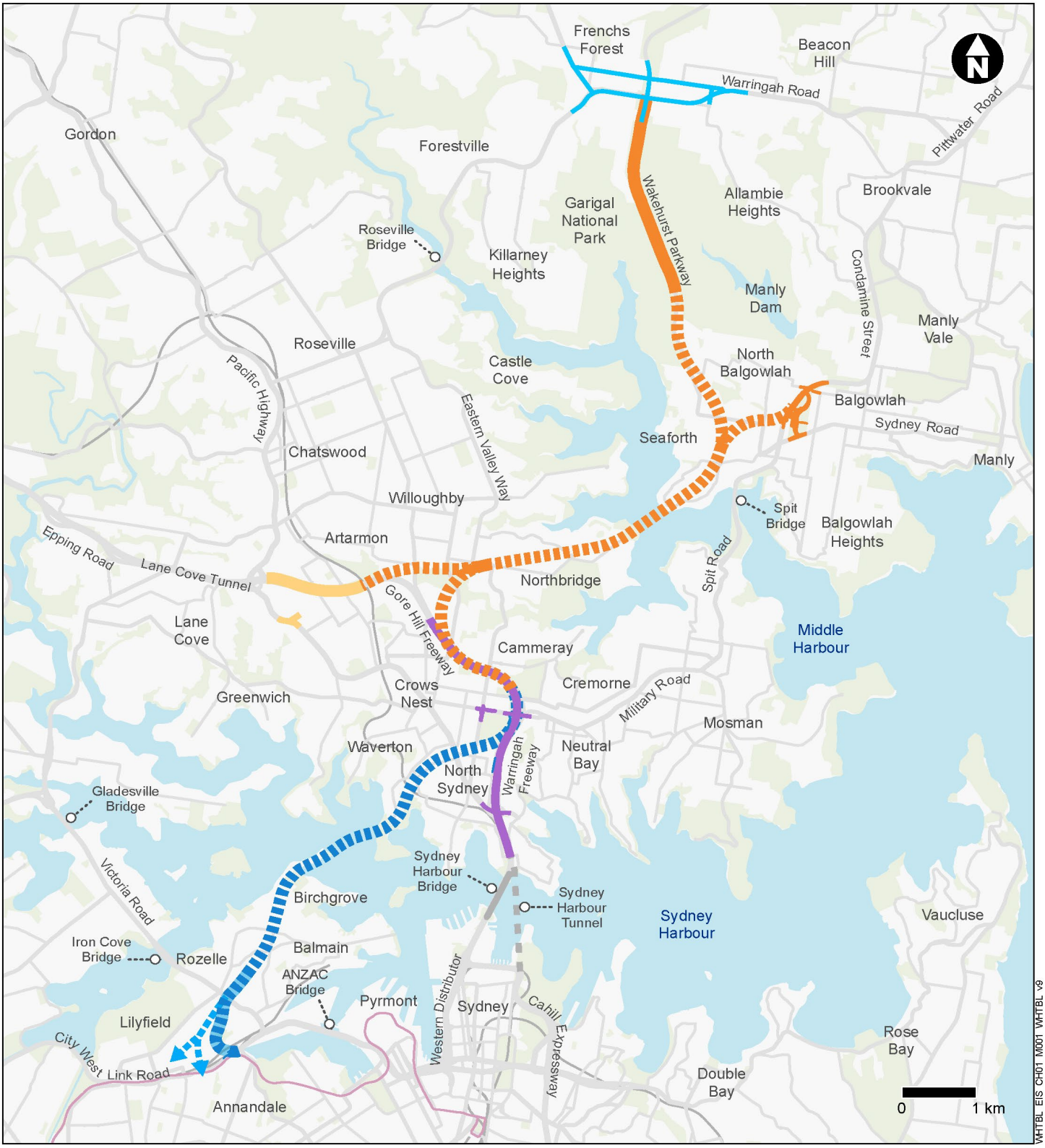
- Upgrades to existing roads around the Warringah Freeway to integrate the project with the surrounding road network
- Upgrades and modifications to bus infrastructure, including relocation of the existing bus layover along the Warringah Freeway
- Other operational infrastructure including surface drainage and utility infrastructure, signage, tolling, lighting, CCTV and other traffic management systems.

The location of the project is shown in Figure 28-1 and key features are shown in Figure 28-2 and Figure 28-3.

The project does not include ongoing motorway maintenance activities during operation or future use of residual land occupied or affected by project construction activities, but not required for operational infrastructure. These would be subject to separate planning and approval processes at the relevant times and in consultation with relevant stakeholders.

The residual land created as a result of the project would largely continue to remain suitable for future development in accordance with the relevant land use zonings and applicable development standards. Where a part of any lot is identified as being usable post construction and surplus to operational requirements, or requiring boundary adjustment following the completion of construction, Deposited Plans of subdivision would be lodged at NSW Land Registry Services.

A detailed description of the project is provided in Chapter 5 (Project description).



Legend

Operational features

- Beaches Link
- Gore Hill Freeway Connection
- Western Harbour Tunnel
- Warringah Freeway Upgrade
- M4-M5 Link tunnel fitout and commissioned as part of Western Harbour Tunnel

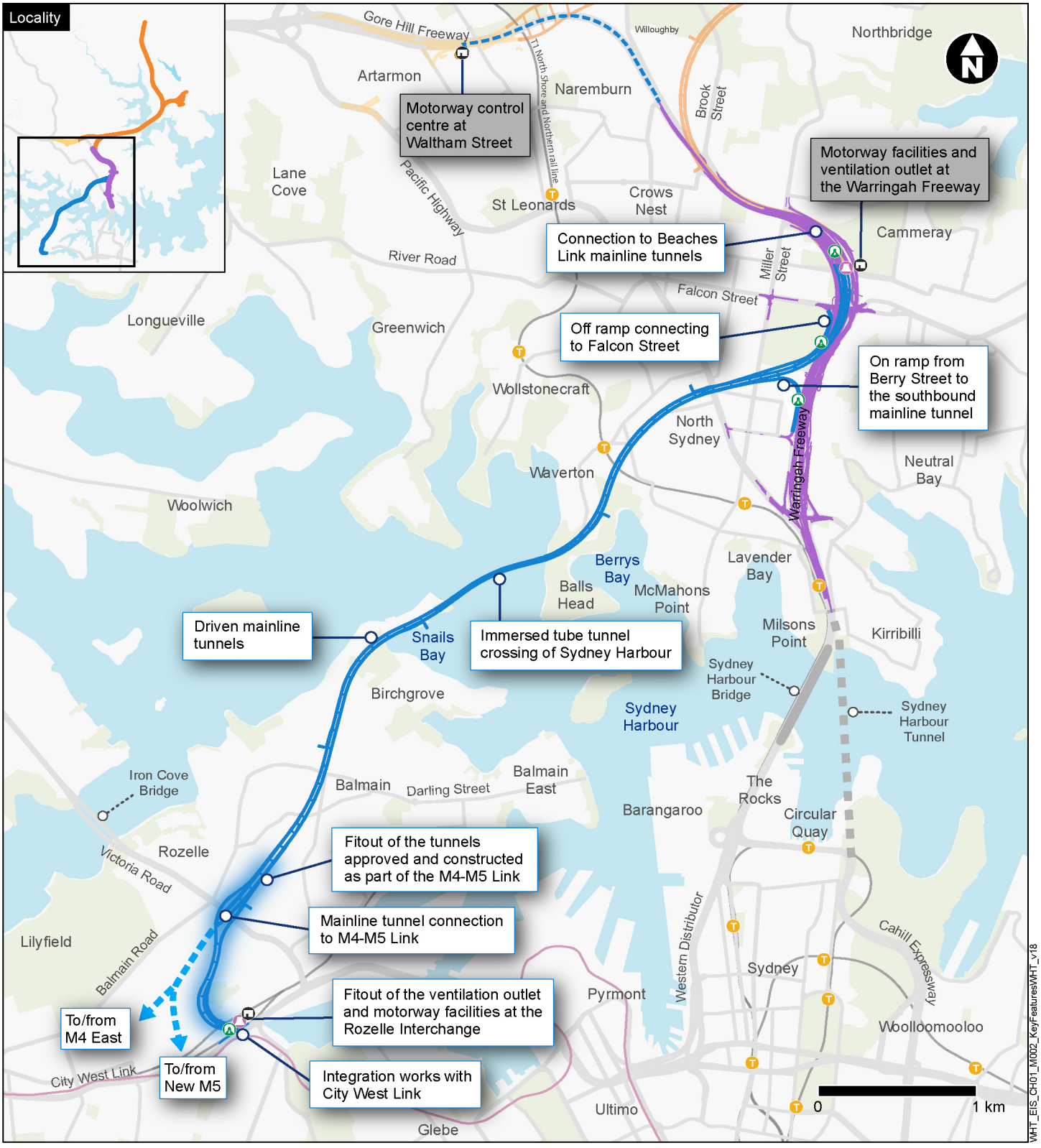
Connecting projects

- M4-M5 Link connections (indicative)
- Northern Beaches Hospital road upgrade

Existing rail network

- Heavy rail
- Light rail

Figure 28-1 Location of the project



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Operational features

- Western Harbour Tunnel
- Warringah Freeway Upgrade
- Communications cable for motorway control centre
- M4-M5 Link tunnel fitout and commissioned as part of Western Harbour Tunnel
- Surface connection
- Permanent operational facility
- Ventilation outlet

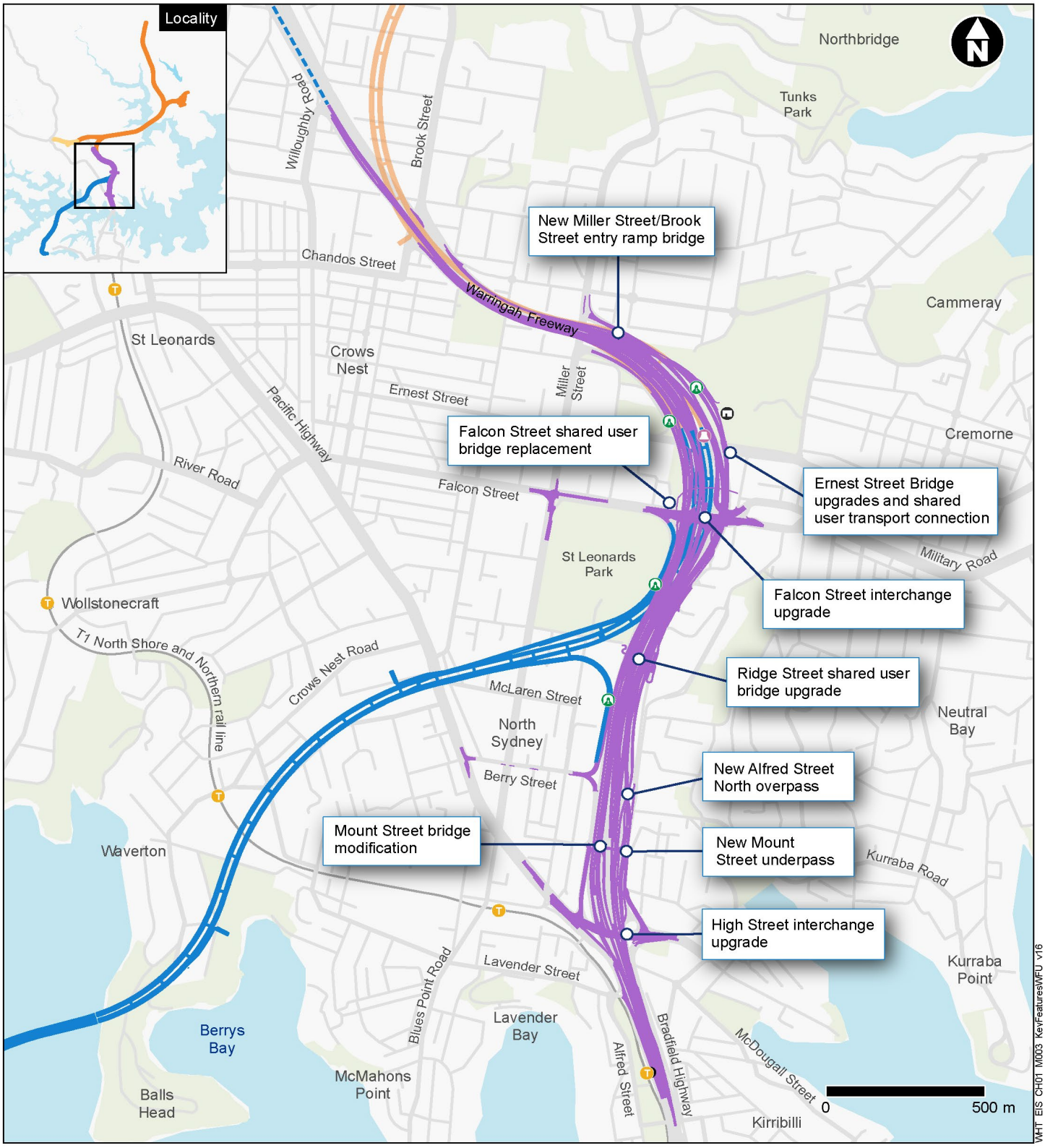
Connecting projects

- Beaches Link
- Gore Hill Freeway Connection
- M4-M5 Link connections (indicative)

Existing rail network

- Heavy rail
- Light rail
- Train station

Figure 28-2 Key features of the Western Harbour Tunnel component of the project



Legend

Operational features
- Warringah Freeway Upgrade
- Western Harbour Tunnel
- Communications cable for motorway control centre
- Surface connection
- Permanent operational facility
- Ventilation outlet

Connecting projects
- Beaches Link

Existing rail network
- Heavy rail
- Train station

Figure 28-3 Key features of the Warringah Freeway Upgrade component of the project

28.2 Construction of the project

Most of the construction for the Western Harbour Tunnel component of the project would occur underground with the mainline tunnels being constructed using roadheaders. Where the tunnel crosses Sydney Harbour, an immersed tube tunnel would be constructed in a trench excavated through the bed of the harbour between Birchgrove and Waverton. Surface works would also be required to support tunnelling activities and to construct the surface connections, tunnel portals, surface road works, active transport facilities (pedestrian and cyclist facilities) and operational facilities. Construction activities for the Warringah Freeway Upgrade would generally include surface earthworks, bridgeworks, construction of retaining walls, installation of stormwater drainage and pavement construction. Subject to planning approval, construction of the project is planned to commence in 2020, with completion of construction anticipated in 2026.

28.2.1 Key construction activities

The area required to construct the project is referred to as the construction footprint. Most of the project would be located underground within the mainline tunnels. However, surface areas would be required to support tunnelling activities, to construct the tunnel connections, tunnel portals and operational ancillary facilities and the Warringah Freeway Upgrade component.

Key construction activities would include:

- Early works and site establishment, with typical activities being property acquisition and condition surveys, utilities installation, protection, adjustments and relocations, installation of site fencing, environmental controls (including noise attenuation and erosion and sediment control), traffic management controls, vegetation clearing, earthworks and demolition of structures, establishment of construction support sites including acoustic sheds and associated access decline acoustic enclosures (where required), construction of minor access roads and the provision of property access, temporary relocation of pedestrian and cycle paths and bus stops, temporary relocation of swing moorings within Berrys Bay and relocation of historic vessels
- Construction of Western Harbour Tunnel, with typical activities being excavation of tunnel construction accesses, construction of driven tunnels, cut and cover and trough structures and construction of cofferdams, dredging activities in preparation for the installation of immersed tube tunnels, casting and installation of immersed tube tunnels and civil finishing and tunnel fitout
- Construction of operational facilities comprising a motorway control centre at Waltham Street in Artarmon, motorway and tunnel support facilities, ventilation outlets at the Warringah Freeway in Cammeray, construction and fitout of the project operational facilities that form part of the M4-M5 Link Rozelle East Motorway Operations Complex, a wastewater treatment plant at Rozelle and the installation of motorway tolling infrastructure
- Construction of the Warringah Freeway Upgrade, with typical activities being earthworks, bridgeworks, construction of retaining walls, stormwater drainage, pavement works and linemarking and the installation of road furniture, lighting, signage and noise barriers
- Testing of plant and equipment, and commissioning of the project, backfill of access declines, removal of construction support sites, landscaping and rehabilitation of disturbed areas and removal of environmental and traffic controls.

Further details are provided in Chapter 6 (Construction work).

28.2.2 Construction support sites

Temporary construction support sites would be required as part of the project and would include tunnelling and tunnel support sites, civil surface sites, cofferdams, mooring sites, wharf and berthing facilities, laydown areas, parking and workforce amenities. Construction support sites for the Western Harbour Tunnel component of the project would include:

- Rozelle Rail Yards (WHT1)
- Victoria Road (WHT2)
- White Bay (WHT3)
- Yurulbin Point (WHT4)
- Sydney Harbour south cofferdam (WHT5)
- Sydney Harbour north cofferdam (WHT6)
- Berrys Bay (WHT7)
- Berry Street north (WHT8)
- Ridge Street north (WHT9)
- Cammeray Golf Course (WHT10)
- Waltham Street (WHT11).

During the construction of the Warringah Freeway Upgrade, smaller construction support sites would be required to support the construction works, and would include:

- Blue Street (WFU1)
- High Street south (WFU2)
- High Street north (WFU3)
- Arthur Street east (WFU4)
- Berry Street east (WFU5)
- Ridge Street east (WFU6)
- Merlin Street (WFU7)
- Cammeray Golf Course (WFU8)
- Rosalind Street east (WFU9).

A detailed description of construction works for the project is provided in Chapter 6 (Construction work).

28.3 Project uncertainties

As with any project of the nature and scale of this project, the project design presented in this environmental impact statement would continue to be refined during further design development. As such, the design of the project would continue to be refined and would be guided by the key principles developed during the design and environmental impact statement phase. Some flexibility has been provided in the design to:

- Allow for refinement during further design development to consider alternative construction techniques
- Allow for refinement in response to submissions received following the exhibition of this environmental impact statement
- Respond to improved technologies or materials

- Improve value for money.

The final design may vary from that described in Chapter 5 (Project description). Any changes to the project would be reviewed for consistency with the assessment contained in the environmental impact statement including relevant environmental management measures, environmental performance outcomes and any future conditions of approval. If design refinements are not consistent with the approval issued by the Minister for Planning and Public Spaces, approval would be sought from the Minister for any such modifications in accordance with the requirements of Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

Areas where further work would be carried out to optimise the design outcomes and construction method include refinements to:

- Avoid services and utilities that present significant construction difficulties in terms of logistics, time and/or cost
- Reduce the duration of construction
- Avoid areas of environmental sensitivity
- Reduce impacts on the community during construction and/or operation
- Improve operation of the project without increasing the potential environmental impacts.

For any future design refinements, a screening assessment would be carried out to consider whether the refinement would:

- Result in any inconsistency with the conditions of approval
- Result in any inconsistency with the objectives and operation of the project as described in the environmental impact statement
- Result in a change to the approved project that may require a modification of the approval
- Result in any potential environmental or social impacts of a greater scale or impact on previously unaffected receivers than that considered by the environmental impact statement or the submissions and preferred infrastructure report.

Table 28-2 outlines key project components that have been identified as requiring resolution during further design development, construction and/or operation of the project and references where these uncertainties are discussed in this environmental impact statement.

Table 28-2 Resolution of project uncertainties

Project uncertainties	Proposed resolution	Timing	Where discussed
Design details for ventilation outlets	Refinement of the architectural design of the project ventilation outlets would be confirmed during further design development. A design for the ventilation outlets would be developed that aims to incorporate the ventilation outlets as an integral component of surrounding land use in accordance with the project's urban design framework (refer to Appendix V (Technical working paper: Urban design, landscape character and visual impact) for more information).	Design	**Chapter 22** (Urban design and visual amenity)
Tunnel alignment	• Confirmation of the final tunnel alignment would be carried out by the construction contractor, once appointed • Future consultation to engage with communities and affected stakeholders about the final alignment of the mainline tunnels and to explain any differences between the design presented and assessed in this environmental impact statement and the design refined during further development, as required.	Design	**Chapter 5** (Project description)
Spoil disposal locations	• Confirmation of the locations that would accept spoil from the project for reuse and/or disposal would be carried out during development of the detailed construction method for the project by the construction contractor, once appointed • A review of spoil transport and disposal options identified in the environmental impact statement would be carried out by the construction contractor, once appointed • Spoil transport options would be adjusted as required and the relevant construction management plans updated, in accordance with relevant requirements of the conditions of approval.	Design and construction	**Chapter 6** (Construction work) **Chapter 24** (Resource use and waste management)
Construction method and staging	Final construction methods and staging plans including road possessions would be prepared by the construction contractor, once appointed. The staging plans would be based on further design development and refinement of the construction method. The plans would describe how construction areas	Construction	**Chapter 6** (Construction work) **Chapter 8** (Construction traffic and transport)

Project uncertainties	Proposed resolution	Timing	Where discussed
	associated with road works would be established to safely maintain traffic flows in areas of reduced traffic capacity, and to minimise delays to motorists, public transport, pedestrians and cyclists.		
Final noise mitigation requirements	• Further noise modelling would be carried out during further design development to confirm the receivers (as identified in this environmental impact statement) that are eligible for at-property treatments. Feasible and reasonable environmental management measures would be considered for each of the receivers during further design development in accordance with the *Noise Mitigation Guideline* (Roads and Maritime, 2015b) • The operational noise performance of the project would be reviewed during further design development and operational noise mitigation (low noise pavement, noise barrier, at-property treatment or a combination) would be confirmed • Ongoing community and stakeholder engagement to assist in informing and determining appropriate noise mitigation would be carried out throughout project development and construction.	Design	**Chapter 11** (Operational noise and vibration)
The locations and extent of potential settlement impacts.	• Further assessment would be carried out with regards to settlement, including groundwater and geotechnical modelling during further design development to refine the level of predicted settlement, where required • Building condition surveys would be carried out as necessary and monitor settlement during construction would be carried out by the contractor.	Design	**Chapter 16** (Geology, soils and groundwater).
Urban design detail of fixed infrastructure (ventilation outlets, substations, portals, water treatment facilities and bridges) and other key features.	• A detailed Urban Design and Landscape Plan would be developed for the project during further design development, considering the Urban Design Framework for the project (refer to Appendix V (Technical working paper: Urban design, landscape character and visual impact)).	Design	**Chapter 22** (Urban design and visual amenity)

Project uncertainties	Proposed resolution	Timing	Where discussed
Location and degree of contamination	• Further investigations of potentially contaminated sites are required to quantify the exposure risk. These investigations would be carried out prior to construction activities so that contamination (if present) can be adequately planned for and managed.	Design	**Chapter 16** (Geology, soils and groundwater).
The presence of, and potential impacts to areas of archaeological potential	Additional archaeological investigations would be carried out at: • Yurulbin Park, Birchgrove • Former BP site, Waverton.	Design	**Chapter 14** (Non-Aboriginal heritage)
The presence of, and potential impacts on, registered Aboriginal Heritage Information Management System (AHIMS) sites and sites containing potential Aboriginal heritage significance	• Further consultation with Department of Premier and Cabinet (Heritage), Metropolitan Local Aboriginal Land Council (LALC), and Registered Aboriginal Parties would be carried out to determine appropriate management of Aboriginal sites not assessed during archaeological surveys due to site accessibility issues • Aboriginal site condition surveys would be completed using photogrammetry and 3D capture techniques employed to record Aboriginal sites prior to, and post construction, to determine impacts from construction activity.	Design	**Chapter 15** (Aboriginal cultural heritage)
The presence of, and potential impacts on, maritime heritage	• Investigate the potential to relocate or redesign the temporary wharves at Berrys Bay construction support site (WHT7) to minimise impact on maritime heritage • Any pre-dredge clearance of the bed of the harbour to include involvement by maritime archaeologist to minimise the risk of impact to potential maritime heritage remains such as maritime infrastructure, shipwrecks and discarded objects • Complete and review the sidescan sonar survey for areas to be affected by project works • Carry out high-resolution geophysical survey to further investigate potential submerged cultural heritage material where necessary • Carry out controlled archaeological investigations to recover any artefacts if required and feasible.	Design and construction	**Chapter 14** (Non-Aboriginal heritage) **Chapter 15** (Aboriginal cultural heritage)

Project uncertainties	Proposed resolution	Timing	Where discussed
Construction and operational water treatment plant design and development of discharge criteria	• The relevant discharge criteria would be identified in consultation with relevant agencies and include within the relevant environmental management plans • The construction water treatment plants would be refined to achieve site specific trigger values to ensure wastewater would be treated to a level that is representative of background concentrations at the receiving environment • The water treatment plant design at Rozelle and associated treatment systems would be refined to achieve the adopted discharge criteria • The local stormwater system capacity to receive discharge flows would be confirmed during further design development, and environmental management measures implemented in the event of a capacity issue.	Design	**Chapter 17** (Hydrodynamics and water quality)
Construction support sites – location, layout and facilities	The final location and layout of construction support sites would be confirmed during construction planning, the final construction method and the conditions of approval.	Design	**Chapter 6** (Construction work)
Interface of the project with the M4-M5 Link at Rozelle Interchange, including location and design of operational infrastructure.	Continued consultation with the M4-M5 Link project team to: • Inform the design of project infrastructure at the Rozelle Interchange, as determined during further design development of the Rozelle Interchange • Manage potential cumulative impacts (construction).	Construction	**Chapter 2** (Assessment process) **Chapter 5** (Project description) **Chapter 27** (Cumulative impacts)

28.4 Summary of project impacts and management measures

This section provides a summary of the impacts of the project that could not be avoided. These impacts are discussed in detail in Chapter 8 (Construction traffic and transport) through to Chapter 26 (Climate change risk and adaption) of this environmental impact statement.

28.4.1 Key impact avoidance

Many potential impacts have been avoided through the project development process which included input from key stakeholders and the community. A number of corridor alternatives were evaluated to identify the most technically, socially and environmentally acceptable alternative with the most efficient transport connections (refer to Chapter 4 (Project development and alternatives) for more information on the alternatives considered). Following identification of the preferred corridor for the project, further design development and refinements have been carried out which have resulted in the avoidance or minimisation of environmental impacts and include:

- Selection of roadheaders instead of tunnel boring machines for construction of the land-based tunnels, resulting in lower spoil volumes and fewer heavy vehicle movements
- The selection of precast immersed tunnel units on top, or within the top layers, of harbour rock and sediments as the preferred harbour crossing method, rather than the use of driven tunnel, thereby avoiding the need for tunnelling in challenging geology and enabling better grades and journey experience (eg safety, long-term emissions)
- Refinements to the location of the North Sydney connections, resulting in improved connectivity and network performance, improved constructability and design, and minimising traffic impacts
- Ventilation system design alternatives. A longitudinal system with elevated ventilation outlets was selected as the preferred option as it is able to meet the requirement to minimise portal emissions as far as practicable, manage smoke in the tunnel in the event of a fire and ensure emissions are dispersed and diluted so that there is minimal or no effect on ambient air quality and is less costly to construct and operate
- Construction support site location alternatives were considered to minimise impacts to environmental and community locations while minimising property disturbance and acquisition requirements. Locations were also selected to maximise opportunities for direct access to arterial roads or water transport opportunities
- Alternatives for the transport of spoil were considered, including the use of rail, barge or truck. A combination of trucks and some barging was selected as the preferred spoil transport option for the project as it reduces the amount of double or triple handling of spoil required (ie transfer spoil to a loading facility) while also providing the ability to move large volumes of spoil, thereby reducing the number of heavy vehicle movements on the wider road network
- Dredged material management alternatives were considered. An application for offshore disposal of suitable dredged material has been submitted to the Commonwealth Department of the Environment and Energy. It is proposed that suitable dredged material would be transported by barge and disposed of at a designated offshore disposal site (in accordance with legislative requirements)
- Further refinement of the design including consideration of community issues through the environmental impact statement exhibition process may further reduce and if possible avoid impacts.

Potential impacts would also be further avoided and minimised, where possible, through the implementation of the environmental management measures complying with the performance outcomes identified in Chapter 4 (Project development and alternatives).

28.4.2 Key project impacts

The environmental impact statement has assessed the potential environmental impacts that may occur as a result of the project and recommends measures to manage these impacts. Table 28-3 provides a summary of potential impacts of the project that could not be avoided and the associated environmental management measures. Table 28-3 is not a comprehensive list of all environmental management measures proposed in this environmental impact statement. For further details refer to the individual chapters. Unavoidable impacts would be addressed through design refinements or ongoing management during construction and operation.

Table 28-3 Summary of key project impacts and environmental management measures

Summary of key impact	Construction / operation	Management measure
Traffic and transport • Increased heavy vehicle movements around work sites during construction • Increased traffic volumes and delays for traffic in the North Sydney area during construction • Temporary, full or partial closures of the Warringah Freeway for short periods of time to carry out key construction activities which are located above or within the road corridor • Temporary increase in travel times and reduction in bus speeds particularly along bus routes in North Sydney • Temporary changes to access in and around North Sydney that would streamline movements around North Sydney CBD but limit access for some residents and businesses in the area • Temporary impacts to ferry infrastructure • Temporary impacts on maritime traffic associated with the partial closures of Sydney Harbour for recreational, commercial and passenger vessels between Yurulbin Point, Birchgrove and Berrys Bay, Waverton to enable construction works for the crossing of Sydney Harbour.	Construction	• Extensive community and stakeholder consultation will be carried out in conjunction with the Sydney Coordination Office to manage impacts along the Warringah Freeway and North Sydney road network. This is likely to include a Community and Road User Campaign which will be implemented before the start of works to inform all road users including bus operators of the upcoming network changes and proposed detour routes • Directional signage and line marking will be used to direct and guide drivers, cyclists and pedestrians past construction sites and on the surrounding network. This will be supplemented by Variable Message Signs to advise drivers of potential delays, traffic diversions, speed restrictions, or alternative routes • Any adjustments to existing bus stops will be determined in consultation with relevant stakeholders including other divisions of Transport for NSW, and advanced notification will be provided to affected bus customers. Relocations will be as close as feasible and reasonable to their existing position • Truck marshalling areas will be identified and used where feasible and reasonable to minimise potential queueing and traffic and access disruptions in the vicinity of construction support sites • Activities requiring partial and full road closures will be carried out outside of peak periods and/or during night time to minimise the impact of these activities on the road network where feasible and reasonable • Partial or full closures of Warringah Freeway will be carried out in consultation with the Sydney Coordination Office • Opportunities to relocate the Birchgrove Ferry Wharf will be investigated during construction planning. Birchgrove Ferry Wharf customers would be notified of alternative travel arrangements in advance of the wharf closure • Construction marine traffic activities will be scheduled to avoid times and locations of high recreational marine traffic where feasible and reasonable.

Summary of key impact	Construction / operation	Management measure
Noise and vibration • Construction noise levels predicted to exceed noise management levels at some sensitive receiver locations • Potential for sleep disturbance impacts during the night • Construction traffic movements may result in road traffic noise levels above the relevant criteria • Potential underwater noise impacts to marine mammals, reptiles and sharks generated through construction dredging and piling activities.	Construction	• Monitoring will be carried out at the commencement of new noise and vibration intensive activities and works in new locations • Opportunities to manage high noise impact activities though scheduling, the provision of feasible and reasonable respite, and the early installation of operational noise management measures, will be identified during further design development and construction planning to limit the number of highly noise affected receivers • An out-of-hours works protocol will be developed for the construction of the project. The protocol will be prepared in consultation with the Department of Planning, Industry and Environment and the NSW Environment Protection Authority and implemented during construction of the project • Refinement of the piling method will consider reasonable and feasible alternatives, attenuated mitigation methods and programming to minimise underwater noise.
Human health and air quality • Underwater noise and vibration impacts affecting water users.	Construction/ operation	• Opportunities for refinement of piling and associated scheduling will be considered during further design development and in consultation with relevant authorities and stakeholders • An underwater noise monitoring program and adaptive management measures for the construction period of the project will be developed. This would include a monitoring program with an initial trial of piling with corresponding communication measures to validate the predicted underwater acoustic thresholds and management areas, and an ongoing review of management measures and monitoring outcomes • Communication and management measures will be implemented during construction to manage potential underwater noise impacts to water-based recreational users during dredging and piling activities in Sydney Harbour.
Non-Aboriginal heritage • Direct and indirect impacts to non-Aboriginal heritage items in the vicinity of the project	Construction	• Non-Aboriginal historical heritage awareness training will be provided for contractors prior to commencement of construction works to ensure understanding of potential heritage items that may be impacted during the

Summary of key impact	Construction / operation	Management measure
including: - Major impacts at Yurulbin Park, as a result of the temporary establishment and operation of the Yurulbin Park construction support site (WHT4) and the Sydney Harbour south cofferdam (WHT5) - Moderate and permanent impacts to Cammeray Park (including Golf Course) as a result of the construction activities and the installation of permanent operational infrastructure within the heritage boundary - Installation of architectural noise treatments at heritage listed properties such as within the boundary of Cammeray Conservation Area and Holtermann Estate Conservation Area.		project, and the procedure required to be carried out in the event of discovery of historical heritage materials, features or deposits, or the discovery of human remains • Archival recording will be carried out in accordance with the *Photographic Recording of Heritage Items Using Film or Digital Capture* guideline for areas/items subject to change • Archaeological investigations would be carried out to collect archaeological information from heritage sites where necessary before construction • Should at-property noise treatment be required at a premises that is heritage listed, this will be carried out in a manner to minimise heritage impact, and advice of a heritage conservation architect will be sought prior to carrying out the works • Yurulbin Park would be rehabilitated in line with the design vision provided by the original landscape architect (Bruce Mackenzie AM) as soon as practicable at the completion of construction. The design would seek to retain and enhance the existing character and the original design intent as much as possible. The project would not impact on the long-term viability of the site to continue to be used for public recreation and open space purposes. These works would also improve the quality and long-term viability of landscaping and useability of the park.
Biodiversity • Removal of potential roosting habitat for some bat species at Yurulbin Park and Berrys Bay and the removal of a potential hollow-bearing tree in Jefferson Jackson Reserve • Potential impacts to key fish habitats in Sydney Harbour due to the removal of some rocky reef and deepwater soft sediment habitats, turbidity and sedimentation from dredging, and underwater noise from dredging and piling	Construction	• Pre-clearing surveys for microbat roosts will be carried out on the wharf structures to be demolished at Yurulbin Point (WHT4) and Berrys Bay (WHT7) construction support sites • Carry out inspections of Eastern Bent-wing bat roosting sites in the surrounding locality (eg concrete box culverts, jetties) prior to construction to determine the roosting capacity of each site • Carry out monthly monitoring of Eastern Bent-wing bats in the Coal Loader tunnel prior to construction (in the months of March to September) • Subtidal rocky reef and intertidal rocky shore habitat removed along the shoreline will be rehabilitated and restored as close as possible to pre-

Summary of key impact	Construction / operation	Management measure
• Potential impacts on marine threatened species in Sydney Harbour, such as the Black Rockcod, White's seahorse and Little Penguin that would reside, forage or transit through habitat affected during construction • Potential impacts on some marine mammals, turtles and sharks, which may forage or transit through seagrass, rocky reef or deepwater soft sediment habitats • Potential underwater noise impacts to marine mammals, reptiles and sharks generated through construction dredging and piling activities.		construction conditions where reasonable and feasible • Exclusion zones will be implemented to avoid disturbance to sensitive marine habitats not proposed to be directly impacted by the project. These include any intertidal sand and mudflats, intertidal rocky shore, subtidal rocky reef and seagrass habitats with potential to occur within or next to transit routes and vessel movements • Routine inspections and maintenance of exclusion fencing would be carried out • Silt curtains will be monitored for effectiveness particularly following inclement weather and maintenance carried out when required. Records of monitoring and maintenance will be kept • Visual monitoring from the harbour surface will be carried out to identify any underwater noise related impacts on marine mammals, reptiles, sharks and other fish. If required, additional at source protection measures such as qualified observers to spot marine mammals, reptiles and sharks would be used during marine construction activities. A stop-work procedure would be implemented upon sighting of the species in proximity of the works area.
Land use and property • Temporary lease or acquisition of three properties for Western Harbour Tunnel and one property for the Warringah Freeway Upgrade • Temporary land use changes to some areas associated with construction activities or construction support sites • Temporary relocation of boat moorings in the Birchgrove to Berrys Bay area to provide safe access to construction support facilities • Temporary closure of Birchgrove ferry wharf.	Construction	• Land subject to temporary use, including areas of public open space, will be rehabilitated as soon as practicable to an appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses. This will be carried out in consultation with the relevant council and/or the land owner • Transport for NSW will consult with the owners and/or leaseholders and/or licence holders of moorings that require temporary relocation to determine alternative arrangements. All efforts will be made to relocate facilities as close to their original locations as possible • Birchgrove Ferry Wharf customers would be notified of alternative travel arrangements in advance of the wharf closure.

Summary of key impact	Construction / operation	Management measure
Land use and property • Permanent acquisition of four properties for Western Harbour Tunnel and 20 properties for the Warringah Freeway Upgrade • Permanent land use changes where permanent project infrastructure is established • Permanent acquisition of part of Cammeray Golf Course for permanent operational facilities • Air quality impacts for future elevated receivers located around ventilation outlets and motorway facilities.	Operation	• Land acquisition for the project will be carried out in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* (NSW), the *Roads and Maritime Services Land Acquisition Information Guide* (Roads and Maritime, 2014a) and *Fact sheet: Property acquisition of subsurface lands* (Roads and Maritime, 2015) and in accordance with the land acquisition reforms announced by the NSW Government in 2016 • Residual land remaining following construction of the project would be confirmed to identify appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses • Transport for NSW will continue to work with Cammeray Golf Club with a view to maintaining the long-term viability of Cammeray Golf Course • Transport for NSW would assist Inner West Council, North Sydney Council and the Department of Planning, Industry and Environment (as appropriate) in determining relevant land use considerations applicable to future development in the immediate vicinity of ventilation outlets for inclusion in local environmental plans or development control plans, where required, to manage interactions between the project and future development. This may include procedures for identifying the requirement for consultation with Transport for NSW.
Urban design and visual amenity • Visual impacts during construction as a result of the presence of construction works, plant and equipment • Loss of vegetation providing screening and amenity	Construction	• Construction support sites, including the locations of visible structures and plant and perimeter fencing and treatments, will be developed to minimise visual impacts for adjacent receivers where feasible and reasonable • Existing trees will be retained and protected adjacent to the works where possible to screen construction support sites, minimising clearing where possible • Early planting works will be considered to provide a screening buffer that has time to mature before the project is fully operational.
Geology, soils and groundwater • Ground movement may occur as a result of the	Construction	• Detailed predictive settlement models will be developed for areas of concern to guide tunnel design and construction method. Building/structure

Summary of key impact	Construction / operation	Management measure
construction of project or associated components or from groundwater drawdown • The project is situated adjacent to a number of areas that are considered to have a 'moderate' or 'high' risk rating of contaminated material • The project requires the works within Sydney Harbour, sediments of which could potentially pose a contamination risk due to the contamination associated with historical industrial use.		condition surveys will be prepared for properties (and heritage assets) within the zone of influence of tunnel settlement • Potentially contaminated areas directly affected by the project will be investigated and managed in accordance with the requirements of guidance endorsed under section 105 of the *Contaminated Land Management Act 1997* • The dredging methodology has been designed to minimise impacts on the marine environment and would include the use of a closed environmental bucket to avoid the spread of potentially contaminated material and the use of silt curtains.
Resource use and waste management • About 2.1 million cubic metres of spoil would be produced from land-based construction activities (terrestrial spoil) during construction. In addition, marine construction works for the project within Sydney Harbour would produce around 900,000 cubic metres of dredged material.	Construction	• The design of the project and preferred construction methodology has taken into consideration the waste hierarchy by aiming to reduce the volume of excess spoil generated, as far as practical. Where possible, the project would maximise reuse of spoil generated during construction before alternative off-site spoil disposal options are pursued • An application for offshore disposal of suitable dredged material has been submitted to the Department of the Environment and Energy. Dredged material suitable for offshore disposal would be transported from Sydney Harbour on hopper barges and disposed within the existing designated offshore disposal site, which is located about 10 to 15 kilometres offshore of Sydney Heads and regulated by the Commonwealth. Offshore disposal would reduce the number of heavy vehicle movements required to transport dredged material.
Hydrodynamics and water quality • Potential to reduce water quality and disturb contaminated sediments through dredging and piling.	Construction	• The dredging method has been designed to minimise impacts on the marine environment and would include the use of a closed environmental bucket to avoid the spread of potentially contaminated material and the use of silt curtains.

Summary of key impact	Construction / operation	Management measure
Socio-economic • Loss of open space, parks and recreational facilities, due to use for construction support sites and permanent project facilities • Potential reduction in amenity at social infrastructure due to reduced visual amenity and increased air-borne construction noise, dust and traffic • Potential impacts on community cohesion due to temporarily restricting access to some social infrastructure and meetings places, which may reduce opportunities for social and community interaction • Changes in passing trade to business, employee and customer access, servicing and deliveries, business visibility, demand for services, displacement of business and potential impacts on maritime businesses and freight and efficiency.	Construction/ operation	• Ongoing engagement will be carried out with managers of social infrastructure located near to surface construction works/construction support sites and sensitive social infrastructure • Where feasible and reasonable, the extent of permanent impact on public open space areas (for example, ANZAC Park, St Leonards Park, Cammeray Golf Course) will be minimised in further design development • Parks, open space and sport and recreation areas impacted by construction and not required for permanent infrastructure will be reinstated and rehabilitated • Specific consultation will be carried out with businesses potentially impacted during construction. Consultation will aim to identify specific potential construction impacts for individual businesses.
Cumulative impacts There is the potential for construction fatigue and complaint fatigue to be experienced by surrounding receivers as a result of concurrent and consecutive construction programs.	Construction	Multi-party engagement and cooperation will be established prior to construction to coordinate with the following projects to manage fatigue impacts where possible: • M4-M5 Link • Beaches Link and Gore Hill Freeway Connection • Sydney Metro City & Southwest. Cumulative complaints fatigue would be managed in accordance with the Community Consultation Framework.

28.4.3 Residual impacts

An environmental risk analysis for the project has been carried out and is detailed in Appendix C (Environmental risk analysis). The risk analysis identifies an initial risk rating for each of the environmental issues and the residual risk rating derived after the application of environmental management measures developed and recommended by this environmental impact statement. It involved:

- Rating the risk of each identified potential impact by identifying the consequences of the impact and the likelihood of each impact occurring
- Considering the probable effectiveness of the proposed environmental management measures to determine the likely residual risk of each impact.

The risk analysis outlined in Appendix C (Environmental risk analysis) has identified several 'medium' level residual risks. No potential impacts with a residual risk rating of 'high' were identified for the project. During further design development, opportunities would be identified for 'medium' level residual risks to:

- Resolve residual impacts and risks through further design refinement
- Develop effective construction methodologies and planning to ensure that environmental management measures can be effectively implemented
- Implement a process of review, correction and audit for the management measures that were identified in this environmental impact statement and summarised in Appendix Y (Compilation of environmental management measures). This would be a process of continuous improvement that would form part of the construction environmental management plan and operational environmental management plan and would allow for environmental management measures to be updated or improved during construction and operational phases, where practical.

Where 'medium' level residual risks are considered to still be likely after further design development, additional refined environmental management measures would be developed where appropriate to ensure those risks are suitably mitigated.

Where 'low' level residual risks are identified, an appropriate process of continuous improvement would be applied to address these potential impacts during construction and operation as far as is reasonable and feasible.

28.5 Environmental management plan framework

The implementation of environmental management measures during further design development, construction and operation of the project would minimise any potential adverse impacts arising from the proposed work on the surrounding environment.

These environmental management measures related to construction would be captured in a construction environmental management plan. The plan would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation.

The plan would be prepared prior to construction of the project and would be reviewed and certified by Transport for NSW and the Department of Planning, Industry and Environment, prior to the commencement of any on-site work. The construction environmental management plan would be a working document, subject to ongoing change and updated as necessary, to respond to specific requirements. The construction environmental management plan would include a framework for the management of environmental impacts during construction including details on the following:

- Traffic and transport management

- Noise and vibration management
- Heritage management
- Air quality management
- Waste and resource management, including spoil management
- Visual amenity management
- Soil and water management
- Flora and fauna management
- Construction support site and ancillary works management
- Sustainability management.

In addition, the design, construction and operation of the project would be carried out in accordance with the Utilities management strategy (Appendix D) and Community consultation framework (Appendix E).

During operation, the project's environmental performance would be managed under Transport for NSW existing environmental management system (or similar) for asset maintenance prepared in accordance with the *AS/NZS ISO 14000 Environmental Management System* series. This EMS has been developed to be consistent with the broad environmental objectives and policies set out in the Transport for NSW environmental management system. Transport for NSW is committed to managing its impacts on the environment and undertaking its activities so as to avoid, minimise or mitigate environmental impacts. Accordingly, any project-specific operational environmental management practices and procedures will be incorporated into the existing environmental management system.

28.6 Performance outcomes

The project's performance outcome as measured against those identified for key impacts in the Secretary's environmental assessment requirements is provided in Table 28-4 along with a summary of how each performance outcome would be achieved by the project.

Table 28-4 Design performance outcomes and project outcomes

Desired performance outcome	How performance outcomes would be achieved
Environmental impacts assessment process The process for assessment of the proposal is transparent, balanced, well focussed and legal.	• This environmental impact statement has been prepared in accordance with Part 3 of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* • Based on the results of the environmental investigations carried out for this environmental impact statement, it is considered that matters of national environmental significance are not likely to be significantly impacted by the project. Accordingly, Transport for NSW has decided that a referral to the Commonwealth is not required at this stage.
Environmental impact statement The project is described in sufficient detail to enable clear understanding that the project has been developed through an iterative process of impact	• The project has been described in detail in Chapter 5 (Project description) • The merits of the project, and the design options were considered in the context of a range of alternatives based on how well they performed with reference to

Desired performance outcome	How performance outcomes would be achieved
identification and assessment and project refinement to avoid, minimise or offset impacts so that the project, on balance, has the least adverse environmental, social and economic impact, including its cumulative impacts.	transport, environmental, engineering, social and economic factors (refer to Chapter 4 (Strategic context and project need)). The preferred design provides a combination of benefits compared with other options assessed, including improved access, minimised impacts on properties and on future development potential.
Assessment of key issues Key issue impacts are assessed objectively and thoroughly to provide confidence that the project would be constructed and operated within acceptable levels of impact.	• The assessment of key issues has been conducted objectively and thoroughly. The implementation of environmental management measures would ensure the project is constructed and operated within acceptable levels of impact. Refer to Chapter 8 (Construction traffic and transport) to Chapter 26 (Climate change risk and greenhouse gas) for further details.
Consultation The project is developed with meaningful and effective engagement during project design and delivery.	• Consultation has been carried out to inform the design process and project development (refer to Chapter 7 (Stakeholder and community engagement)) • The construction contractors would respond to complaints in a timely and appropriate manner, to ensure all stakeholders' concerns are managed effectively and promptly.
Transport and traffic • Network connectivity, safety and efficiency of the transport system in the vicinity of the project are managed to minimise impacts • The safety of transport system customers is maintained • Impacts on network capacity and the level of service are effectively managed • Works are compatible with existing infrastructure and future transport corridors.	In respect to transport and traffic, the project has been developed such that it would: • Minimise impacts to local streets from loss of parking, road closures and heavy vehicle movements during construction • Minimise impacts to road network efficiency during construction • Enable access to properties to be maintained during construction and operation • Improve the performance and capacity of Sydney's road network • Provide an efficient motorway link which improves traffic flow on Sydney's motorway network • Relocate a significant volume of through traffic underground • Improve traffic conditions, and eases future congestion on the road network • Provide functional connectivity between the subsurface and surface road network • Provide future motorway connections to support a growing Sydney • Maintain pedestrian and cyclist safety along surface roads near the project • Provide significant travel time savings for motorists and freight vehicles using Sydney's motorway network • Enable long-term development of Sydney's motorway network, including facilitating new cross-harbour capacity and connections to Sydney's north.

Desired performance outcome	How performance outcomes would be achieved
Air quality The project is designed, constructed and operated in a manner that minimises air quality impacts (including nuisance dust and odour) to minimise risks to human health and the environment to the greatest extent.	In respect to air quality, the project has been developed such that it would: • Provide effective management of dust, odour and other emissions during construction • Result in zero portal emissions during normal operations • Provide effective dispersion of emissions from the tunnels. Tunnel ventilation design would be developed to maintain in-tunnel air quality in accordance with relevant criteria.
Health and safety The project avoids or minimises any adverse health impacts arising from the project. The project avoids, to the greatest extent possible, risk to public safety.	In respect to health and safety, the project has been developed such that: • Incidents and crashes and risks to public safety would be minimised during construction • The motorway design would achieve safe and efficient road user movements • Establishment and operation of ancillary facilities and construction sites would protect road users and public • The project avoids, to the greatest extent possible, risk to public safety • Hazardous materials within project areas would be managed to protect human health.
Noise and vibration – Amenity Construction noise and vibration (including airborne noise, ground-borne noise and blasting) are effectively managed to minimise adverse impacts on acoustic amenity. Increases in noise emissions and vibration affecting nearby properties and other sensitive receivers during operation of the project are effectively managed to protect the amenity and well-being of the community.	In respect to noise and vibration (amenity), the project has been developed such that it would: • Relocate a significant volume of through traffic on surface arterials underground, improving surface road noise • Comply with the relevant criteria from the NSW Industrial Noise Policy • Minimise increases in road traffic noise, where possible • Include effective implementation of noise management measures during operation • Include effective management of construction noise and vibration in accordance with relevant guidelines, for example through the use of acoustic sheds • Minimise surface activity and associated noise at tunnelling sites, as once tunnelling starts the majority of the work at these sites would be underground • Minimise impacts to the local community by: - Controlling noise and vibration at the source - Controlling noise and vibration on the source to receiver transmission path - Controlling noise and vibration at the receiver - Implementing practicable and reasonable measures to minimise the noise and vibration impacts of construction activities on local sensitive receivers.
Noise and vibration – Structural Construction noise and vibration (including airborne noise, ground-borne	In respect to noise and vibration (structural), the project would minimise impacts to structures by: • Controlling vibration at the source

Desired performance outcome	How performance outcomes would be achieved
noise and blasting) are effectively managed to minimise adverse impacts on the structural integrity of buildings and items including Aboriginal places and environmental heritage. Increases in noise emissions and vibration affecting environmental heritage as defined in the *Heritage Act 1977* during operation of the project are effectively managed.	• Controlling vibration on the source to receiver transmission path • Implementing practicable and reasonable measures to minimise vibration impacts of construction activities on structures • Carrying out building/structure condition surveys for properties (and heritage assets) within the zone of influence of tunnel settlement prior to the commencement of construction.
Biodiversity The project design considers all feasible measures to avoid and minimise impacts on terrestrial and aquatic biodiversity. Offsets and/or supplementary measures are assured which are equivalent to any remaining impacts of project construction and operation.	In respect to biodiversity, the project has been developed such that: • It would minimise impacts on biodiversity • Where practicable, the design would minimise the need to clear vegetation • Potential impacts on biodiversity would be managed in accordance with relevant legislation, including the *Environmental Planning and Assessment Act 1979*, *Biodiversity Conservation Act 2016* and the *Environment Protection and Biodiversity Conservation Act 1999*.
Place making and urban design The project design complements the visual amenity, character and quality of the surrounding environment. The project contributes to the accessibility and connectivity of communities.	In respect to place making and urban design, the project has been developed such that: • It would connect disconnected communities • The tunnel would relocate a significant volume of through traffic on surface arterials underground, improving urban amenity • Sympathetic urban design would integrate with adjacent and historical land uses • It would establish and operate ancillary facilities to minimise adverse impacts on the visual amenity of the local community • It would provide for new and improved active transport links.
Socio-economics, land use and property The project minimises adverse social and economic impacts and capitalises on opportunities potentially available to affected communities. The project minimises impacts to property and business and achieves appropriate integration with adjoining land uses, including maintenance of appropriate access to properties and community facilities, and minimisation of displacement of existing land use activities, dwellings and infrastructure.	In respect to socio-economics, land use and property, the project has been developed such that it would: • Minimise property acquisition • Manage the property acquisition process to minimise impacts to community • Minimise impacts to businesses during construction • Make provision for social infrastructure • Ease future congestion on the road network, supporting future urban regeneration • Avoid barriers and division of the community through the tunnel solution.

Desired performance outcome	How performance outcomes would be achieved
Water – Hydrology Long term impacts on surface water and groundwater hydrology (including drawdown, flow rates and volumes) are minimised. The environmental values of nearby, connected and affected water sources, groundwater and dependent ecological systems including estuarine and marine water (if applicable) are maintained (where values are achieved) or improved and maintained (where values are not achieved). Sustainable use of water resources.	In respect to water (hydrology), the project has been developed such that: • Design and construction of the tunnels would minimise groundwater inflow • Opportunities for reuse of treated water during construction has been considered throughout project development • The environmental values of nearby, connected and affected water sources would be improved and/or maintained.
Water – Quality The project is designed, constructed and operated to protect the NSW Water Quality Objectives where they are currently being achieved, and contribute towards achievement of the Water Quality Objectives over time where they are currently not being achieved, including downstream of the project, to the extent of the project impact including estuarine and marine waters (if applicable).	In respect to water (quality), the project has been developed such that it: • Would operate under water quality discharge criteria with consideration of NSW Water Quality Objectives • Would effectively treat water to meet water quality discharge criteria.
Flooding The project minimises adverse impacts on existing flooding characteristics. Construction and operation of the project avoids or minimises the risk of, and adverse impacts from, infrastructure flooding, flooding hazards, or dam failure.	In respect to flooding, the project has been developed such that: • Construction would be carried out in a manner that minimises the potential for adverse flooding impacts, through staging of works and the implementation of environmental management measures • Construction support sites and construction sites would be laid out such that flows are not significantly impeded • The project would maintain or reduce flood levels within and adjacent to the alignment.
Soils The environmental values of land, including soils, subsoils and landforms, are protected. Risks arising from the disturbance and excavation of land and disposal of soil are minimised, including disturbance to acid sulfate soils and site contamination.	In respect to soils, the project has been developed such that: • Erosion and sediment controls would be implemented in accordance with *Managing Urban Stormwater – Soils and Construction, Volume 1 (*Landcom 2004) and *Volume 2D (*DECC 2008*),* commonly referred to as the 'Blue Book' • Acid sulfate soils would be managed in accordance with good practice measures • Contamination would be managed to protect environmental values and human health.

Desired performance outcome	How performance outcomes would be achieved

Heritage
The design, construction and operation of the project facilitates, to the greatest extent possible, the long term protection, conservation and management of the heritage significance of items of environmental heritage and Aboriginal objects and places.
	• In respect to heritage, the project has been developed such that it would:
	  - Establish archival recordings of items of heritage significance that would be demolished
	  - Minimise impacts on heritage items during construction
	  - Incorporate key heritage values and stories into the final urban design and landscaping outcome
	  - Minimise damage to features of heritage conservation significance from vibration
	• The design would be sympathetic to the heritage significance of surrounding listed heritage items, and where practicable, avoids and minimises impacts to heritage
	• Impacts on heritage would be managed in accordance with relevant legislation, including the *Environmental Planning and Assessment Act 1979*, the *Heritage Act 1977*, and relevant guidelines.

Sustainability The project reduces the NSW Government's operating costs and ensures the effective and efficient use of resources. Conservation of natural resources is maximised.	In respect to sustainability, the project has been developed such that: • Sustainability considerations would be integrated throughout design, construction, and operation • The project would seek to achieve an 'Excellent' Design and 'As Built' Infrastructure Sustainability rating • The project would be carried out in accordance with the sustainability framework developed for the project • Activities to implement the sustainability framework, including requirements from the Infrastructure Sustainability rating scheme, would be implemented through a Sustainability Management Plan.
Waste All wastes generated during the construction and operation of the project are effectively stored, handled, treated, reused, recycled and/or disposed of lawfully and in a manner that protects environmental values.	In respect to waste, the project has been developed such that: • Where feasible and reasonable, the project would recycle or reuse clean spoil either onsite or off-site • Off-site waste re-use would be managed in accordance with relevant NSW Environment Protection Authority resource recovery exemptions and requirements • Waste would be disposed of at appropriately licensed facilities.
Climate change risk The project is designed, constructed and operated to be resilient to the future impacts of climate change.	In respect to climate change risk, the project has been developed such that it: • Would incorporate climate change and sea level rise adaptation measures during further design development and construction planning for the project.

28.7 Project justification and conclusion

28.7.1 Biophysical, economic and social considerations

The environmental impact statement has been prepared with regard to the key issues associated with the project and the integration of biophysical, economic and social considerations.

While the development of the project would have some unavoidable impacts (associated with, for example, construction impacts from heavy vehicle traffic, noise, vibration and dust, access disruptions and visual impacts) overall, the project would deliver a large number of benefits and opportunities including:

- Reducing congestion on distributor roads around the Harbour CBD, including the Sydney Harbour Bridge, Western Distributor and ANZAC Bridge
- Creating faster and more reliable cross-harbour journeys, particularly for traffic bypassing the Harbour CBD to the west
- Improving productivity along the Eastern Economic Corridor
- Increasing the resilience for the critical cross-harbour transport corridor
- Improving traffic performance on the Warringah Freeway to support long-term increased demand
- Improving urban amenity.

28.7.2 Sustainable development

Facilitating ecologically sustainable development is adopted as an objective of the *Environmental Planning and Assessment Act 1979*. This objective requires the integration of 'relevant economic, environmental and social considerations in decision making about environmental planning and assessment'.

Ecologically sustainable development is defined under the *Protection of the Environment Administration Act 1991* (NSW) and *Environmental Planning and Assessment Regulation 2000* and includes four principles. The project is consistent with these four principles of ecologically sustainable development:

- **Precautionary principle:** The environmental impact statement was prepared adopting a conservative approach, which includes an assessment of the worst case impacts and scenario and using the best available technical information and has adopted best practice environmental standards, goals and measures. The design and development of the project included consideration of potential environmental impacts associated with the project alternatives and options analysis and opportunities identified to avoid and minimise surface disturbance. In addition, sustainability workshops and meetings were held during design development with planning and design teams to develop draft sustainability targets and objectives for the project
- **Intergenerational equity:** The project is designed to meet needs of both current and future generations with a design life of about 100 years and would contribute to an increase in resilience and capacity of the Sydney transport network. During construction and operation of the project, opportunities would be taken to reduce resource and material use and maximise the use of materials with low embodied environmental impact, where feasible
- **Conservation of biological diversity and ecological integrity:** The design and assessment of the project has been carried out with the aim of identifying, avoiding, minimising and mitigating impacts to biodiversity and ecological integrity. Consistent with the *Biodiversity*

Conservation Act 2016 and the Secretary's environmental assessment requirements, a biodiversity offset strategy has been developed to compensate for the potential threatened species impacted by the project

- **Improved valuation and pricing and incentive mechanisms:** The value placed on avoiding and minimising environmental impacts is demonstrated in the design features incorporated into the project (for example identifying opportunities to improve local amenity, and improve public transport access and active transport connections). The costs of planning, design and implementation of avoidance and environmental management measures have been incorporated into the project cost.

28.7.3 Objects of the *Environmental Planning and Assessment Act 1979* (NSW)

A consideration of the project against the objects of the *Environmental Planning and Assessment Act 1979* is outlined in Table 28-5.

Table 28-5 Objects of the *Environmental Planning and Assessment Act 1979* (NSW)

Objects of the *Environmental Planning and Assessment Act 1979*	**Project attributes**
(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,	The project would enable long-term development of Sydney's motorway network, including facilitating new cross-harbour capacity and relieving pressure on the critical cross-harbour road network, providing improved traffic conditions, safety and efficiency for motorists and freight vehicles using Sydney's motorway network. The combination of freight and business travel time savings using the Harbour CBD and wider Eastern Economic Corridor as a result of the project would generate significant productivity benefits for the Harbour CBD and the wider region. During construction and operation the following opportunities would be taken to reduce material use and maximise the use of materials with low embodied environmental impact, where practical: • Water efficiency measures would be implemented where possible, with the reuse of non-potable water from stormwater harvesting and on-site reuse of treated water from groundwater inflows, where water quality and volume requirements are met • The design of the project has included careful consideration of the construction methodology and selection of materials and resources to minimise resource consumption • Consistent with the resource management hierarchy under the *Waste Avoidance and Resource Recovery Act 2001*, solid wastes would be reused and recycled where feasible and reasonable. Where possible, the project has been designed to avoid impacts on the natural environment and to minimise the need for land acquisition, as well as impacts on existing development and local communities.
(b) to facilitate ecologically sustainable development	The project is consistent with the principles of ecologically sustainable development as outlined in Section 28.7.2.

Objects of the *Environmental Planning and Assessment Act 1979*	Project attributes
by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,	
(c) to promote the orderly and economic use and development of land,	The project has been designed to: • Provide improved efficiency of the road network, in particular for freight and commercial users, resulting in economic benefits for NSW • Provide an additional underground motorway alternative for the crossing of Sydney Harbour, which is an orderly and economic approach to support wider network improvements • Minimise impacts to the surrounding natural and built environments where possible, for example by integrating design features such as tunnel portals and ventilation facilities, into the existing road corridors as far as practical • Integrate with, and thereby minimise disruption to, existing development and other projects (such as M4-M5 Link at the Rozelle Interchange) • Provide ancillary facilities, such as ventilation outlets at the Warringah Freeway, for use as part of the wider program of work to avoid additional future civil works.
(d) to promote the delivery and maintenance of affordable housing,	Not applicable to this project. The residual land created as a result of the project would largely continue to remain suitable for future development in accordance with the relevant land use zonings and applicable development standards. Land use considerations would be required to manage any interaction between the project and future development for buildings with habitable structures above 20 metres and within 300 metres of the ventilation outlet.
(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,	While construction would not result in the clearing of native vegetation, some areas of planted vegetation would be removed. Management measures have been proposed to minimise the potential for direct and indirect impacts. Some terrestrial fauna species would be impacted by the project. Management measures including pre-clearing surveys and monitoring would be carried out to minimise the risk of impacts to native species. Mitigation and rehabilitation works would be carried out to protect and restore any subtidal rocky reef and intertidal rocky shore habitat removed along the shoreline. In accordance with the SEARs and the requirements of the *Biodiversity Conservation Act 2016,* a biodiversity offset strategy has been developed to compensate for the loss of ecological values as a result of the project.

Objects of the *Environmental Planning and Assessment Act 1979*	Project attributes
(f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),	• Impacts on heritage items would be minimised during construction where possible, and works would be carried out in accordance with relevant management strategies where impacts are unavoidable • Visual and physical impacts to Yurulbin Park would be mitigated through appropriate landscape and reinstatement treatments, which would be in line with the design vision provided by the original landscape architect (Bruce Mackenzie AM). The new design would seek to retain and enhance the existing character and the original design intent as much as possible. These works would also improve the quality and long-term viability of landscaping and useability of the park • Possible indirect impacts associated with vibration and settlement from tunnelling works or surface works beneath or near to Aboriginal sites would be managed in accordance with relevant management measures.
(g) to promote good design and amenity of the built environment,	The project would provide: • Additional and upgraded shared user facilities • Reduction in traffic noise at a significant number of receivers, most notably around Warringah Freeway, due to the redistribution of traffic. The project is expected to lead to an overall improvement in noise levels within the community (compared with the existing situation). Noise mitigation (such as at-property treatment) would be implemented where required • Improved access and connectivity through improved travel time and improved travel time reliability, including to local and regional infrastructure within and near the project.
(h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,	The construction of the project, including motorway facilities, ventilation outlets and tunnel portals would be completed in line with the applicable Australian and international safety standard as well as any applicable Transport for NSW Safety in Design guidelines.
(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,	Consultation has been carried out with the relevant local councils and government agencies throughout the development of the project and the preparation of this environmental impact statement. All levels of government have been encouraged to be actively involved in and to contribute to the evolution of the project through consultation to date and continuing consultation activities.
(j) to provide increased opportunity for community participation in environmental planning and assessment.	Consultation has been carried out through all stages of the project development, with targeted community consultation periods undertaken in 2017 and 2018, consultation with key community and interest groups, and a business survey carried out in November 2017 across nine local centres potentially affected by the project. Community feedback has been considered at each stage of the project development to inform the selection of the preferred corridor

Objects of the *Environmental Planning and Assessment Act 1979*	Project attributes
	alignment and subsequent design development and refinements. Community consultation would continue through public exhibition of this environmental impact statement and during detailed design and construction, should the project be approved, in accordance with the Community Consultation Framework.

28.7.4 Cumulative impacts

Once operational, the Western Harbour Tunnel and Beaches Link program of works is expected to deliver beneficial cumulative impacts including significant increases in travel speeds through sections of the surface road network, increased reliability, and a reduction in average travel times.

Adverse cumulative impacts could occur when impacts from the project interact or overlap with impacts from other projects and potentially result in a larger overall impact. Cumulative impacts may also occur when there are projects that are constructed consecutively, resulting in construction fatigue for local receivers. Cumulative impacts for the project are presented in Chapter 27 (Cumulative impacts).

The implementation of environmental management measures for the project would avoid, to the greatest extent possible, cumulative impacts with surrounding development. In particular, the design of the project has carefully considered minimising construction fatigue as far as practical. The intent is to reduce the overall cumulative or consecutive impacts on the community over a longer period.

28.7.5 Conclusion

This environmental impact statement addresses the key issues identified in the Secretary's environmental assessment requirements issued under Division 5.2 of the *Environmental Planning and Assessment Act 1979* and the relevant provisions of Schedule 2 of the *Environmental Planning and Assessment Regulation 2000* (NSW).

The project is part of the NSW Government's commitment to investing in and delivering efficient and effective transport systems including road infrastructure that would relieve congestion, improve travel times, improve road safety and enhance and expand capacity on key road corridors. In particular, the project would relieve congestion on the Sydney Harbour Bridge and Sydney Harbour Tunnel, enabling faster, more reliable journeys for bus customers, freight and private vehicle users on all road corridors crossing Sydney Harbour.

The merits of the project were considered in the context of a range of other alternatives including do-nothing, based on the extent to which they could meet the project objectives and how well they performed with reference to other transport, environmental, engineering, social and economic factors. No other alternative would satisfy the need and objectives as effectively as the project.

As for any major infrastructure project to be constructed through the middle of major urban areas, there are expected to be impacts. Designing and constructing the project mainly underground has significantly reduced impacts and largely confined these to the construction stage. The design and construction method would continue to be developed with the objective of further minimising potential impacts taking into account the input of stakeholders and the local community.

Notwithstanding there would be a range of residual impacts. With the implementation of the proposed environmental management measures, the potential residual environmental impacts of the project are considered manageable and the project would be in the public interest.

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