WestConnex M4-M5 Link

Rozelle Interchange – Modification: The Crescent overpass and active transport links

Modification report

Appendix A

Environmental assessment requirements

1 Environmental assessment requirements

1.1 Environmental assessment requirements for the proposed modification

The modification report would address relevant environmental assessment requirements set out for the M4-M5 Link EIS in May 2017 and presented in s**ection 1.2**. Other relevant matters determined by DPIE in May 2019 are to be addressed in the proposed modification and are presented in **section 1.3** to follow.

1.2 Environmental assessment requirements for the proposed modification as proposed by RMS

Table 1 presents environmental assessment requirements as proposed by RMS for the M4-M5 Link Rozelle Interchange - Modification: The Crescent overpass and active transport links.

Table 1 Environmental assessment requirements for the proposed modification as proposed by RMS

Matter	Environmental Assessment Requirement	Where addressed
1. Construction Transport and Traffic	(a) Confirmation that car parking arrangements for the construction workforce is as per the EIS and that construction vehicles would be parked in previously approved locations as provided in the EIS.	**Modification report:** section 6.3.4 **Appendix B:** Section 3.3
	(b) In comparison with the assessment provided in the EIS, a quantitative assessment of the proposed modification's traffic impacts associated with the proposed heavy vehicle and light vehicle estimates during the AM and PM peak hours in the forecast peak construction year (2021) would be completed. This would be consistent with the construction traffic modelling methodology used for the EIS and the Preferred Infrastructure Report and would include assessment of mid-block road capacity and performance of signalised intersections in the vicinity of the proposed works.	**Modification report:** Section 6.3.3 **Appendix B:** Section 3.2
	(c) In comparison with the assessment provided in the EIS, quantitative and qualitative assessments of other potential traffic and transport impacts including access, on-street parking, pedestrians and cyclists, public transport services and infrastructure and traffic crashes.	**Modification report:** Sections 6.3.3 and 6.6.3 **Appendix B:** Sections 3 and 4
	(d) Outline the need to close, divert or otherwise reconfigure elements of the road, cycle and pedestrian network associated with construction of the modified design. Where the closure, diversion or reconfiguration would be temporary, provide an estimate of the duration of the altered access arrangements.	**Modification report:** Section 6.3.3 **Appendix B:** Section 3.6

Matter	Environmental Assessment Requirement	Where addressed
	(e) A review of the potential cumulative traffic impacts of other key infrastructure projects preparing for or commencing construction, including but not limited to other stages of WestConnex where potential impacts are likely to differ from those that were previously assessed under the EIS for SSI 7485.	**Modification report:** Section 6.3.3 **Appendix B:** Section 4.2
	(f) Assessment of safety impacts associated with the construction of the three bridge structures for pedestrians and traffic (including public transport) using City West Link and The Crescent. This assessment would also consider the Rozelle Bay light rail stop.	**Modification report:** Section 6.3.3 **Appendix B:** Sections 3.6, 3.7 and 3.8
2. Operational Transport and Traffic	Provide an assessment of the operational transport impacts of the proposed modification as compared to the EIS including, but not necessarily limited to:	**Modification report:** Section 6.3.3 **Appendix B:** Section 4
	a. changes to the forecast travel demand and traffic volumes (expressed in terms of total numbers and heavy and light vehicle numbers) for the modified design and the surrounding road, cycle and public transport network relevant to the proposed modification;	**Modification report:** Section 6.3.3 **Appendix B:** Sections 4.1.3, 4.1.7 and 4.1.8
	b. travel time analysis compared to the approved Project;	**Modification report:** Section 6.3.3 **Appendix B:** Section 4.1.5
	c. performance of the modified intersection and road network in close proximity to the City West Link / Crescent Intersection by undertaking a level of service analysis at key locations, for peak periods;	**Modification report:** Section 6.3.3 **Appendix B:** Sections 4.1.3 and 4.1.4
	d. the redistribution of traffic and impacts on traffic volumes and levels of service on the road network in close proximity to the Rozelle Interchange precinct resulting from the proposed modified design;	**Modification report:** Section 6.3.3 **Appendix B:** Sections 4.1.3 and 4.1.4

Matter	Environmental Assessment Requirement	Where addressed
	e. operational implications for existing and proposed public transport (particularly with respect to the Light Rail and bus services) and consideration of opportunities to improve access to public transport; and	**Modification report:** Section 6.3.3 **Appendix B:** Sections 4.1.5 and 4.1.7
	f. potential impacts on cyclist and pedestrian access and safety, including on known routes and future proposals in close proximity to the proposed modification.	**Modification report:** Section 6.3.3 **Appendix B:** Sections 4.1.8 and 4.1.10
3. Noise and vibration	(a) Assessment of construction and operational noise and vibration impacts including sleep disturbance associated with the proposed modification. This assessment must be in accordance with relevant NSW noise and vibration guidelines and potential noise and vibration mitigation measures should be identified.	**Modification report:** Sections 6.4.1 and 6.4.3 **Appendix C:** Sections 4, 5 and 6
	(b) An assessment of construction noise and vibration impacts which addresses:	**Modification report:** Section 6.4.3 **Appendix C:** Section 5
	a. the nature of construction activities (including transport, tonal or impulsive noise-generating works as relevant);	**Modification report:** Sections 4.3.1 and 6.4.3 **Appendix C:** Sections 5.2.1, 5.3.1 and 5.4.1
	b. the likely intensity and duration of potential noise and vibration impacts (both air and ground-borne);	**Modification report:** Section 6.4.3 **Appendix C:** Tables 5-3, 5-4, 5-6, 5-7, 5-9, 5-10)

Matter	Environmental Assessment Requirement	Where addressed
	c. the potential for works outside standard construction hours, including estimated duration and timing, predicted levels, exceedances and number of potentially affected receivers and justification for the activity in terms of the Interim Construction Noise Guideline (DECCW, 2009);	**Modification report:** Section 6.4.3 **Appendix C:** Sections 5.2.2, 5.3.2 and 5.4.2
	d. figures illustrating the existing, previously assessed and predicted noise levels related to the modification; and	**Modification report:** Figures 6-1 and 6-2 **Appendix C:** Figures 5-2 to 5-7, 5-9 to 5-11, 5-12 and 5-13
	e. As relevant to the proposed modification, a cumulative noise and vibration assessment of other key infrastructure projects preparing for or commencing construction, including but not limited to other stages of WestConnex where potential impacts are likely to differ from those that were previously assessed under the EIS for SSI 7485.	**Modification report:** Section 6.13.3 **Appendix C:** Sections 7.2.1 and 7.2.2
4. Air Quality	(a) Assessment of potential air quality impacts during the construction period. This would be a risk-based assessment consistent with the assessment prepared for the EIS.	**Modification report:** Section 6.5.3 **Appendix D:** Sections 2.2.1 and 3
	(b) Consideration of potential changes to the predicted operational air quality impacts for the approved project as a result of the proposed modification.	**Modification report:** Section 6.5.3 **Appendix D:** Sections 2.2.2, 4, 5, 6 and 7
5. Visual Amenity and Urban Design	(a) Assessment of visual impacts associated with the proposed modified design for the Rozelle Rail Yard Pedestrian and Cycling Green Link (also referred to as the land bridge), the shared path and The Crescent Overpass when viewed from residential receivers and public vantage points including open space and vehicular and pedestrian traffic along The Crescent and City West Link.	**Modification report:** Sections 6.7.2 and 6.7.3
	(b) Where relevant, consider any urban design opportunities or changes resulting from the proposed modification in relation to the urban design principles and objectives as assessed under the EIS.	**Modification report:** Section 6.6.3

Matter	Environmental Assessment Requirement	Where addressed
6. Heritage	(a) Assessment of the potential impact of the proposed modification on State Heritage Listed and locally listed heritage items.	**Modification report:** Section 6.8.3
7. Socio-economic, Land use and property	(a) Assess the potential impacts, by comparison to that assessed in the EIS, from the construction and operation on potentially affected property, businesses, and recreational users, including property acquisitions/adjustments, access amenity, and relevant statutory rights resulting from the proposed modification.	**Modification report:** Sections 6.3.3, 6.7.3 and 6.11.2
	(b) Assess potential impacts, by comparison to that assessed in the EIS, on utilities (including communications, electricity, gas, and water and sewerage) and the relocation of these utilities.	**Modification report:** Section 6.12
8. Flooding	(a) Qualitative assessment of potential drainage and flooding impacts, by comparison to that in the EIS, associated with the construction and operation of the proposed modification in the vicinity of the intersection between The Crescent and City West Link.	**Modification report:** Section 6.9.3

1.3 Other relevant matters to be assessed as proposed by DPIE for the proposed modification

Table 2 presents other relevant matters for assessment for the M4-M5 Link Rozelle Interchange - Modification: The Crescent overpass and active transport links.

Table 2 Other relevant matters to be assessed as proposed by DPIE for the proposed modification

Other relevant matters		Where addressed
Environmental Impact Assessment Process	The assessment process must provide a description of how options were analysed to inform the selection of the overpass over The Crescent and the shared pedestrian and cycle link.	**Modification report:** Section 1.4.3
Transport and Traffic	The construction traffic impact assessment must assess the potential impacts on traffic, parking and property access arising from road closures, road and intersection upgrades, road reconfigurations and diversions during construction. Any impacts to public transport must also be addressed. The operational impact assessment must address the wider traffic and transport interactions.	**Modification report:** section 6.3.3 **Appendix B:** Sections 3 and 4
Noise and Vibration – Amenity and Structural	The construction and operational noise and vibration assessment must be quantitative assessments. The assessments must identify any sensitive receivers not previously affected by the modified activities and those where the level of impact is predicted to increase. The assessment must describe the management measures that will be implemented to mitigate noise impacts. In particular, it must indicate whether noise barriers will be required on the overpass to reduce operational traffic noise and if so, any requirements that would be placed on the types of barriers e.g. wind shear strengths, transparent barriers to reduce visual impacts.	**Modification report:** Sections 6.4.3 and 6.4.4 **Appendix C:** Sections 6.3.2 and 6.4
Visual Amenity and Urban Design	The assessment must be supported by elevations and relevant perspective photographs / drawings / and or artists impressions, including views from the most affected sensitive receivers on Bayview Crescent, Annandale. The assessment should identify how Crime Prevention Through Environmental Design principles have been incorporated into the design of the shared pedestrian and cycle link.	**Modification report:** Section 6.7.2
Socio-economic, Land Use and Property	The assessment must assess and describe the actual impacts and not be limited to a comparison assessment as proposed.	**Modification report:** Section 6.11.2
Water	The assessment of operational impacts must describe the measures for conveying pavement drainage from the overpass to the receiving environment and any potential impact on receiving water bodies	**Modification report:** Section 6.9.3
Flooding	The assessment of potential drainage and flooding impacts in the vicinity of the intersection between The Crescent and City West Link must be quantitatively assessed, including the conveyance capacity of the existing stormwater system. The assessment should detail the measures that would be implemented to reduce flooding impacts. The estimated frequency and duration of flooding should be described.	**Modification report:** Section 6.9.3

WestConnex M4-M5 Link

Rozelle Interchange – Modification: The Crescent overpass and active transport links

Modification report

Appendix B

Traffic and transport assessment

Roads and Maritime Services

WestConnex - M4-M5 Link

Rozelle Interchange - Modification: The Crescent overpass and active transport links

Modification report

Appendix B Traffic and transport assessment

August 2019

Prepared for

NSW Roads and Maritime Services

Prepared by

AECOM Australia

Contents

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Glossary of terms and abbreviations

Term	Definition
A	
AM peak hour	Unless otherwise stated, this refers to vehicle trips arriving at their destination during the average peak one hour in the AM peak period between 7.00 am–9.00 am on a normal working weekday
AWT	Average Weekday Traffic
C	
Capacity	The nominal maximum number of vehicles which has a reasonable expectation of passing over a given section of a lane or roadway in one direction during a given time period under prevailing roadway conditions
Carriageway	The portion of a roadway used by vehicles including shoulders and ancillary lanes
Construction	Includes all physical work required to construct the project
Construction ancillary facilities	Temporary facilities during construction that include, but are not limited to construction sites (civil and tunnel), sediment basins, temporary water treatment plants, precast yards and material stockpiles, laydown areas, workforce parking, maintenance workshops and offices
Construction Traffic Transport and Access Management Sub-Plan	Traffic and Transport Construction Environmental Management Plan sub-plan
Cumulative impacts	Impacts that, when considered together, have different and/or more substantial impacts than a single impact assessed on its own
D	
DPIE	NSW Department of Planning, Industry and Environment
E	
EB	Eastbound
EIS	Environmental Impact Statement
Entry ramp	A ramp by which one enters a limited-access highway/tunnel
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
Exit blocking	Queuing traffic from a downstream link or intersection that blocks traffic from being able to travel through and exit an intersection
Exit ramp	A ramp by which one exits a limited-access highway/tunnel
F	
Footpath	The paved area in a footway
Footprint	The extent of the impact that a development (in plan-view) makes on the land
Footway	An area open to the public designated for the movement of pedestrians or has one of its main uses for pedestrians
Freeways	Fast, high volume, access-controlled roads that primarily link regional hubs and cities usually with grade separated intersections and without traffic lights
H	
h	Hour
HV (Heavy vehicles)	A heavy vehicle is classified as a Class 3 vehicle (a two-axle truck) or larger, in accordance with the Austroads Vehicle Classification System
I	
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment
L	
Local road	A road or street used primarily for access to abutting properties
LoS	Level of service. A qualitative measure describing operational conditions within a traffic stream or intersection and the perception by motorists and/or passengers

Term	Definition
M	
M4 East Motorway project	A component of the WestConnex program of works. Extension of the M4 Motorway in tunnels between Homebush and Haberfield via Concord. Includes provision for a future connection to the M4-M5 Link at the Wattle Street Interchange
M4-M5 Link	The project which is the subject of this modification. A component of the WestConnex program of works
Midblock	A general location on a road between two intersections
Motorway	Fast, high volume, access-controlled roads. May be tolled or untolled
N	
NB	Northbound
NSW	New South Wales
P	
PM peak hour	Unless otherwise stated, this refers to trips travelling on the network during the average peak one hour in the PM peak period between 3.00 pm–6.00 pm on a normal working weekday
Portal	The entry and/or exit to a tunnel
Project	A new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. The project includes an interchange at Lilyfield and Rozelle (the Rozelle Interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link). In addition, construction of tunnels, ramps and associated infrastructure to provide connections to the proposed future Western Harbour Tunnel and Warringah Freeway Upgrade project would be carried out at the Rozelle Interchange
Public transport	Includes train, bus (government and private), ferry (government and private) and light rail (government and private) services
R	
Roads and Maritime	NSW Roads and Maritime Services (formerly NSW Roads and Traffic Authority (RTA))
Roundabout	An intersection where all traffic travels in one direction clockwise around a central island
Rozelle Interchange	A new interchange at Lilyfield and Rozelle that would connect the M4-M5 Link Mainline Tunnels with City West Link, Anzac Bridge, the Iron Cove Link and the proposed future Western Harbour Tunnel and Warringah Freeway Upgrade project
S	
SB	Southbound
SPIR	Submissions and Preferred Infrastructure Report
STM	Strategic Travel Model, operated by Transport for NSW Transport Performance and Analytics
T	
Traffic efficiency	Measured by savings (and delays) in travel time
Transport infrastructure	Permanent installations including roads, rail, buildings and storage associated with transport
Transport for NSW	NSW Government Department Transport for NSW
V	
Veh	Vehicle
Veh/h	Vehicle per hour
V/C	Volume to capacity ratio, ratio of the traffic volume to the road capacity
W	
WB	Westbound
WRTM	WestConnex Road Traffic Model

1 Introduction

NSW Roads and Maritime Services (Roads and Maritime) is seeking to modify the existing project approval for the construction and operation of the WestConnex M4-M5 Link project (the project), which is part of the WestConnex program of works. Approval for the construction and operation of the project was granted on 17 April 2018 by the NSW Minster for Planning (application number SSI_7485). **Figure 1-1** provides an overview of the approved project.

1.1 Overview of M4-M5 Link project

The EIS for the project described construction and operation of the M4-M5 Link project in two stages:

- Stage 1[1]: A new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters (Mainline Tunnels)
- Stage 2[2]: An interchange at Lilyfield and Rozelle (the Rozelle Interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link).

Stage 2 works commenced in 2019 with these components of the project anticipated to open to traffic in 2023.

A more comprehensive overview of the M4-M5 Link project, as well as other aspects of the WestConnex program of works is provided within the Environmental Impact Statement (EIS) and the Submissions and Preferred Infrastructure Report (SPIR).

[1] M4-M5 Link Stage 1 (the Mainline Tunnels)
[2] M4-M5 Link Stage 2 (the Rozelle Interchange and Iron Cove Link)

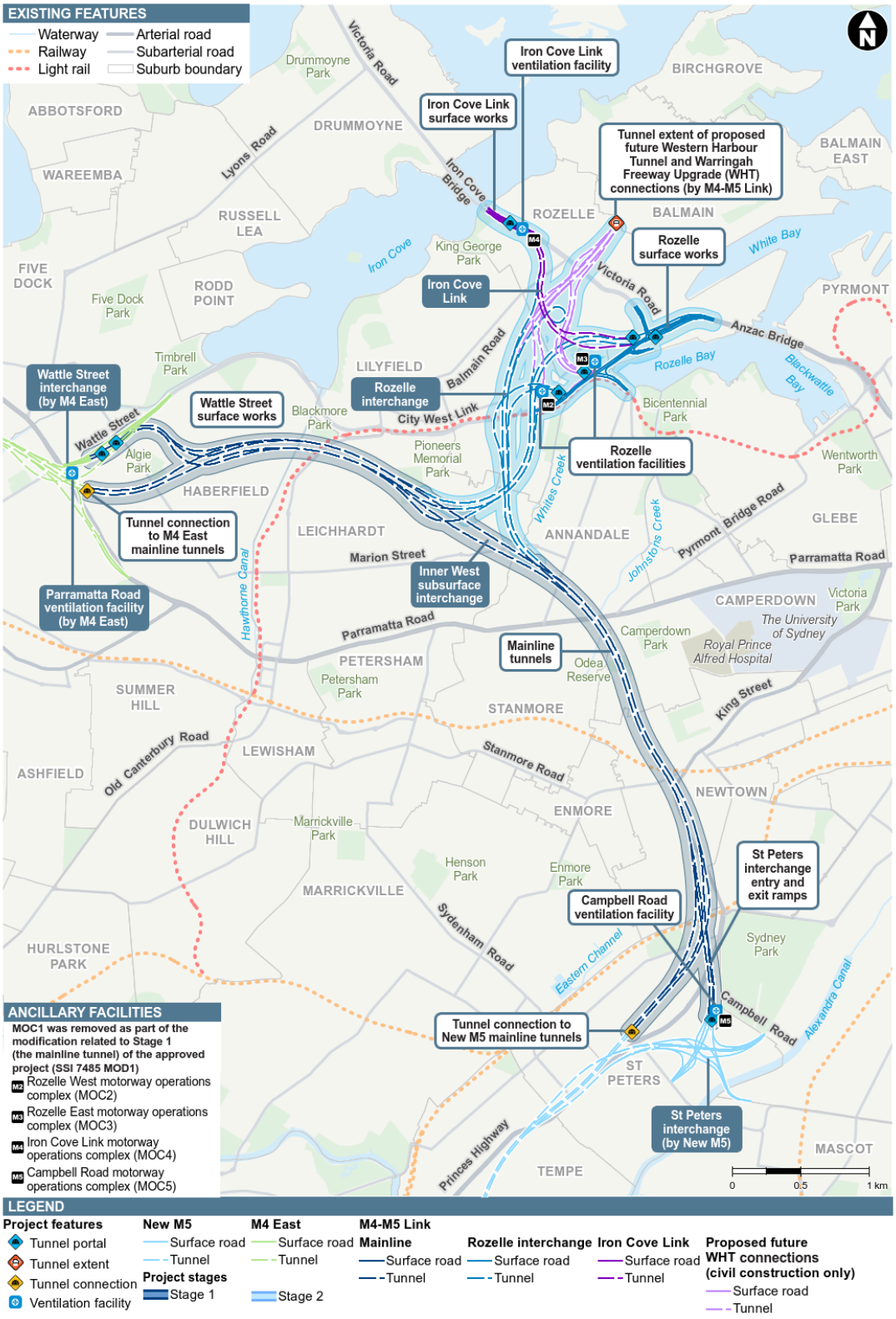

Figure 1-1 Overview of the M4-M5 Link project

1.2 Overview of proposed modification

Since Planning Approval (April 2018 Infrastructure Approval) was granted, a contractor has been appointed to construct Stage 2 of the approved project on behalf of Roads and Maritime. The contractor has reviewed the concept design for the approved project and in discussions with Roads and Maritime has identified a number of potential design and constructability improvements.

The proposed modification relates to Stage 2 of the approved project. The following key components are proposed as part of the proposed modification (refer to Figure 1-2):

- A new elevated vehicular overpass ('The Crescent overpass') that would allow eastbound traffic heading north on The Crescent from Annandale to bypass the signalised intersection at The Crescent / City West Link junction and continue east on The Crescent towards Victoria Road and the Anzac Bridge
- Modifications to the eastbound lanes of the City West Link and The Crescent on either side of the intersection and northbound lanes on The Crescent at Annandale to provide space for the tie-in of The Crescent overpass
- Upgrades to the intersection of The Crescent/Johnston Street/Chapman Road (including lane reconfiguration and marking, signal phasing, adjusting positions of traffic signals kerb works etc.)
- Realignment of the Pedestrian and Cycling Green Link ('green link') to the west of The Crescent, providing a connection between the Rozelle Rail Yards and the Rozelle Bay light rail stop
- A new shared user path bridge spanning The Crescent to the east of The Crescent / City West Link intersection. The shared user path bridge provides a connection between Rozelle Rail Yards and the shared user path to Bicentennial Park along the east side of The Crescent and adjacent to Rozelle Bay. The shared user path bridge and shared user path would provide the pedestrian and cyclist connectivity required by Conditions E120 and E121, albeit in a different arrangement to that shown in the EIS
- Minor changes to the layout of the approach roads leading to the Anzac Bridge from Victoria Road, The Crescent and the Rozelle Interchange to improve traffic merging arrangements.
- Use of a minor construction ancillary facility, established in accordance with Condition C24, as a construction ancillary facility. The proposed construction ancillary facility (C6a) is located on the south side of The Crescent to the west of James Craig Road and adjacent to Rozelle Bay. The proposed modification would allow use of the site for a limited number of additional purposes which are not permitted by Condition C24 including:
  - Light vehicle parking for workers (around 9 spaces) and
  - Material laydown areas and a limited number of associated vehicle movements (small delivery vans and rigid trucks).

  These additional purposes would support the various construction activities at the C6 civil site.

As outlined in Chapter 1 (Introduction) of the Modification report, the proposed modification would:

- Improve intersection performance on this congested section of the road network including at the City West Link/The Crescent and The Crescent/Johnston Street/Chapman Road intersections
- Adjust the alignment of active transport links to avoid conflict with The Crescent overpass while improving the overall connectivity proposed within the EIS and Conditions of Approval (CoA) for the project by providing a direct connection between the suburbs of Rozelle and Annandale and public transport infrastructure including the Rozelle Bay light rail stop
- Improve the efficiency of construction and minimise the duration of construction impacts on nearby residents by reducing the need for further construction activities to accommodate the proposed Western Harbour Tunnel and Warringah Freeway Upgrade project (Western Harbour Tunnel project) at City West Link and The Crescent, should that project proceed in the future

- Improve capacity at the intersections so that they can maintain performance with traffic generation from future development proposed in the vicinity of the project including the Western Harbour Tunnel project if that future development proceeds.

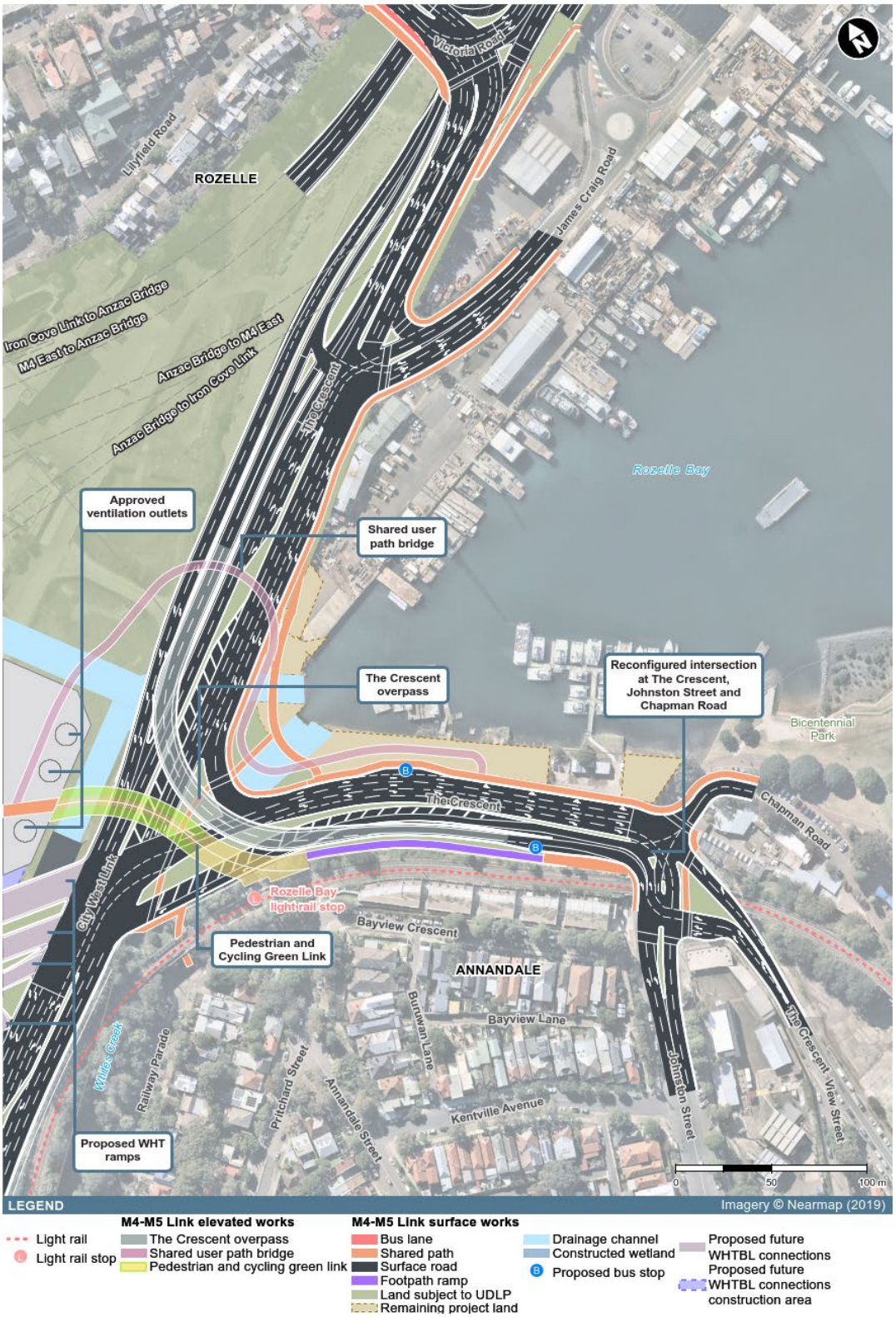

Figure 1-2 Overview of the proposed modification

1.3 Purpose of this report

The purpose of the traffic and transport assessment is to support the environmental assessment for the proposed project modification by assessing and reporting the future traffic and transport conditions under the proposed modification. Specifically, the assessment includes the following:

- Traffic, transport and access impacts associated with changes to proposed construction activities
- Impacts on operational performance during the AM peak and PM peak hours of the future road network around the Rozelle Interchange due to the proposed modification. This includes network performance, intersection levels of service and general traffic and public transport travel time analysis
- Impacts on active transport links and public transport stops due to the proposed modification
- Impacts on local property access and on-street parking due to the proposed modification
- Impacts on connectivity due to the proposed modification.

1.4 Assessment requirements

In preparing this assessment, the Secretary's Environmental Assessment Requirements (SEARs), issued for the proposed modification have been reviewed.

Environmental assessment requirements as proposed by Roads and Maritime for the M4-M5 Link Rozelle Interchange Modification: The Crescent overpass and active transport links as relevant to the Traffic and Transport Assessment, and where this report addresses these matters, are outlined in **Table 1-1**.

Table 1-1 How the assessment requirements have been addressed in this report

Requirement	Section where addressed in report
1. Construction transport and traffic impacts:	**Chapter 3**
(a) Confirmation that car parking arrangements for the construction workforce is as per the EIS and that construction vehicles would be parked in previously approved locations as provided in the EIS	**Section 3.3**
(b) In comparison with the assessment provided in the EIS, a quantitative assessment of the proposed modification's traffic impacts associated with the proposed heavy vehicle and light vehicle estimates during the AM and PM peak hours in the forecast peak construction year (2021) would be completed. This would be consistent with the construction traffic modelling methodology used for the EIS and the Preferred Infrastructure Report and would include assessment of mid-block road capacity and performance of signalised intersections in the vicinity of the proposed works	**Section 3.2**
(c) In comparison with the assessment provided in the EIS, quantitative and qualitative assessments of other potential traffic and transport impacts including access, on-street parking, pedestrians and cyclists, public transport services and infrastructure and traffic crashes	**Sections 3.4, 3.5, 3.6, 3.7 and 3.8**
(d) Outline the need to close, divert or otherwise reconfigure elements of the road, cycle and pedestrian network associated with construction of the modified design. Where the closure, diversion or reconfiguration would be temporary, provide an estimate of the duration of the altered access arrangements	**Section 3.6**
(e) A review of the potential cumulative traffic impacts of other key infrastructure projects preparing for or commencing	**Section 6.3.3 and 6.13.3 of the main EIS**

Requirement	Section where addressed in report
construction, including but not limited to other stages of WestConnex where potential impacts are likely to differ from those that were previously assessed under the EIS for SSI 7485	**report**
(f) Assessment of safety impacts associated with the construction of the three bridge structures for pedestrians and traffic (including public transport) using City West Link and The Crescent. This assessment would also consider the Rozelle Bay light rail stop	**Section 3.8**
(g) The construction traffic impact assessment must assess the potential impacts on traffic, parking and property access arising from road closures, road and intersection upgrades, road reconfigurations and diversions during construction. Any impacts to public transport must also be addressed.	**Section 3**
2. Operational transport and traffic impacts:	
(a) changes to the forecast travel demand and traffic volumes (expressed in terms of total numbers and heavy and light vehicle numbers) for the modified design and the surrounding road, cycle and public transport network relevant to the proposed modification	**Section 4 Sections 4.1.3, 4.1.7 and 4.1.8**
(b) travel time analysis compared to the approved project	**Section 4.1.5**
(c) performance of the modified intersection and road network in close proximity to the City West Link / Crescent Intersection by undertaking a level of service analysis at key locations, for peak periods	**Sections 4.1.3 and 4.1.4**
(d) the redistribution of traffic and impacts on traffic volumes and levels of service on the road network in close proximity to the Rozelle Interchange precinct resulting from the proposed modified design	**Sections 4.1.3 and 4.1.4**
(e) operational implications for existing and proposed public transport (particularly with respect to the Light Rail and bus services) and consideration of opportunities to improve access to public transport	**Sections 4.1.5 and 4.1.7**
(f) potential impacts on cyclist and pedestrian access and safety, including on known routes and future proposals in close proximity to the proposed modification.	**Sections 4.1.8 and 4.1.10**
The operational impact assessment must address the wider traffic and transport interactions.	**Section 4**

1.5 Structure of this report

This report has been structured as follows:

- **Chapter 2** presents the assessment methodology used
- **Chapter 3** considers the potential impacts associated with construction activities
- **Chapter 4** documents the impact assessment undertaken for the project only peak hour and the cumulative peak hour operational scenarios with the proposed modifications
- **Chapter 5** documents management measures that are proposed to mitigate impacts
- **Chapter 6** provides a conclusion to the assessment
- **Chapter 7** presents reference material used.

2 Assessment methodology

2.1 Relevant guidelines and policies

The following guidelines were used in carrying out this assessment:

- Guide to Traffic Management – Part 3 Traffic Studies and Analysis (Austroads 2013)
- Traffic Modelling Guidelines (Roads and Maritime 2013)
- Guide to Traffic Generating Developments Version 2.2 (NSW Roads and Traffic Authority (RTA) 2002).

2.2 Key assumptions

The following assumptions were made in the assessment:

- The assumptions in the WestConnex Road Traffic Model (WRTM v2.3) – the strategic traffic model used by Roads and Maritime to forecast traffic demands for future scenarios – were retained, ie land use and infrastructure assumptions were the same as that used in the EIS
- The forecast traffic from the construction sites associated with Stage 2 (Rozelle Interchange) of the project (as modified) remain as in the M4-M5 Link: EIS, as varied by the Submissions and Preferred Infrastructure Report (M4-M5 Link SPIR) (January 2018) except as discussed in **section 3.2**.

2.3 Methodology

The traffic impacts of the proposed road network components of the proposed modification were assessed using existing VISSIM traffic models previously used to assess operational impacts for the Rozelle Interchange in the EIS. The assessments were undertaken on the surrounding road network during the AM and PM peak hours in the forecast year 2023 and 2033. The VISSIM model area coverage is shown in **Figure 2-1**.

Four future year scenarios were modelled to assess the traffic impacts of the proposed modification in comparison to the approved project:

- **Future case with the project (2023)**: The future case 'with project' assumes the NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic
- **Cumulative case (2023)**: Assumes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic, and in addition, the proposed future Sydney Gateway and Western Harbour Tunnel project are complete and open to traffic
- **Future case with the project (2033)**: The future case 'with project' includes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic, but the proposed future Sydney Gateway, Western Harbour Tunnel project and the F6 Extension are not operational
- **Cumulative case (2033)**: The future Cumulative scenario assumes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic and also assumes proposed future Sydney Gateway, Western Harbour Tunnel project and Beaches Link project and the F6 Extension are complete and open to traffic.

These scenarios are consistent with what was assessed in the EIS, enabling a comparison in performance to be made to the approved project. The measures of performance or assessment criteria are consistent with those presented in the EIS.

As in the EIS, it is noted that this assessment has been based on forecast traffic demands derived from the WRTM and, consequently, the outcome may be affected by the limitations of the modelling process as described in the EIS.

The boundaries of the VISSIM operational model were reviewed. Based on the forecast changes in traffic volumes on the surrounding road network due to the project, the current model boundaries were considered adequate. Additional traffic is forecast on Johnston Street northbound, the majority is forecast to occur in off peak periods. A maximum additional 90 northbound vehicles is forecast during the 2033 AM peak hour. A sensitivity test was undertaken to test the significance of this increase on the VISSIM model peak period network performance, which indicated minimal impact. More detail is provided in **section 4.1.2**.

2.3.1 Interchange road network performance

The project involves interaction of wide, congested multi-lane carriageways and development of interchanges between at-grade and sub-surface road infrastructure. Given the complex nature of these interactions, it is important to understand the potential impact that the project would have on the road network. Of importance is merge behaviour at tunnel portals and potential blocking of entry and exit ramps. Such behaviour is best represented by microsimulation modelling.

Microsimulation software (VISSIM) was selected for detailed network and intersection analysis due to its ability to model individual vehicle interactions, traffic signal effects, overtaking manoeuvres, and queuing. The visual representation and interaction of individual vehicles is of importance where merge and weave behaviour, as well as differential lane utilisation, are expected to have an impact on traffic capacity. Updated analysis of the network performance impacted by the changes compared to the EIS performance is reported using the following modelling parameters collected and reported for the AM and PM peak hours in each scenario:

- Total vehicle demand – number of vehicles wanting to use the modelled network
- Vehicle kilometres travelled in network – total distance travelled by vehicles travelling through the modelled network
- Vehicle time travelled approaching and in network – the total time taken by vehicles to enter and drive through the modelled network
- Total vehicles arrived – the number of vehicles completing their journey on the network
- Total stops made by vehicles in the network, either due to intersection controls or congestion – the number of stops that vehicles make while travelling through the modelled network. Generally, the fewer stops, the less congested the network
- Average speed of vehicles – the average speed at which vehicles travel through the network. Calculated by dividing the VKT by the vehicle time travelled. Generally, the higher the speed, the better the network operates
- Travel time for typical cross-network trips – the time taken by vehicles to travel between two points in the network. Used as a comparison of how the network is performing, although with changes in the network, vehicles can take different routes between points
- Unreleased demand at the end of peak hour – the number of vehicles unable to enter the model due to congestion extending back to model entry points. The number of ‘unreleased’ vehicles is an indication of the effectiveness of the network. Generally, the lower the number of unreleased vehicles, the better the network can accommodate travel demand.

2.3.2 Intersection level of service

Average delay is commonly used to assess the operational performance of intersections, with level of service (LoS) used as an index. A summary of the intersection level of service criteria is shown in **Table 2-1**.

As in the EIS, for the analysis of intersection performance in this assessment, all exit blocking constraints, applied in the microsimulation models to reflect network congestion beyond the modelled network extents, were removed. This allows for an assessment of intersections within the modelled network, irrespective of any downstream queuing that would mask the actual operation of the intersection.

Table 2-1 Level of service criteria for intersections

LoS	Average delay/vehicles (sec/veh)	Traffic signals/roundabouts	Give way and stop signs
A	≤ 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents would cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: *Guide to Traffic Generating Developments*, RTA 2002

Figure 2-1 VISSIM model area coverage

3 Potential impacts – construction

3.1 Proposed modification

As a result of updated construction planning, a number of changes that were not considered in the EIS are proposed as part of the proposed modification.

It is proposed to use a minor construction ancillary facility, established in accordance with Condition C24, as a construction ancillary facility. The proposed construction ancillary facility (C6a) is located on the south side of The Crescent to the west of James Craig Road and adjacent to Rozelle Bay. The proposed modification would allow use of the site for a limited number of additional purposes which are not permitted by Condition C24 including:

- Light vehicle parking for workers (around 9 spaces) and
- Material laydown areas and a limited number of associated vehicle movements (small delivery vans and rigid trucks).

These additional purposes would support the various construction activities at the C6 civil site.

The proposed construction ancillary facility (C6a) is shown on **Figure 3-1**. As the proposed C6a construction ancillary facility would include the provision of light vehicle parking spaces and material laydown areas with a limited number of associated vehicle movements, an assessment is required on the potential impacts during operation of this compound area.

In addition, detailed construction planning in the area of the approved realignment of The Crescent between The Crescent / Johnston Street / Chapman Road intersection and the City West Link / The Crescent intersection has identified that the construction activities would occur across area is broadly bounded by:

- The Crescent / Johnston Street / Chapman Road intersection in the south east
- City West Link / The Crescent intersection in the north west
- The light rail corridor in the south west
- Rozelle Bay in the north east.

This is shown in **Figure 3-1**.

The approved C6 civil site on The Crescent will continue to be managed through the implementation of the approved Construction Establishment Management Plan as required by Conditions C1-C4 of the CoA.

Most of the works for construction of The Crescent overpass, green link and shared user path bridge would occur in laydown areas, including bridge assembly. As described in the EIS, there would be temporary road and lane closures, especially related to bridge span lifts. Closures associated with The Crescent overpass, green link and shared user path bridge would be managed through the Construction Traffic, Transport and Access Management Sub-Plan of the Construction Environmental Management Plan, as described in Conditions C4-C8 of the CoA.

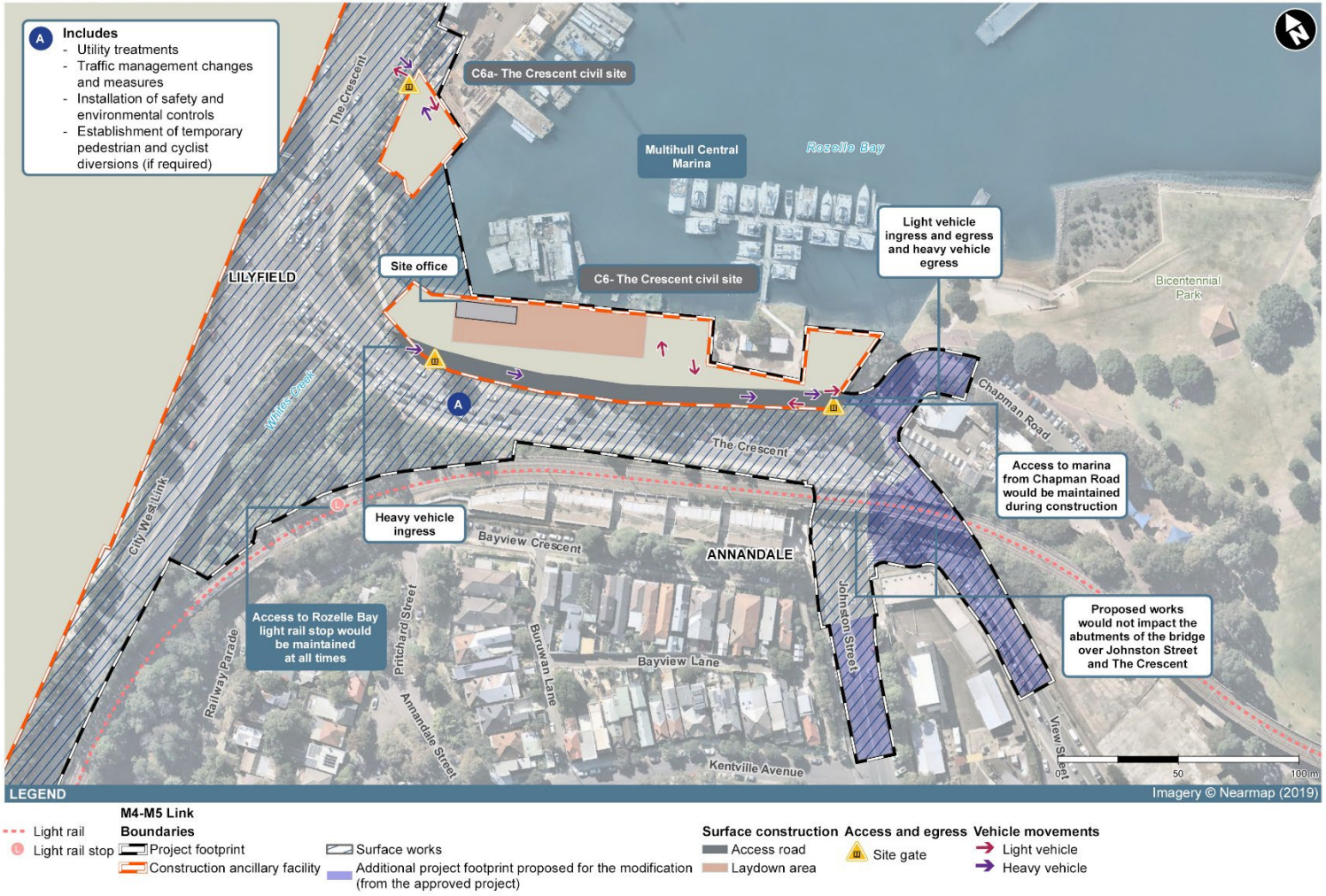

Figure 3-1 Proposed construction ancillary facility (C6a)

3.2 Impacts on construction traffic generation

No changes to construction traffic volumes from the construction sites as described in the EIS are proposed, which for the proposed construction ancillary facility (C6a) were:

- Daily: 10 heavy vehicles in and out (20 movements per day) and 20 light vehicles in and out (40 movements per day)
- AM peak hour: Two heavy vehicles in and out (four movements per hour) and no light vehicles in and out (zero movements per hour)
- PM peak hour: Two heavy vehicles in and out (four movements per hour) and five light vehicles out (five movements per hour).

No re-assessment of the 2021 construction traffic scenario was therefore required to be undertaken.

The proposed construction ancillary facility (C6a) on the southern side of The Crescent adjacent to Rozelle Bay and to the east of the City West Link / The Crescent intersection would be used for some light vehicle parking and material laydown areas (delivery and pick up).

Nine light vehicle parking spaces are proposed. In addition, small delivery vans and rigid trucks would access the material laydown areas although no more than 2-3 movements per hour would be expected between 6am and 6pm. Vehicles would access this site through a westbound left in, left out on The Crescent.

3.3 Impacts on construction workforce parking

Approved peak construction work estimates at the proposed construction ancillary facility (C6a) include up to 50 workers per shift. It is anticipated that the proposed modification would be undertaken within these approved worker numbers, and therefore there would be no change from the EIS. Worker carparking would be managed through the Construction Parking and Access Strategy, as required by Condition E54 of the CoA.

3.4 Impacts on construction access points and routes

The proposed construction ancillary facility (C6a) on the southern side of The Crescent adjacent to Rozelle Bay and to the east of the City West Link / The Crescent intersection would be accessed through a westbound left in, left out on The Crescent.

It is not anticipated that the low number of left-in, left-out light vehicles from this site would impact on traffic operations, especially as the peak hours for the construction sites are slightly different to the surrounding road network peak hours, i.e. the busiest periods on the general road network and at the construction sites do not coincide. With a shift start time of 7am, most light vehicle arrivals would occur before the road network AM peak hour at these locations. The end of the shift is more likely to coincide with the road network PM peak hour, although some vehicles would leave before the road network peak hour.

3.5 Impacts on on-street parking and local access

The proposed The Crescent / Johnston Street / Chapman Road intersection upgrade would temporarily remove four on-street parking spaces on the northern side of Chapman Road during construction. However, once construction works are completed these spaces would be relocated in the immediate vicinity resulting in no permanent loss of on-street parking as part of the proposed modification. The proposed The Crescent / Johnston Street / Chapman Road intersection upgrade would also result in the loss of two permanent on-street parking spaces at the very northern end of the northbound carriageway of Johnston Street.

Local access to 300 Johnston Street, just south of The Crescent / Johnston Street / Chapman Road intersection, would be within the construction zone for the proposed The Crescent / Johnston Street / Chapman Road intersection upgrade. No significant construction works are proposed adjacent to 300 Johnston Street and access to this property would be maintained and managed in accordance with Conditions E46 and E47, which relate to property access. Construction works could be up to 12 months duration at The Crescent / Johnston Street / Chapman Road intersection.

3.6 Impacts on pedestrians and cyclists

No changes to pedestrian and cycle provision during construction are proposed to that described in the EIS. Safe pedestrian and cyclist access would be maintained during construction in accordance with Condition E57 and road safety audits would be carried during detailed design to assess the safety performance of new or modified road and pedestrian and cyclist infrastructure (including around construction ancillary facilities).

3.7 Impacts on public transport

As there are no changes proposed to construction traffic from the construction sites as described in the EIS, there would be no additional impact on buses during construction. As described in the EIS, the bus stops on The Crescent (northbound and southbound) near the intersection with City West Link would be moved south towards Johnston Street to allow for construction along The Crescent. The northbound bus stop would be permanently moved south to accommodate the new alignment. The southbound bus stop would be reinstated in generally the same location. No additional temporary impact on bus stops is expected to occur due to the proposed modification.

Access to the Rozelle Bay light rail stop during construction is also consistent with that described in the EIS, namely that pedestrian access would be maintained during construction and alternative access from The Crescent to the Rozelle Bay light rail stop would also be provided.

3.8 Impacts on road safety

As there are no changes proposed to the construction traffic from the construction sites, there is not expected to be an additional impact on road safety in the study area due to additional construction vehicles.

There is still a risk with construction traffic interacting with general traffic, with elevated risk when construction-related vehicles are entering and leaving construction sites. The C6a construction ancillary facility site proposed on the southern side of The Crescent adjacent to Rozelle Bay introduces a westbound left in movement on The Crescent just prior to The Crescent / City West Link intersection. The left in movement would take place in the demarcated left turn lane on the approach to this intersection. Other motorists would need to be made aware of this possible movement, as they would currently expect the left turn movement to happen at the intersection and not prior to it, which may raise the risk of rear-end crashes at this location.

Any foreseen impacts on road safety for all users during construction, including the safety impacts of the construction of the three bridge structures for pedestrians and traffic using City West Link and The Crescent, would be mitigated as much as practicable through the provision of tailored construction traffic management plans and other measures as detailed in the M4-M5 Link SPIR and in the Construction Traffic, Transport and Access Management Sub-Plan that will be prepared for the project, as required by Condition C4 of the CoA. Maintaining safe pedestrian and cyclist access around work sites during construction is also a requirement of Condition E57 of the CoA.

4 Potential impacts – operational

4.1 Assessment of operational traffic impacts in 'with project' scenario

This section discusses the potential traffic impacts of the proposed modification during the 'with project' scenarios. Two scenarios were modelled to assess the potential operational traffic impacts:

- **Future case 'with project' (2023)**: The future case 'with project' assumes the NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic
- **Future case 'with project' (2033)**: The future case 'with project' includes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic, but the proposed future Sydney Gateway, Western Harbour Tunnel project and the F6 Extension are not operational.

4.1.1 Changes to road network

Figure 4-1 shows the modelled 'with project' Rozelle Interchange network. Changes proposed in the modification model compared to the EIS design are:

- **The Crescent / Johnston Street / Chapman Road** intersection (refer to **Figure 4-2**) – southern leg of The Crescent is one-way southbound, with northbound traffic using an existing slip road to a new signalised intersection on Johnston Street, where vehicles can turn left or continue northbound along The Crescent. Northbound vehicles on Johnston Street can turn left onto The Crescent or straight ahead to Chapman Road. The right turn from Johnston Street into The Crescent is no longer available. Left turning vehicles from Johnston Street can continue onto The Crescent overpass to turn right at City West Link or continue at grade to turn left onto City West Link. The Crescent southbound approach is expanded from three lanes to four lanes, allowing two right turn lanes, one through lane and one shared through and left turn lane. Vehicles exiting Chapman Road can turn left onto The Crescent (southbound), right onto The Crescent (northbound) and access The Crescent overpass, or continue straight onto Johnston Street (southbound).
- **The Crescent / City West Link intersection** with The Crescent overpass (refer to **Figure 4-3**) – the overpass connecting the northbound and eastbound carriageways of The Crescent heading towards Victoria Road and the Anzac Bridge removes the at grade right turn from this intersection. All other movements remain. Vehicles travelling eastbound along City West Link and on to The Crescent would travel either side of the exit from overpass depending on their destination, with Anzac Bridge-bound vehicles travelling to the left and Victoria Road or James Craig Road-bound (right turn) vehicles travelling to the right of the overpass.
- **The Crescent / James Craig Road intersection** (refer to **Figure 4-4**) – with The Crescent overpass coming to ground on the eastbound approach to the intersection, vehicles can travel straight to Anzac Bridge or straight to Victoria Road. A right turn into James Craig Road from the overpass is not available. The Crescent eastbound bifurcates around the overpass with Anzac Bridge-bound vehicles travelling to the left and Victoria Road or James Craig Road-bound (right turn) vehicles travelling to the right of the overpass.
- **Approach to Anzac Bridge** (refer to **Figure 4-5**) – three lanes from Iron Cove Link / M4 merge to two lanes, while two lanes from Victoria Road merge to one lane and then merge with two lanes from The Crescent. These lanes then continue as four lanes on Anzac Bridge. This differs from the EIS, which had three lanes from Iron Cove Link / M4, one lane from The Crescent and one lane from Victoria Road merging into four lanes on Anzac Bridge. The proposed layout eliminates the zipper merge proposed in the EIS design.

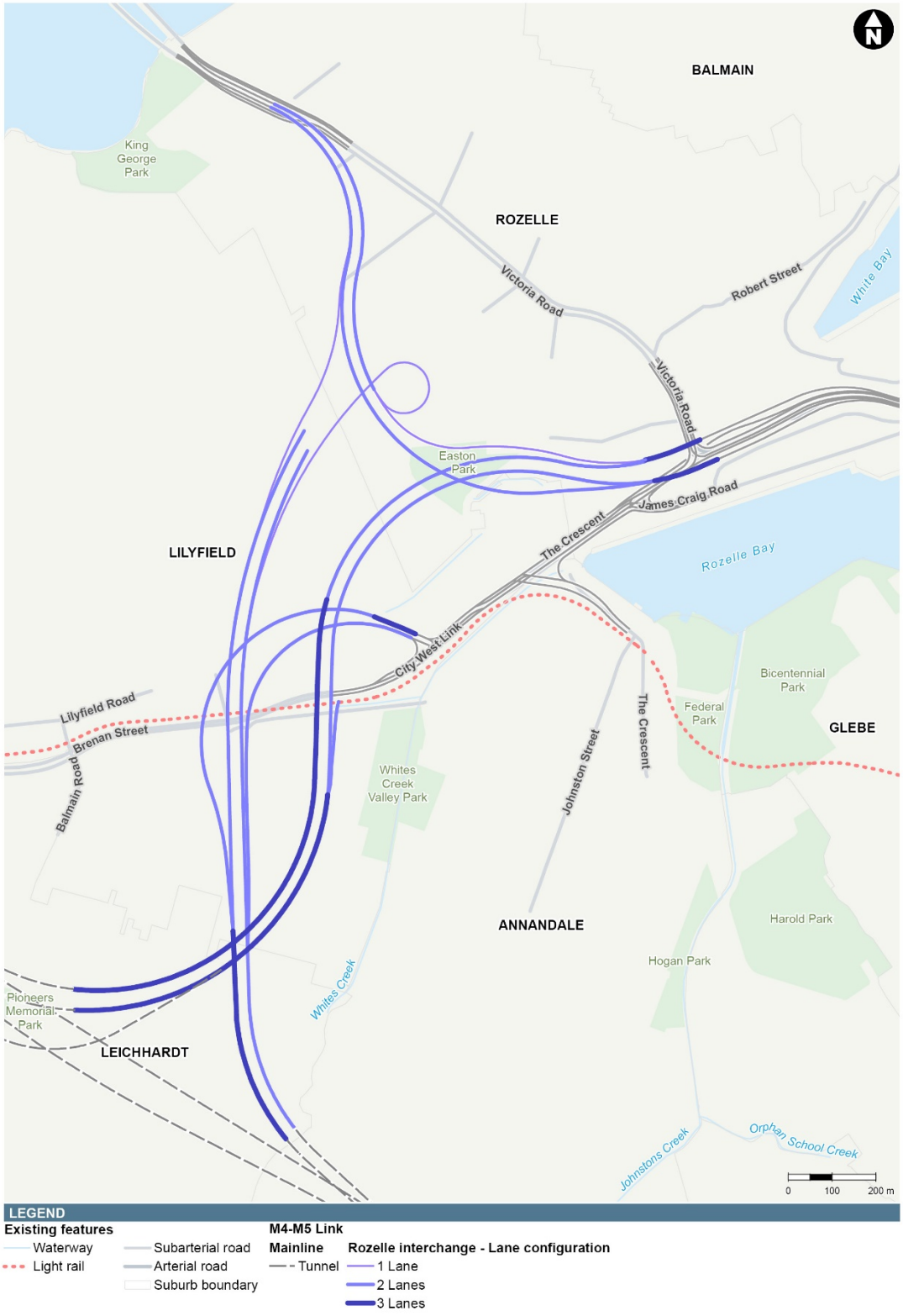

Figure 4-1 Rozelle Interchange: 'with project' road network

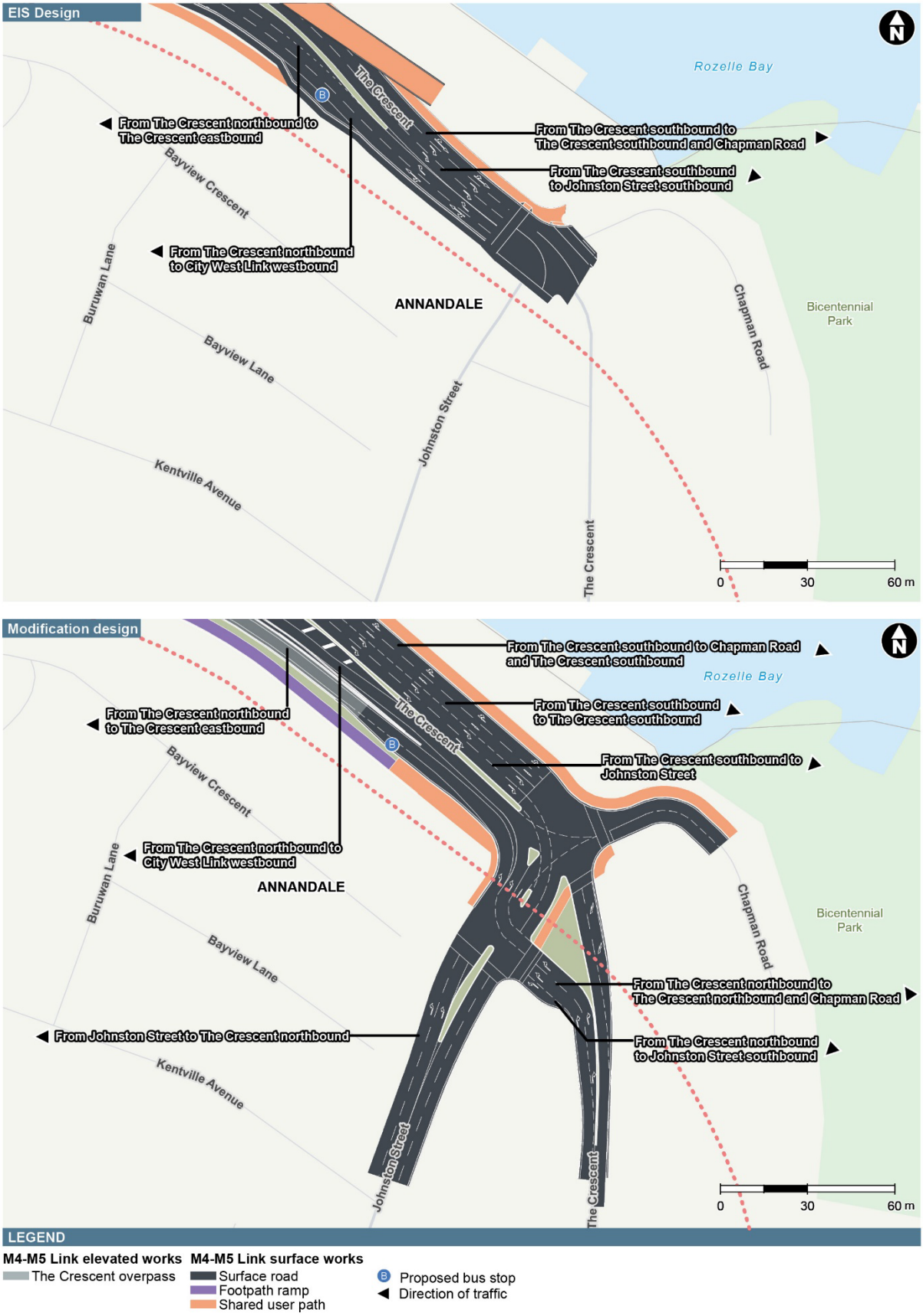

Figure 4-2 The Crescent/Johnston Street/Chapman Road layout in EIS and proposed modification model

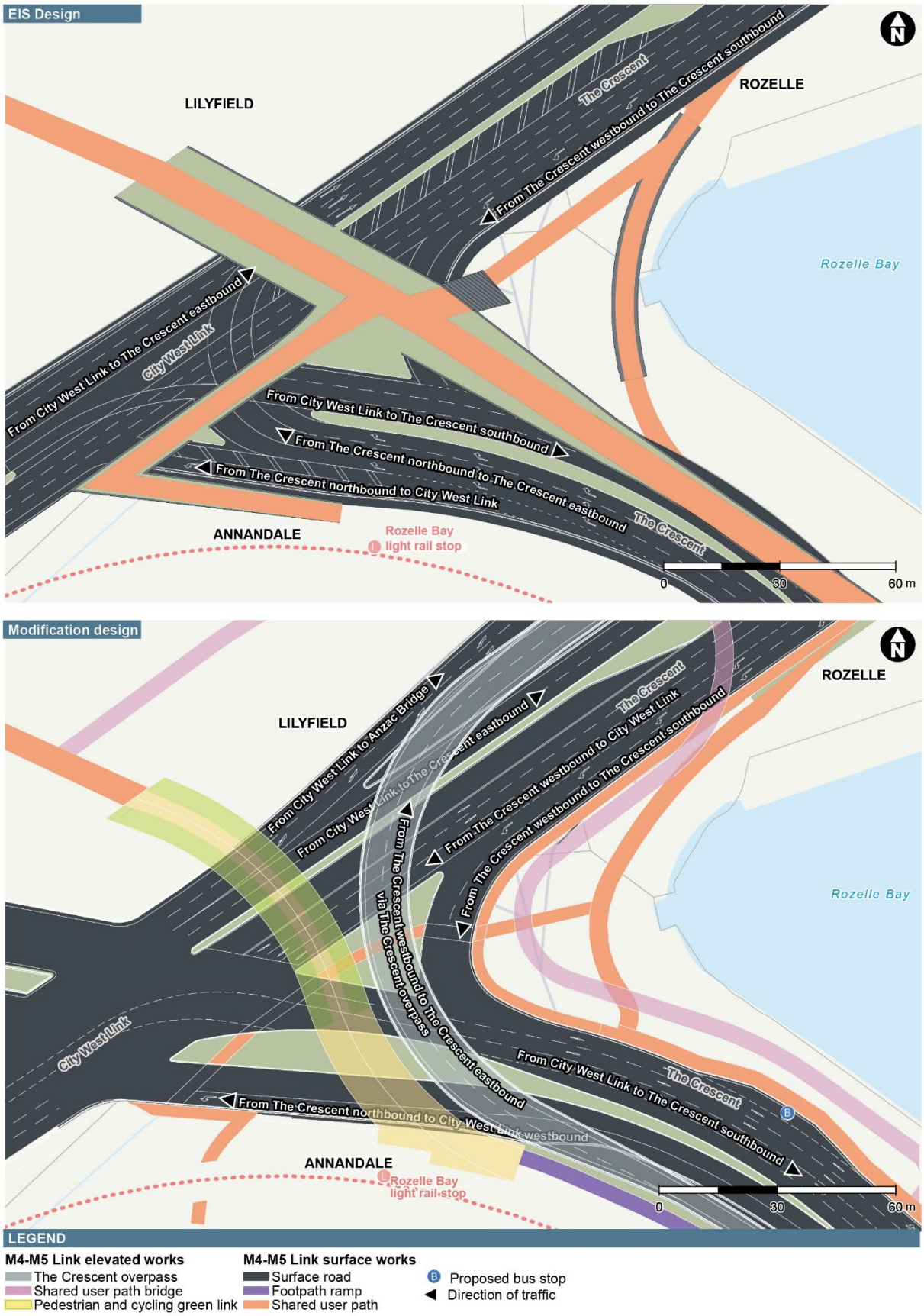

Figure 4-3 City West Link/The Crescent layout in EIS and proposed modification model

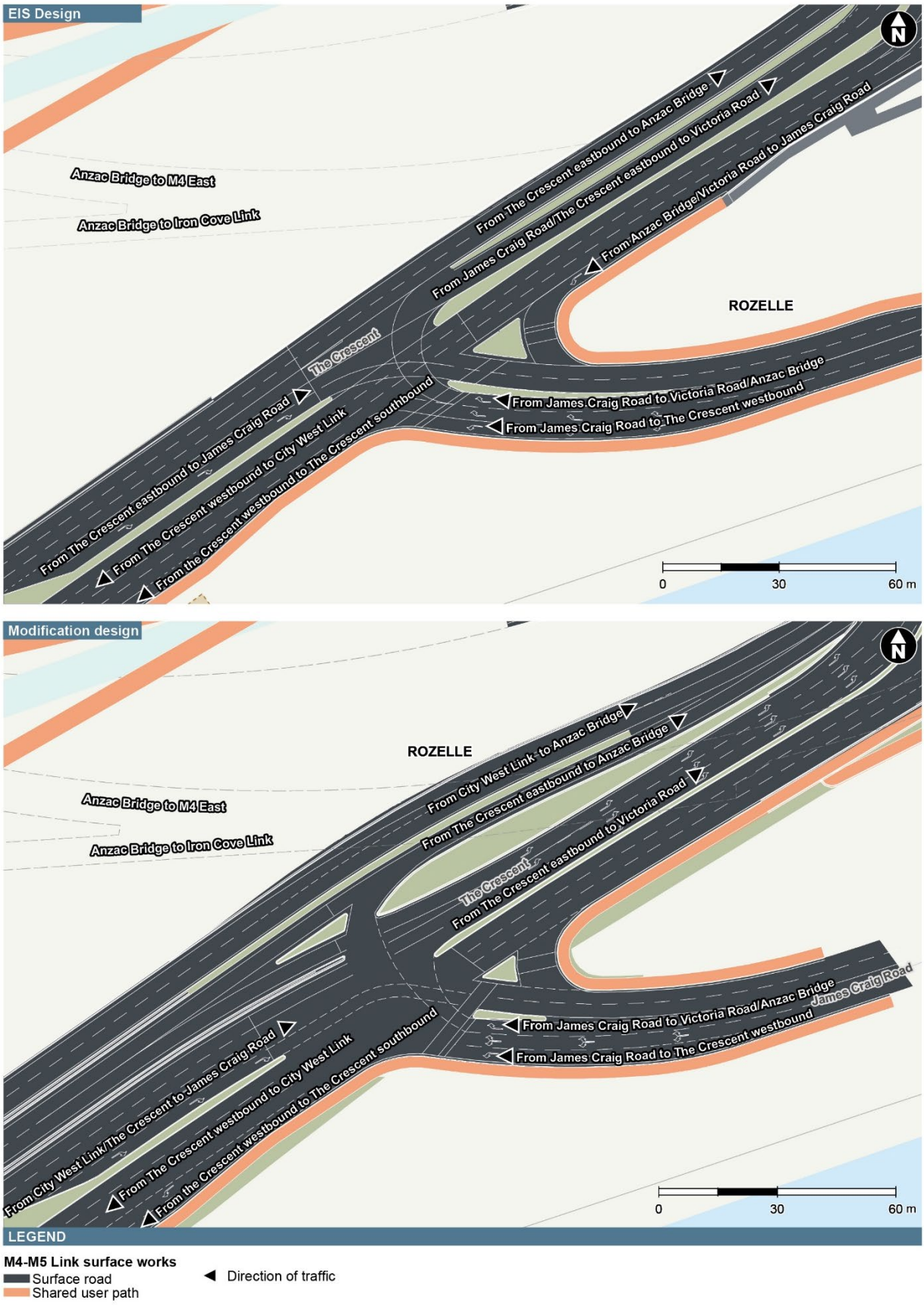

Figure 4-4 The Crescent/James Craig Road layout in EIS and proposed modification model

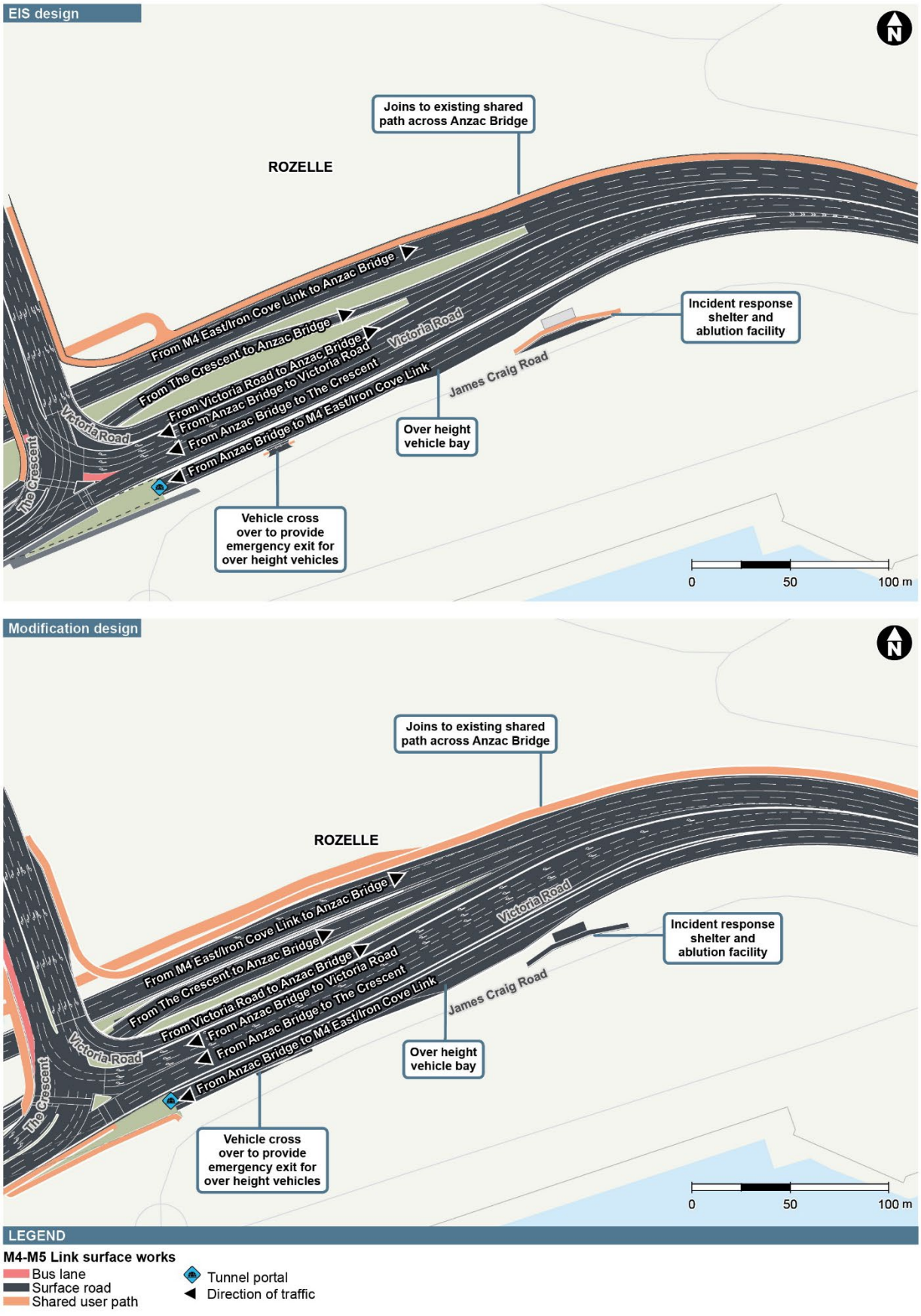

Figure 4-5 Approach to Anzac Bridge layout in EIS and proposed modification model

4.1.2 Impacts on Sydney metropolitan road network

This section details the traffic demand changes forecast by the WRTM due to the modifications in a 'with project' scenario using forecast traffic volumes for 2023 and 2033.

'With project' (2023)

Figure 4-6 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2023 'with project' EIS scenario and 'with project' modification scenario. The changes shown represent differences in the forecast Average Weekday Traffic (AWT) between the modelled scenarios. Roads that are expected to carry less traffic in the future 2023 'with project' modification scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. These forecast traffic volumes include both fixed and induced traffic demand.

With the inclusion of the proposed modification, there is minimal change in the daily traffic forecast on the wider network. The thick red line at the City West Link/The Crescent intersection indicates the traffic shifting from the at grade intersection to the new overpass. About 17,500 vehicles per day are forecast to use the overpass in 2023, with a resultant reduction in volume at the at grade intersection.

A small increase in daily demand is forecast in 2023 on Anzac Bridge eastbound (about 1,500 vehicles per day) and on Johnston Street northbound (about 2,500 vehicles per day). As the northbound traffic on Johnston Street is a forecast increase in demand into the VISSIM operational models, a review of the forecast peak hour volumes was undertaken. This indicated that most of the forecast increase would occur in off peak periods, with only an additional 70 northbound vehicles per hour forecast during each of the AM and PM peak hours. A sensitivity test was undertaken to test the significance of this increase on the VISSIM model peak period network performance, which indicated the increase had minimal impact.

'With project' (2033)

Figure 4-7 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2033 'with project' EIS scenario and 'with project' modification scenario. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2033 'with project' modification scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. These forecast traffic volumes include both fixed and induced traffic demand.

Like the 2023 scenarios, with the inclusion of the proposed modification, there is minimal change in the daily traffic forecast on the network. Again, the thick red line at the City West Link/The Crescent intersection indicates the traffic shifting from the at grade intersection to the new overpass. About 19,000 vehicles per day are forecast to use the overpass in 2023, with a resultant reduction in volume at the at grade intersection.

A small increase in daily demand is forecast on Anzac Bridge eastbound (about 1,500 vehicles per day) and on Johnston Street northbound (about 2,500 vehicles per day). A review of the forecast peak hour volumes was undertaken. This indicated that most of the forecast increase would occur in off peak periods, with only an additional 90 northbound vehicles per hour forecast during the AM peak hour and an additional 20 northbound vehicles per hour forecast during the PM peak hour. A sensitivity test was undertaken in the AM peak hour to test the significance of this increase on the VISSIM model peak period network performance, which indicated the increase had minimal impact.

Source: WRTM v2.3, 2019

Figure 4-6 Difference in AWT between 2023 'with project' EIS and 'with project' modification scenarios

Source: WRTM v2.3, 2019

Figure 4-7 Difference in AWT between 2033 'with project' EIS and 'with project' modification scenarios

4.1.3 Impacts on network performance

2023 'with project' scenario

Table 4-1 and **Table 4-2** present a comparison of the performance of the road network, between the 2023 EIS and modification models for the AM and PM peak hours, produced using microsimulation modelling.

AM peak hour

The 2023 EIS and modification models have the same demand, however, the proposed changes at The Crescent/Johnston Street/Chapman Road intersection along with The Crescent overpass at City West Link/The Crescent intersection allow more traffic into the network. This is reflected in the drop in unreleased vehicles i.e. those unable to enter the network due to congestion.

Network performance metrics indicate an improvement in the modification model compared to the EIS model. In both models, the AM peak citybound movements remain affected by the queues back from the Bathurst Street/Cross City Tunnel exit ramp and the downstream exit blocking from Sydney Harbour Bridge on the Western Distributor. As in the EIS model, the congestion on the Western Distributor and Anzac Bridge is forecast to cause some queuing in the Iron Cove Link and on the M4 exit ramp in the modification model. This is not forecast to extend back to the M4-M5 Link mainline.

Table 4-1 Rozelle Interchange network performance – AM peak hour (2023 'with project' EIS vs 'with project' modification scenario)

Network measure	2023 'with project' (EIS)	2023 'with project' (Modification)	Percentage change
All vehicles			
Total traffic demand (veh)	25,327	25,327	0%
Total vehicle kilometres travelled in network (km)	73,188	73,426	<1%
Total time travelled approaching and in network (hr)	6,308	5,763	-9%
Total vehicles arrived	23,799	24,070	1%
Total number of stops	274,030	266,585	-3%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.1	3.1	0%
Average time travelled in network (mins)	9.8	9.5	-3%
Average number of stops	10.1	9.7	-4%
Average speed (km/h)	18.8	19.4	3%
Unreleased vehicles			
Unreleased demand (veh)	2,309	1,663	-28%
% of total traffic demand	9%	7%	-

PM peak hour

In the PM peak hour, the overall network performance is forecast to improve slightly compared to the 2023 EIS network. The number of stops has decreased compared with the EIS models and average speeds are slightly higher than before with fewer unreleased vehicles.

Table 4-2 Rozelle Interchange network performance – PM peak hour (2023 'with project' EIS vs 'with project' modification scenario)

Network measure	2023 'with project' (EIS)	2023 'with project' (Modification)	Percentage change
All vehicles			
Total traffic demand (veh)	28,109	28,109	0%
Total vehicle kilometres travelled in network (km)	80,108	81,127	1%
Total time travelled approaching and in network (hr)	5,091	5,112	<1%
Total vehicles arrived	24,261	24,472	1%
Total number of stops	179,138	169,063	-6%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.3	3.3	0%
Average time travelled in network (mins)	7.9	7.8	-1%
Average number of stops	6.4	6.0	-6%
Average speed (km/h)	25.1	25.5	2%
Unreleased vehicles			
Unreleased demand (veh)	2,655	2,529	-5%
% of total traffic demand	9%	9%	-

2033 'with project' scenario and **Table 4-4** present a comparison of the performance of the road network (as shown in **Figure 4-1**), between the 2033 EIS and modification models for the AM and PM peak hours, produced using microsimulation modelling.

AM peak hour

Similar to the 2023 analysis, the 2033 EIS and modification models have the same demand, and the two networks have similar performance metrics. More vehicles reach their destinations in the modified network with less unreleased demand with negligible change in average speeds. The proposed changes at The Crescent/Johnston Street/Chapman Road intersection along with the Crescent overpass at City West Link/The Crescent intersection allow more traffic into the network. This is reflected in the reduction in unreleased vehicles i.e. vehicles unable to enter the network due to congestion.

In the modification model, the Western Distributor is forecast to be slightly more congested compared to the EIS model. The citybound movements are likely to be affected by the queues from the Bathurst Street/Cross City Tunnel exit ramp and the downstream exit blocking from the Sydney Harbour Bridge, which cause flow breakdown on Anzac Bridge. This congestion on the Western Distributor and Anzac Bridge is forecast to cause queuing in the Iron Cove Link, and on the M4 exit ramp. Again, this is not forecast to extend back to the M4-M5 Link mainline.

Table 4-3 Rozelle Interchange network performance – AM peak hour (2033 'with project' EIS vs 'with project' modification scenario)

Network measure	2033 'with project' (EIS)	2033 'with project' (Modification)	Percentage change
All vehicles			
Total traffic demand (veh)	28,023	28,023	0%
Total vehicle kilometres travelled in network (km)	77,690	77,169	-1%
Total time travelled approaching and in network (hr)	7,221	7,050	-2%
Total vehicles arrived	25,794	25,888	<1%
Total number of stops	272,544	272,460	<1%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.0	3.0	0%
Average time travelled in network (mins)	9.3	9.2	-1%
Average number of stops	9.2	9.2	0%
Average speed (km/h)	19.4	19.4	0%
Unreleased vehicles			
Unreleased demand (veh)	2,719	2,609	-4%
% of total traffic demand	10%	9%	-

PM peak hour

In the PM peak hour, the overall 2033 network performance is forecast to deteriorate slightly compared to the EIS network. In the 2033 PM modified network more traffic is released into the network and as a result, more traffic is able to travel northbound on Victoria Road because of the improvements at the Victoria Road / The Crescent intersection. This results in longer travel times in the northbound direction on Victoria Road with a slight drop in average speeds and slight increase in average travel times. These small changes do impact the overall network performance which shows a slight deterioration compared with the EIS models. There is still queuing back from Sydney Harbour Bridge but it is not as extensive as in the 2023 PM peak. Overall, the network performance for this scenario is very similar to the EIS models.

Table 4-4 Rozelle Interchange network performance – PM peak hour (2033 'with project' EIS vs 'with project' modification scenario)

Network measure	2033 'with project' (EIS)	2023 'with project' (Modification)	Percentage change
All vehicles			
Total traffic demand (veh)	30,259	30,259	0%
Total vehicle kilometres travelled in network (km)	86,924	86,873	<1%
Total time travelled approaching and in network (hr)	5,286	5,362	1%
Total vehicles arrived	27,082	26,917	-1%
Total number of stops	92,817	99,419	7%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.2	3.2	0%
Average time travelled in network (mins)	6.1	6.4	5%

Network measure	2033 'with project' (EIS)	2023 'with project' (Modification)	Percentage change
Average number of stops	3.1	3.3	6%
Average speed (km/h)	31.3	30.3	-3%
Unreleased vehicles			
Unreleased demand (veh)	2,974	2,991	1%
% of total traffic demand	10%	10%	-

4.1.4 Impacts on intersection performance

Table 4-5 presents the modelled AM and PM peak hour Level of Service (LoS) for key intersections in the modelled Rozelle Interchange network. The intersection performance is based on an 'unconstrained' network which allows the full demand to reach the intersections. This methodology is used to ensure that the intersections have sufficient capacity to meet future predicted demands and was also used in the EIS.

In the AM peak hours, the intersection performances are forecast to be comparable or better when compared with the EIS. The most noticeable improvement is at the Victoria Road/Robert Street intersection in the 2033 AM peak hour, which is forecast to improve from LoS F to LoS C.

In the 2023 PM peak hour, all intersections are forecast to perform the same or better when compared with the EIS, especially The Crescent/Johnston Street/Chapman Road intersection, where a better LoS is forecast, and more vehicles can be accommodated. In the 2033 PM peak hour, the Victoria Road/Darling Street intersection is forecast to perform slightly worse than in the EIS model due to a higher total intersection demand. The average delay in the EIS model was at the high end of the LoS D band and the additional traffic has pushed it into the LoS E band.

Table 4-5 Rozelle Interchange: key intersection performance (LoS) – Peak hour ('with project' EIS vs 'with project' modification scenario)

Key intersections	2015 Base	2023 'with project' (EIS)	2023 'with project' (Modification)	2033 'with project' (EIS)	2033 'with project' (Modification)
AM peak hour					
Victoria Road/Wellington Street	D	C	C	D	C
Victoria Road/Darling Street	F	F	F	F	F
Victoria Road/Robert Street	D	C	C	F	C
Victoria Road/The Crescent	B	C	B	D	C
The Crescent/James Craig Road	A	B	A	B	B
City West Link/The Crescent	B	C	B	D	C
The Crescent/Johnston Street	C	C	B	C	C
The Crescent/M4-M5 link ramps	–	B	A	B	B
PM peak hour					
Victoria Road/Wellington Street	B	B	B	C	B
Victoria Road/Darling Street	F	D	D	D	E
Victoria Road/Robert Street	F	C	C	C	C

Key intersections	2015 Base	2023 'with project' (EIS)	2023 'with project' (Modification)	2033 'with project' (EIS)	2033 'with project' (Modification)
Victoria Road/The Crescent	F	C	C	C	C
The Crescent/James Craig Road	B	A	A	A	A
City West Link/The Crescent	D	B	B	C	B
The Crescent/Johnston Street	F	F	C	F	E
The Crescent/ M4-M5 link ramps	–	B	A	B	A

4.1.5 Impacts on travel times

Like in the EIS analysis, to assess travel times through the network, exit blocking constraints were retained to reflect network congestion at intersections beyond the modelled network extents. Average travel times along Victoria Road and City West Link onto Anzac Bridge, between the same extents as in the EIS analysis, are presented in **Figure 4-8** and **Figure 4-9**.

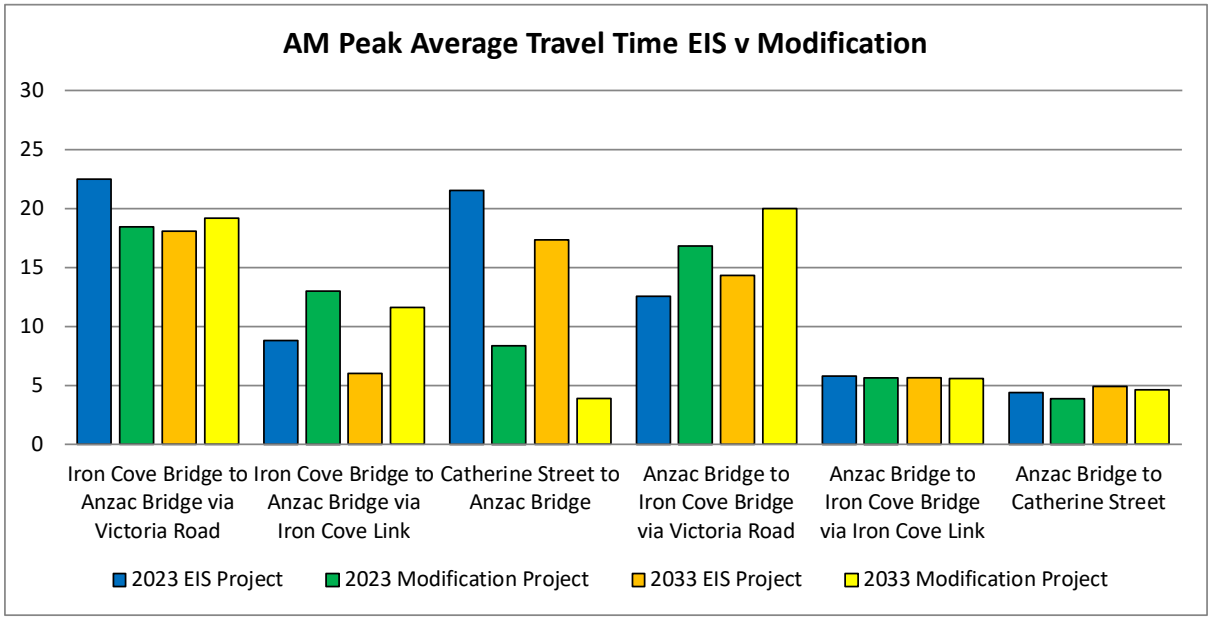

Figure 4-8 **Rozelle Interchange: average travel time (mins) – comparison between AM peak hour 'with project' EIS and 'with project' modification scenarios**

During the AM peak hour, the model shows similar travel times compared to the EIS model. However, the model suggests that increased travel times in the peak direction on Iron Cove Link (inbound to the city) and on Victoria Road (outbound from the city) can be expected in 2023 and 2033.

The demand from Iron Cove Link and the M4 is at or just over the capacity of the merge on the eastbound approach to Anzac Bridge which causes queues to form on Iron Cove Link and impact inbound travel times. Once vehicles have passed the merge and are on the Anzac Bridge, the citybound traffic remains affected by the queues back from the Bathurst Street/Cross City Tunnel exit ramp and the downstream exit blocking from Sydney Harbour Bridge on the Western Distributor similar to the EIS model.

In the modification model, three lanes from Iron Cove Link / M4 merge to two lanes, while two lanes from Victoria Road merge to one lane and then merge with two lanes from The Crescent. These lanes then continue as four lanes on Anzac Bridge. This differs from the EIS, which had three lanes from Iron Cove Link / M4, one lane from The Crescent and one lane from Victoria Road merging into four lanes on Anzac Bridge. The proposed layout eliminates the zipper merge proposed in the EIS design. A schematic diagram of the Anzac Bridge approach in both models is shown in **Figure 4-5**.

In the EIS model, the traffic from City West Link / The Crescent and Victoria Road exceed the capacity of the merge arrangement with the traffic from Iron Cove Link and the M4. As a result, this traffic queues back on City West Link to past the M4-M5 Link ramp and Balmain Road. The congestion means that vehicles on City West Link / The Crescent with destinations on Victoria Road are delayed getting to the Victoria Road / The Crescent intersection.

In the modified network, the proposed layout improves the flow of traffic from City West Link / The Crescent and Victoria Road effectively removing the congestion on City West Link. As a result, traffic from City West Link travelling to Victoria Road is no longer delayed by queuing. However, this means that there is more northbound traffic on Victoria Road compared with the EIS model. This in turn increases the congestion on Victoria Road that extends back from the AM peak capacity constraint (tidal flow arrangement) on Victoria Road in Drummoyne and negatively impacts the northbound travel times on Victoria Road. The queues that form on Victoria Road during the AM peak take longer to dissipate than in the EIS models and this is reflected in the Anzac Bridge to Iron Cove Bridge via Victoria Road travel times.

Removing the congestion on City West Link in the modified model results in a significant improvement in travel times on City West Link for inbound traffic (to the city).

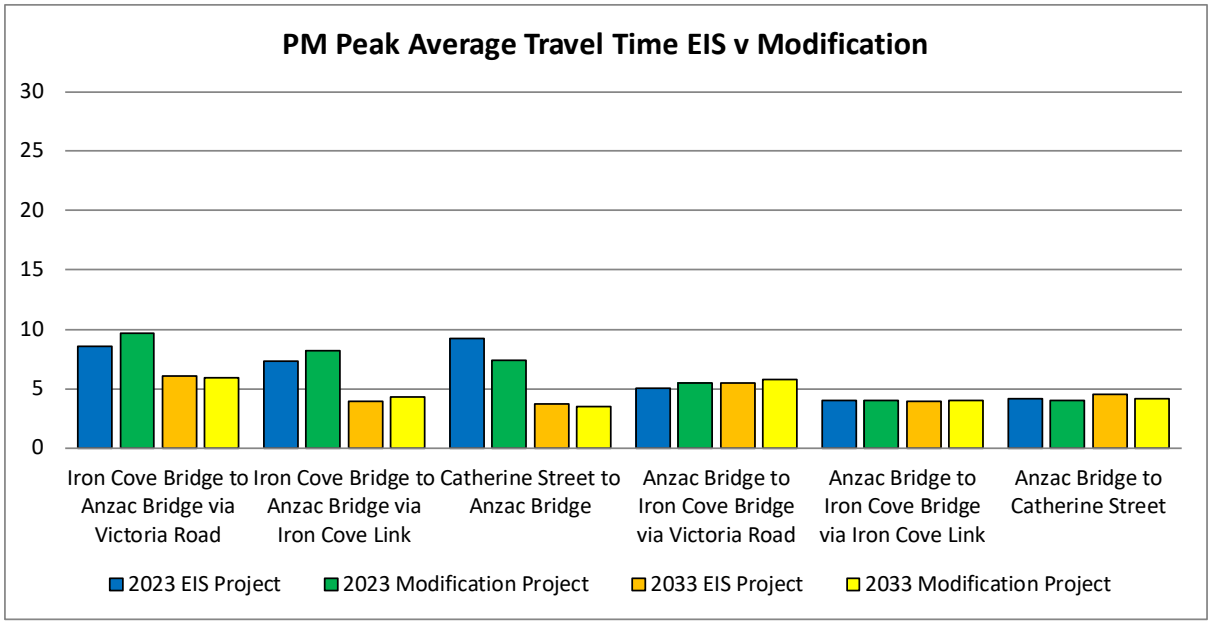

Figure 4-9 **Rozelle Interchange: average travel time (mins) – comparison between PM peak hour 'with project' EIS and 'with project' modification scenarios**

During the PM peak hour, the modified model results are similar to those in the EIS model. There appears to be slight increases in travel times from Iron Cove Bridge to Anzac Bridge via both the Iron Cove Link and Victoria Road. These changes are minimal and not considered to be significant.

4.1.6 Impacts on road safety

The frequency of crashes is expected to change relative to the forecast traffic volume changes. In the EIS, potential future crashes were calculated using the historical crash rates and applied to the forecast average daily traffic flows. Reviewing the forecast daily changes in traffic volumes from the WRTM indicates a minimal change in daily volumes across the network. Based on these forecasts, a minimal change in crashes is also forecast on the roads assessed in the EIS.

The proposed grade separated right turn overpass from The Crescent (northbound) to The Crescent (eastbound) at the City West Link/The Crescent intersection would remove the at grade right turn movement, which would remove safety issues with conflicting movements at the intersection.

4.1.7 Impacts on public transport services

The bus bay on the west side of The Crescent, currently located just south of the City West Link intersection, would be relocated slightly further south on The Crescent to just north of the Johnston Street intersection. This bay will be indented and given the low frequency of the buses using this stop (9-12 minutes in the AM peak period and 5-12 minutes in the PM peak period), the expectation is that the performance of The Crescent / Johnston Street / Chapman Road intersection would not be impacted. No change to the location of the bus stop on the east side of The Crescent is proposed.

The realignment of the green link to the west of The Crescent would provide an improved connection between the Rozelle Rail Yards and the Rozelle Bay light rail stop. No other impacts to light rail is forecast.

Figure 4-10 and **Figure 4-11** show the comparison in AM and PM peak hour travel times for buses in the 'with project' scenarios. The main bus route on Victoria Road, Anzac Bridge and the bus lanes to and from Druitt Street is presented.

The results show comparable citybound bus journey times in the AM peak. In the outbound direction in the AM peak, bus travel time is forecast to increase for the same reasons that affect the general traffic travel times i.e. the additional traffic on Victoria Road northbound, as discussed in section 4.1.5. The increased traffic volumes on Victoria Road means that the queue caused by the capacity constraint to the northern end of Victoria Road in Drummoyne is longer and takes longer to dissipate. In 2023, bus travel times are forecast to increase from about 17 minutes to about 20 minutes, while in 2033, bus travel times are forecast to increase from about 19 minutes to about 25 minutes.

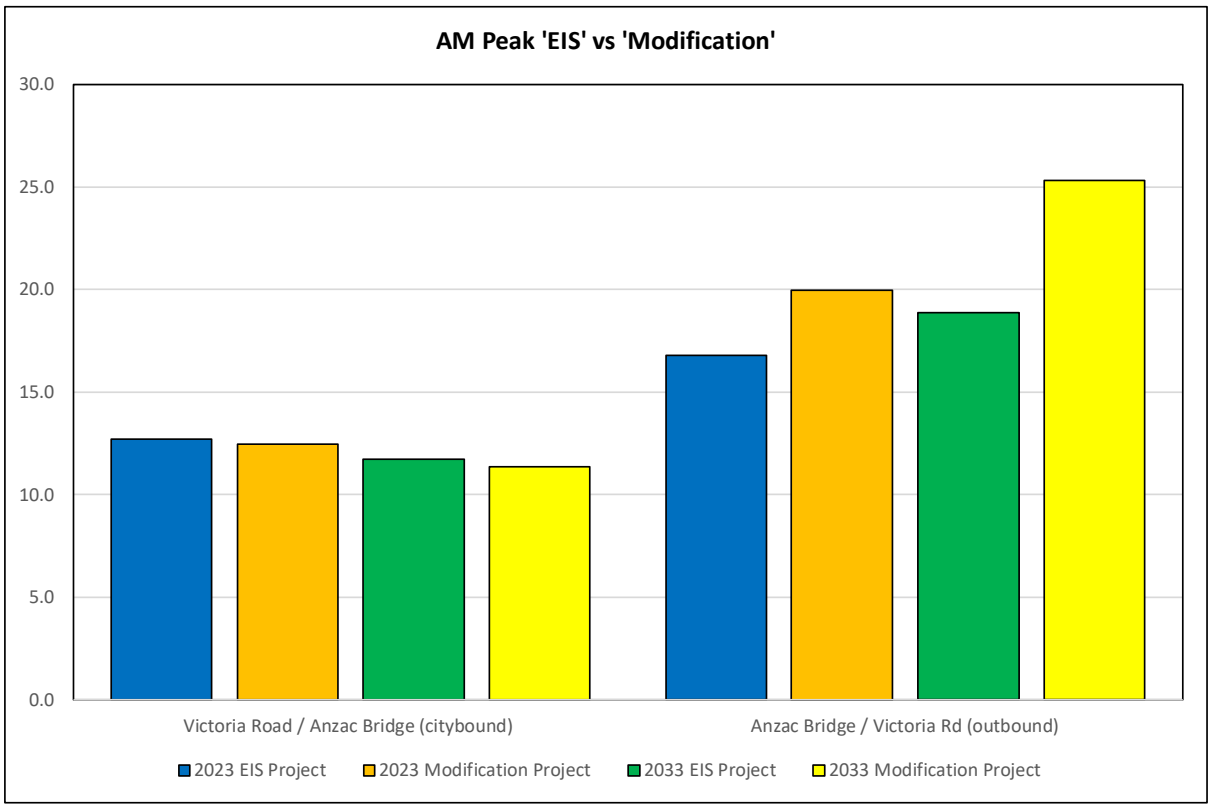

Figure 4-10 Rozelle Interchange: average travel time for buses – comparison between AM peak hour 'with project' EIS and 'with project' modification scenarios

In the PM peak hour, the citybound travel time is forecast to increase slightly but is comparable to the bus travel times in the EIS model.

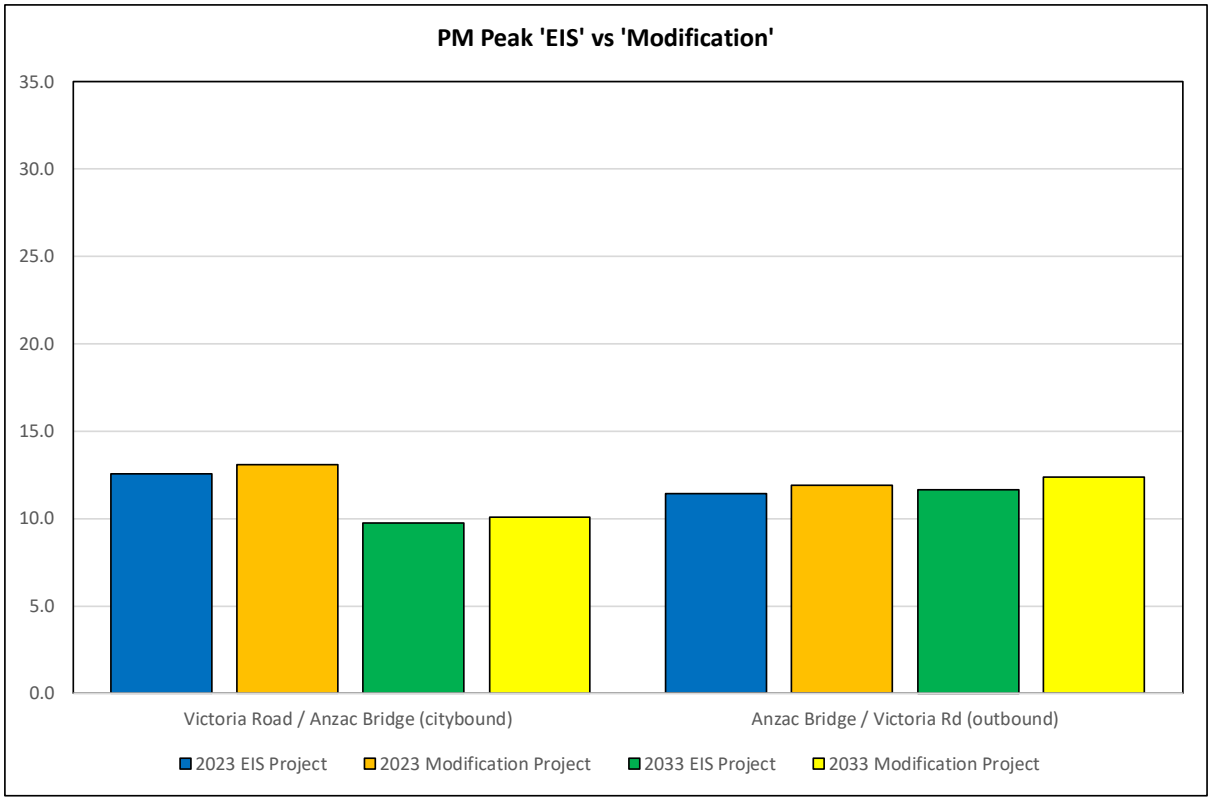

Figure 4-11 **Rozelle Interchange: average travel time for buses – comparison between PM peak hour 'with project' EIS and 'with project' modification scenarios**

4.1.8 Impacts on active transport facilities

The green link and shared user path bridge would provide the same connectivity as described in the EIS for pedestrians and cyclists from the Rozelle Rail Yards to the existing Rozelle Bay light rail stop, Rozelle Bay foreshore and Bicentennial Park. With the green link realigned to the west of The Crescent, travel times to the light rail stop are likely to be shorter, while slightly longer travel times to Bicentennial Park are likely via the shared user path.

As part of the proposed upgrade of The Crescent / Johnston Street / Chapman Road intersection, the existing signalised pedestrian crossing on the western leg will be relocated to the eastern side of the intersection. Pedestrians currently accessing Bicentennial Park from Johnston Street would be required to use the new signalised pedestrian crossing, which would not provide as direct an access to Bicentennial Park. The total number of traffic lanes crossed on The Crescent would be the same as presented in the EIS (five lanes), but moving it to the eastern side, would split the crossing into two sections – one crossing of three lanes and one crossing of two lanes.

4.1.9 Impacts on local property access and on-street parking

There is very little direct impact on local property access in the suburbs of Rozelle and Annandale as part of the proposed modification. Local access to 300 Johnston Street just south of The Crescent / Johnston Street / Chapman Road intersection would be affected and needs to be incorporated into the junction design. The movement of vehicles into and out of the property is unlikely to affect the intersection performance and is an operational matter that would be addressed during detailed design.

The proposed The Crescent / Johnston Street / Chapman Road intersection upgrade would temporarily remove four on-street parking spaces on the northern side of Chapman Road. However, these would be relocated, so there would be no permanent loss of on-street parking on Chapman Road as part of the proposed modification. The proposed The Crescent / Johnston Street / Chapman

Road intersection upgrade would also result in the loss of two permanent on-street parking spaces at the end of the northbound carriageway of Johnston Street.

4.1.10 Impacts on connectivity

The proposed The Crescent / Johnston Street / Chapman Road intersection upgrade would remove the right turn from Johnston Street (northbound) onto The Crescent (southbound). Depending on their origin and destination, motorists that would have made this right turn would in the future travel through Annandale, east of Johnston Street, to access The Crescent / Minogue Crescent / Ross Street or use Parramatta Road, if their origin or destination is further south. Traffic surveys indicate fewer than 100 vehicles currently make this right turn in the AM peak hour and fewer than 50 vehicles in the PM peak hour.

The proposed grade separated right turn overpass from The Crescent (northbound) to The Crescent (eastbound) at the City West Link / The Crescent intersection would remove the ability for motorists to turn right from The Crescent (northbound) onto The Crescent (eastbound) and then turn right onto James Craig Road. Motorists wanting to access James Craig Road from the south would need to use another route to access City West Link from the west and then turn right into James Craig Road or access the Anzac Bridge from the east to then turn left into James Craig Road. The maximum forecast peak hour demand from Johnston Street and The Crescent (south) to James Craig Road in the 'with project' scenario is about 40 vehicles in the 2033 AM peak hour. The impact of these vehicles relocating to other routes is likely to be minimal, especially if they are spread across more than one route.

4.2 Assessment of operational traffic impacts in 'cumulative' scenario

This section details the potential traffic impacts of the proposed modification during the 'cumulative' scenarios. Two scenarios were modelled to assess the operational traffic impacts:

- **Cumulative case (2023)**: Assumes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic, and in addition, the proposed future Sydney Gateway and Western Harbour Tunnel are complete and open to traffic
- **Cumulative case (2033)**: The future Cumulative scenario assumes NorthConnex, M4 Widening, M4 East, King Georges Road Interchange Upgrade, New M5 and the M4-M5 Link are complete and open to traffic and also assumes proposed future Sydney Gateway, Western Harbour Tunnel project and the F6 Extension are complete and open to traffic.

4.2.1 Changes to road network

Figure 4-12 shows the modelled 'cumulative' Rozelle Interchange network. The proposed future Western Harbour Tunnel project (in 2023) and Beaches Link (in 2033) would connect to:

- The M5 to the south providing a north–south through route
- The M4 to the west providing an east–west through route.

Like the EIS, this operational assessment does not assume there are surface connections between the proposed future Western Harbour Tunnel project and City West Link.

Figure 4-12 Rozelle Interchange: 'cumulative' road network for operational traffic modelling

4.2.2 Impacts on Sydney metropolitan road network

This section details the traffic demand changes forecast by the WRTM due to the proposed modification in a 'cumulative' scenario using forecast traffic volumes for 2023 and 2033.

'Cumulative' (2023)

Figure 4-13 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2023 'cumulative' EIS scenario and 'cumulative' modification scenario. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2023 'cumulative' modification scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. These forecast traffic volumes include both fixed and induced traffic demand.

As in the 'with project' scenario, with the inclusion of the proposed modification, there is minimal change in the daily traffic forecast on the network. Again, the thick red line at the City West Link/The Crescent intersection indicates the traffic shifting from the at grade intersection to the new overpass. In the 'cumulative' scenario, about 17,500 vehicles per day are forecast to use the overpass in 2023, with a resultant reduction in volume at the at grade intersection.

Again, a small increase in daily demand is forecast on Anzac Bridge eastbound (about 1,500 vehicles per day) and on Johnston Street northbound (about 2,000 vehicles per day). A review of the forecast Johnston Street northbound peak hour volumes was undertaken. Again, this indicated that most of the forecast increase would occur in off peak periods, with only an additional 80 northbound vehicles per hour forecast during each of the AM and PM peak hours. A sensitivity test was undertaken to test the significance of this increase on the VISSIM model peak period network performance, which indicated the increase had minimal impact.

'Cumulative' (2033)

Figure 4-14 shows bandwidth plots illustrating the forecast change in daily traffic volumes between the 2033 'cumulative' EIS scenario and 'cumulative' modification scenario. The changes shown represent differences in the forecast AWT between the modelled scenarios. Roads that are expected to carry less traffic in the future 2023 'cumulative' modification scenario are shown in green and roads where traffic volumes are predicted to increase are shown in red. These forecast traffic volumes include both fixed and induced traffic demand.

Like the 2023 scenarios, with the inclusion of the proposed modification, there is minimal change in the daily traffic forecast on the network. Again, the thick red line at the City West Link/The Crescent intersection indicates the traffic shifting from the at grade intersection to the new overpass. About 19,000 vehicles per day are forecast to use the overpass in 2023, with a resultant reduction in volume at the at grade intersection.

A small increase in daily demand is forecast on Anzac Bridge eastbound (about 1,500 vehicles per day) and on Johnston Street northbound (about 1,500 vehicles per day). A review of the forecast peak hour volumes was undertaken. This indicated that most of the forecast increase would occur in off peak periods, with only an additional 90 northbound vehicles per hour forecast during the AM peak hour and an additional 40 northbound vehicles per hour forecast during the PM peak hour. A sensitivity test was undertaken in the AM peak hour to test the significance of this increase on the VISSIM model peak period network performance, which indicated the increase had minimal impact.

Source: WRTM v2.3, 2019

Figure 4-13 Difference in AWT between 2023 'cumulative' EIS and 'cumulative' modification scenarios

Source: WRTM v2.3, 2019

Figure 4-14 Difference in AWT between 2033 'cumulative' EIS and 'cumulative' modification scenarios

4.2.3 Impacts on network performance

2023 'cumulative' scenario

Table 4-6 and **Table 4-7** present a comparison of the performance of the road network between the 2023 EIS and modification 'cumulative' scenarios for the AM and PM peak hours, using microsimulation modelling.

AM peak hour

In the 2023 AM peak hour, network performance metrics are comparable with negligible changes to the vehicle performance metrics.

In both models, the AM peak citybound movements remain affected by the queues back from the Bathurst Street/Cross City Tunnel exit ramp and the downstream exit blocking on the Western Distributor from the Sydney Harbour Bridge.

Table 4-6 Rozelle Interchange network performance – AM peak hour (2023 'cumulative' EIS vs 'cumulative' modification scenario)

Network measure	2023 'cumulative' (EIS)	2023 'cumulative' (Modification)	Percentage change
All vehicles			
Total traffic demand (veh)	29,689	29,689	0%
Total vehicle kilometres travelled in network (km)	91,329	91,252	<1%
Total time travelled approaching and in network (hr)	4,139	4,401	6%
Total vehicles arrived	29,253	29,119	<1%
Total number of stops	127,991	117,950	-8%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.1	3.1	0%
Average time travelled in network (mins)	5.9	6.0	2%
Average number of stops	4.0	3.7	-8%
Average speed (km/h)	31.7	31.6	<1%
Unreleased vehicles			
Unreleased demand (veh)	703	809	15%
% of total traffic demand	2%	3%	-

PM peak hour

During the PM peak hour, the overall network performance metrics are comparable with a slight reduction in the number of stops in the modification model. Unlike in the 'with project' scenario, the increased number of vehicles suffer less delay reaching the Anzac Bridge and Western Distributor earlier in the peak hour because the Western Harbour Tunnel has reduced the northbound demand on the Western Distributor approach to Sydney Harbour Bridge.

Table 4-7 Rozelle Interchange network performance – PM peak hour (2023 'cumulative' EIS vs 'cumulative' modification scenario)

Network measure	2023 'cumulative' (EIS)	2023 'cumulative' (Modification)	Percentage change
All vehicles			
Total traffic demand (veh)	30,805	30,805	0%
Total vehicle kilometres travelled in network (km)	96,899	96,988	<1%
Total time travelled approaching and in network (hr)	3,480	3,366	-3%
Total vehicles arrived	29,496	29,564	<1%
Total number of stops	68,692	63,069	-8%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.3	3.3	0%
Average time travelled in network (mins)	5.1	5.1	0%
Average number of stops	2.1	2.0	-5%
Average speed (km/h)	39.0	38.9	<1%
Unreleased vehicles			
Unreleased demand (veh)	1,351	1,324	-2%
% of total traffic demand	4%	4%	-

2033 'cumulative' scenario

Table 4-8 and **Table 4-9** present a comparison of the performance of the road network between the 2033 EIS and modification 'cumulative' scenarios for the AM and PM peak hours, using microsimulation modelling.

AM peak hour

As before, the 'cumulative' model has the same demand, but the proposed changes at The Crescent/Johnston Street/Chapman Road intersection along with The Crescent overpass at City West Link/The Crescent intersection allow more traffic into the network. As with the project model, the improvements to The Crescent merge arrangement at the mousehole improve travel times on City West Link/The Crescent and increase the traffic flow northbound on Victoria Road.

In the modification scenario, the Western Distributor is forecast to be more congested compared to the EIS scenario. In both models, the citybound movements are likely to be affected by the queues from the Bathurst Street/Cross City Tunnel exit ramp and the downstream exit blocking from the Sydney Harbour Bridge, which causes some flow breakdown on Anzac Bridge. This congestion on the Western Distributor and Anzac Bridge is forecast to cause queuing in the Iron Cove Link, and on the M4 exit ramp. The network performance metrics indicate that vehicles in the modified network travel at similar speeds but with fewer stops than in the EIS network.

Table 4-8 Rozelle Interchange network performance – AM peak hour (2033 'cumulative' EIS vs 'cumulative' modification scenario)

Network measure	2033 'cumulative' (EIS)	2033 'cumulative' (Modification)	Percentage change
All vehicles			
Total traffic demand (veh)	34,863	34,863	0%
Total vehicle kilometres travelled in network (km)	103,220	102,871	<1%
Total time travelled approaching and in network (hr)	5,654	5,745	2%
Total vehicles arrived	33,314	33,095	-1%
Total number of stops	151,561	136,784	-10%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.1	3.1	0%
Average time travelled in network (mins)	6.0	6.0	0%
Average number of stops	4.2	3.8	-10%
Average speed (km/h)	31.2	31.3	<1%
Unreleased vehicles			
Unreleased demand (veh)	1,911	1,953	2%
% of total traffic demand	6%	6%	-

PM peak hour

As in 2023, during the PM peak hour, the overall network performance metrics are comparable to the EIS models with a reduction in average speeds and a slight increase in the number of stops.

Table 4-9 Rozelle Interchange network performance – PM peak hour (2033 'cumulative' EIS vs 'cumulative' modification scenario)

Network measure	2033 'cumulative' (EIS)	2033 'cumulative' (Modification)	Percentage change
All vehicles			
Total traffic demand (veh)	34,705	34,705	0%
Total vehicle kilometres travelled in network (km)	102,632	102,145	<1%
Total time travelled approaching and in network (hr)	4,820	4,833	<1%
Total vehicles arrived	32,230	32,091	<1%
Total number of stops	81,682	83,329	2%
Average per vehicle in network			
Average vehicle kilometres travelled in network (km)	3.2	3.2	0%
Average time travelled in network (mins)	5.2	5.3	2%
Average number of stops	2.3	2.4	4%
Average speed (km/h)	37.1	36.2	-2%
Unreleased vehicles			
Unreleased demand (veh)	2,537	2,603	3%
% of total traffic demand	7%	8%	-

4.2.4 Impacts on intersection performance

Table 4-10 presents the modelled AM and PM peak hour LoS for key intersections in the modelled Rozelle Interchange network using 'unconstrained' models. These models do not have the capacity constraints that artificially create congestion. This is done determine how the intersections would operate under the full demand.

In both 2023 and 2033 AM and PM peak hours, the forecast intersection performances are comparable or better in the modification scenarios compared with the EIS, with particular improvement at The Crescent/Johnston Street/Chapman Road intersection.

Table 4-10 Rozelle Interchange: key intersection performance (LoS) – Peak hour ('cumulative' EIS vs 'cumulative' modification scenario)

Key intersections	2015 Base	2023 'cumulative' (EIS)	2023 'cumulative' (Modification)	2033 'cumulative' (EIS)	2033 'cumulative' (Modification)
AM peak hour					
Victoria Road/Wellington Street	D	C	C	C	C
Victoria Road/Darling Street	F	F	F	F	F
Victoria Road/Robert Street	D	C	C	E	D
Victoria Road/The Crescent	B	C	B	D	C
The Crescent/James Craig Road	A	A	A	B	B
City West Link/The Crescent	B	C	B	C	C
The Crescent/Johnston Street	C	C	C	F	C
The Crescent/M5 ramps	–	B	B	B	B
PM peak hour					
Victoria Road/Wellington Street	B	B	B	C	B
Victoria Road/Darling Street	F	D	D	D	D
Victoria Road/Robert Street	F	C	C	C	C
Victoria Road/The Crescent	F	C	C	C	C
The Crescent/James Craig Road	B	A	A	A	A
City West Link/The Crescent	D	C	B	C	B
The Crescent/Johnston Street	F	F	C	F	D
The Crescent/M5 ramps	–	B	A	C	B

4.2.5 Impacts on travel times

Like in the EIS analysis, to assess travel times through the 'cumulative' scenario network, exit blocking constraints were retained to reflect network congestion at intersections beyond the modelled network extents. Average travel times along Victoria Road and City West Link onto Anzac Bridge, between the same extents as in the EIS analysis, are presented in **Figure 4-15** and **Figure 4-16**.

During the AM peak hour, the models show comparable travel times in the peak direction (inbound to the city) from Victoria Road via Iron Cove Link, longer travel times via Victoria Road and faster travel times on City West Link. As the congestion on the Western Distributor and Anzac Bridge is reduced in the 'cumulative' scenario compared to the 'with project' scenario, due to the introduction of Western Harbour Tunnel, these changes are reduced from that seen in the 'with project' comparison.

As in the 'with project' scenarios, the modified network allows improved traffic performance along City West Link and The Crescent, which is reflected in reduced travel times between Anzac Bridge and Catherine Street in both directions.

As in the 'with project' scenarios, the modified network allows more traffic onto Victoria Road which increases travel times affecting both normal traffic and bus travel times. This is caused by longer queues forming from the northern end of Victoria Road when compared with the EIS models. These queues take longer to dissipate resulting in longer northbound travel times on Victoria Road.

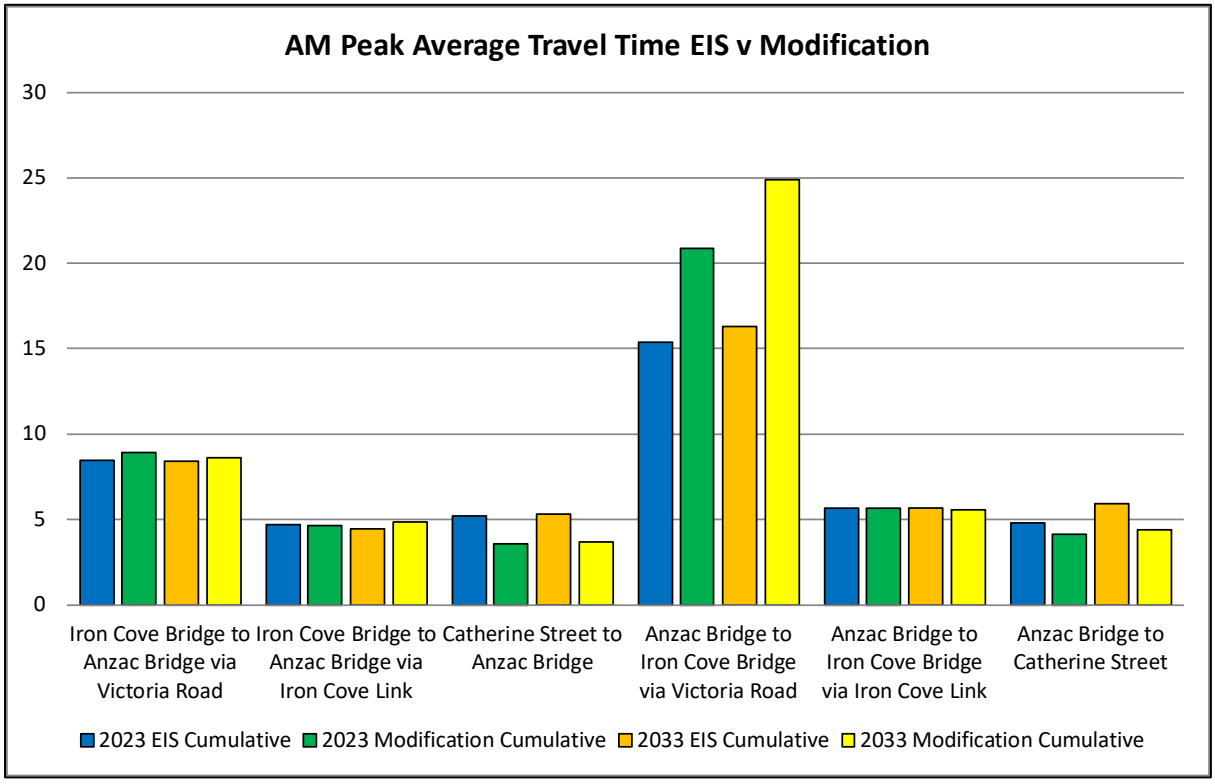

Figure 4-15 **Rozelle Interchange: average travel time (mins) – comparison between AM peak hour 'cumulative' EIS and 'cumulative' modification scenarios**

During the PM peak hour, the model results show comparable travel times in both scenarios.

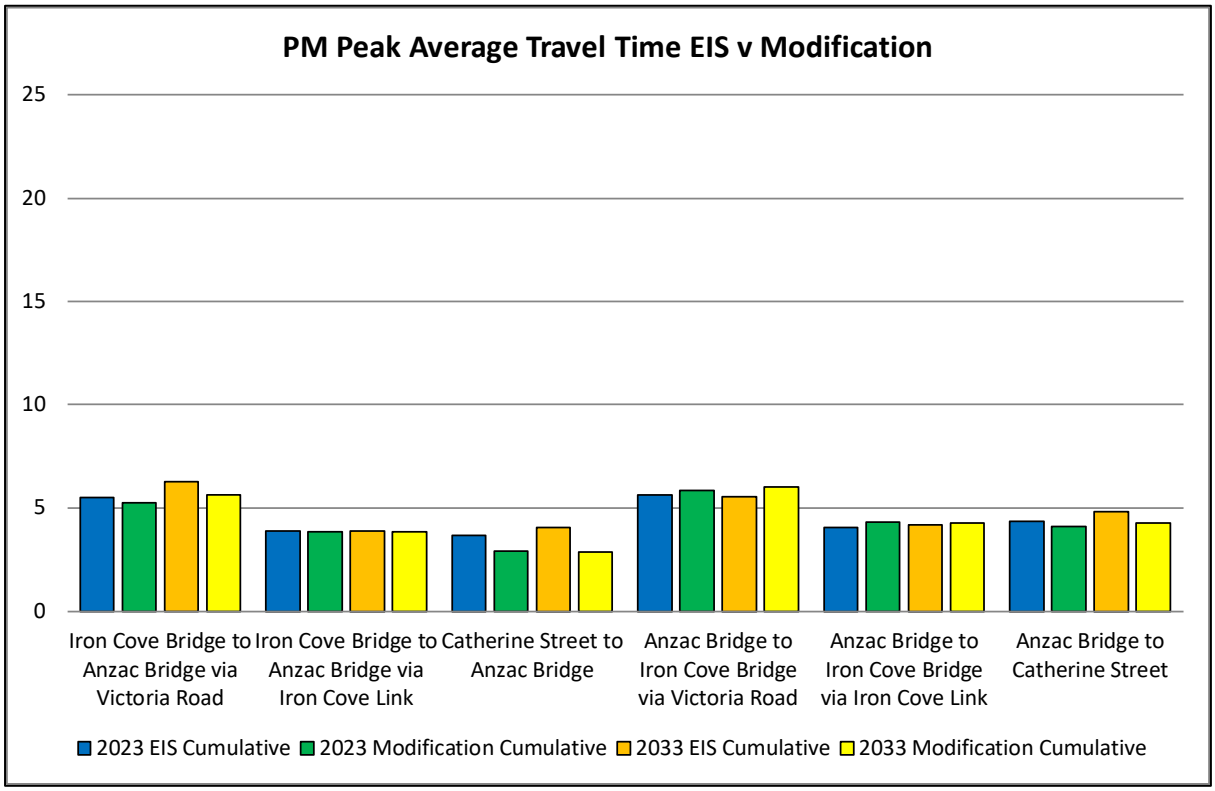

Figure 4-16 **Rozelle Interchange: average travel time (mins) – comparison between PM peak hour 'cumulative' EIS and 'cumulative' modification scenarios**

4.2.6 Impacts on road safety

The frequency of crashes is expected to change relative to the forecast traffic volume changes. In the EIS, potential future crashes were calculated using the historical crash rates and applied to the forecast average daily traffic flows. Reviewing the forecast daily changes in traffic volumes from the WRTM indicates a minimal change in daily volumes across the network. Based on these forecasts, a minimal change in crashes is also forecast on the roads assessed in the EIS.

As noted before, the proposed grade separated right turn overpass from The Crescent (northbound) to The Crescent (eastbound) at the City West Link / The Crescent intersection would remove the at grade right turn movement, which would remove safety issues with conflicting movements to this right turn at the intersection.

4.2.7 Impacts on public transport services

Figure 4-17 and **Figure 4-18** show the comparison in travel times for buses in the 'cumulative' scenarios for the AM and PM peak hours. The main bus route on Victoria Road, Anzac Bridge and the bus lanes to and from Druitt Street is presented.

During the AM peak hour in both forecast years, citybound bus travel times are forecast to marginally improve, which is as a result of the proposed changes to the Anzac Bridge approaches. In the outbound direction, the bus travel time along Victoria Road is forecast to increase in 2033 for the same reason that affects general traffic i.e. congestion on Victoria Road caused by higher traffic volumes travelling northbound. As there is no northbound bus lane on Victoria Road between The Crescent and the exit from the Iron Cove Link, the increased congestion impacts the northbound bus travel times, with 2033 travel times forecast to increase from about 24 minutes to about 30 minutes.

In the PM peak hour, there are only minor differences in the bus travel times in both forecast years compared to the EIS, with a slight increase forecast in outbound travel times.

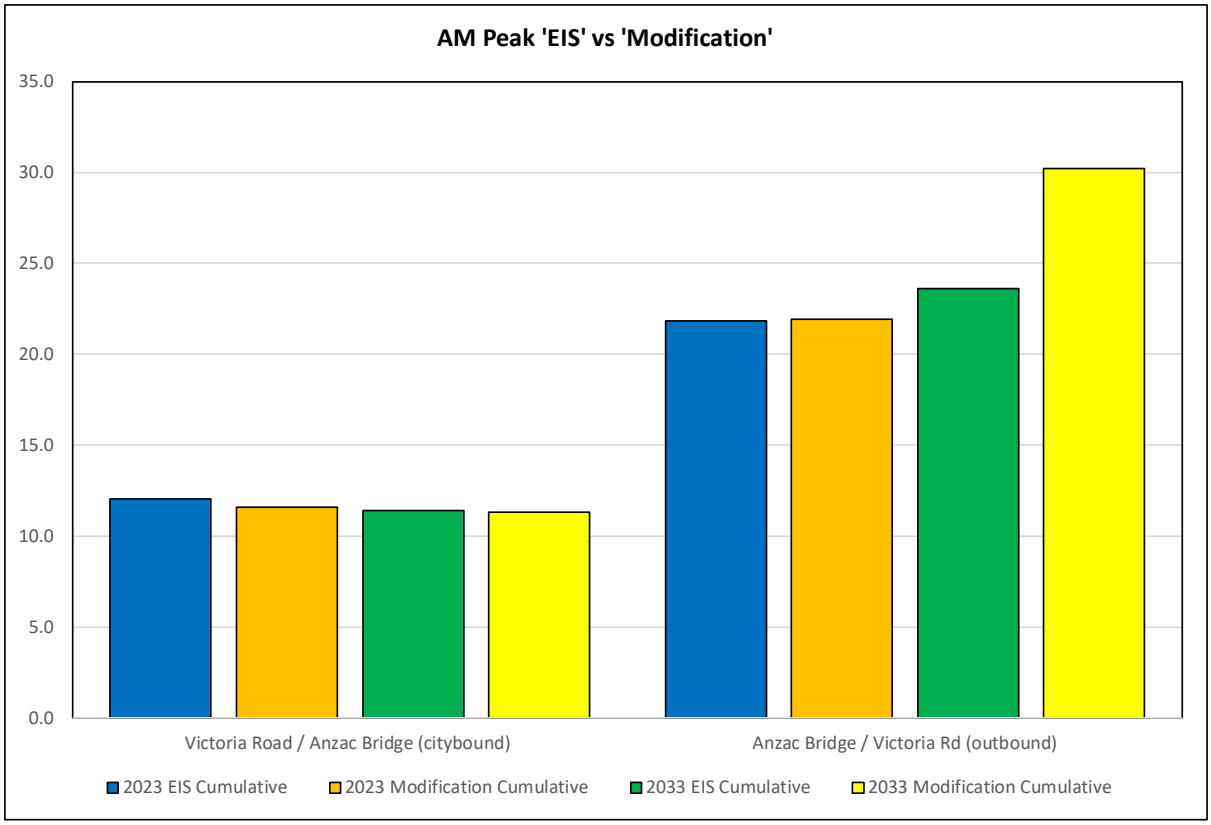

Figure 4-17 **Rozelle Interchange: average travel time for buses – comparison between AM peak hour 'cumulative' EIS and 'cumulative' modification scenarios**

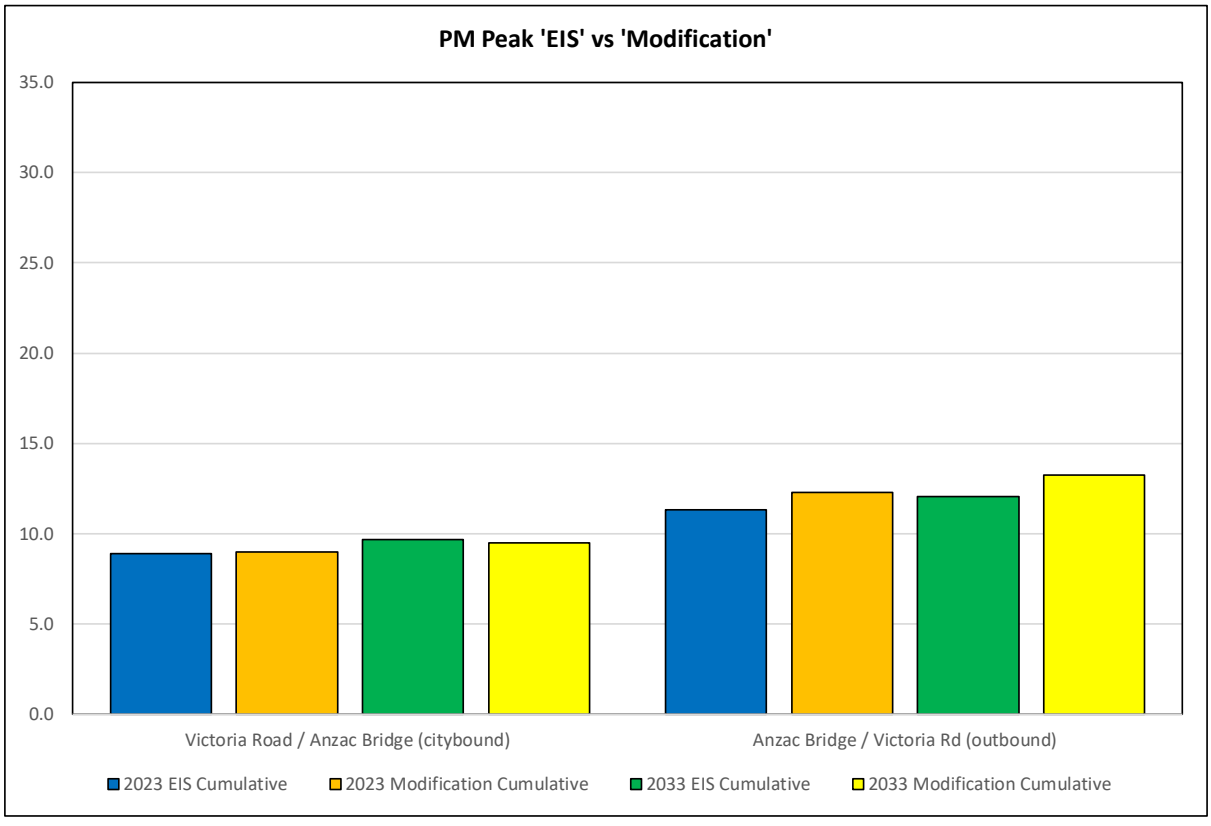

Figure 4-18 **Rozelle Interchange: average travel time for buses – comparison between PM peak hour 'cumulative' EIS and 'cumulative' modification scenarios**

4.2.8 Impacts on active transport facilities

There is no change in active transport facilities for the 'cumulative' scenario compared to the 'with project' scenario. These impacts are discussed in **section 4.1.8**.

4.2.9 Impacts on local property access and on-street parking

There is no change in local property access and on-street parking for the 'cumulative' scenario compared to the 'with project' scenario. These impacts are discussed in **section 4.1.9**.

4.2.10 Impacts on connectivity

There is no change in connectivity for the 'cumulative' scenario compared to the 'with project' scenario. These impacts are discussed in **section 4.1.10**. The maximum forecast peak hour demand from Johnston Street and The Crescent (south) to James Craig Road in the 'cumulative' scenario is about 40 vehicles in the 2033 AM peak hour. The impact of these vehicles relocating to other routes is likely to be minimal, especially if they are spread across more than one route.

5 Management of impacts

5.1 Construction

The proposed modification would result in minimal change to the construction traffic and transport impacts previously assessed in the M4-M5 Link EIS and SPIR. Construction impacts would continue to be managed through the construction management measures contained in the CoA for the project, specifically those in the Construction Traffic Transport and Access Management Sub-Plan, as required by Condition C4 of the CoA, and the Construction Parking and Access Strategy, as required by Condition E54 of the CoA.

Safe pedestrian and cyclist access would be maintained during construction in accordance with Condition E57 and road safety audits would be carried during detailed design to assess the safety performance of new or modified road and pedestrian and cyclist infrastructure (including around construction ancillary facilities).

5.2 Operation

The traffic assessment has identified that the proposed modification would cause some changes to the operational performance of the surrounding road network.

With the proposed modification, it is forecast that more traffic would be better able to enter the network earlier in the peak period, particularly at The Crescent/Johnston Street/Chapman Road intersection. In addition, the Victoria Road/The Crescent intersection operates more efficiently in the modified network compared to the EIS network. As a result, generally more vehicles can be accommodated in the network and the intersection performance and LoS at intersections are improved. However, this increased traffic volume able to enter the network does impact parts of the network that were already forecast to be congested, such as the Western Distributor eastbound and Victoria Road northbound in the AM peak.

Operational traffic impacts would be managed via the existing environmental management measures and the CoA, such as:

- Environmental management measure OpTT3 states that Roads and Maritime will develop a strategy to ensure appropriate network integration in the areas surrounding the Rozelle Interchange. The strategy will include a review of capacity improvement measures, the interface with road based public transport on the Western Distributor and Victoria Road in consultation with Transport for NSW, project staging options and demand management measures
- As per the conditions of the M4-M5 Link approval – road network performance plan (Condition E63) and operational road network performance review (Condition E64) – Roads and Maritime would undertake a review of network performance, in consultation with Transport for NSW and relevant councils, to confirm the operational traffic impacts of the M4-M5 Link on surrounding arterial roads and major intersections at both 12 months and at five years after the commencement of operation of the M4-M5 Link. The assessment would be based on updated traffic surveys at the time and the methodology used would be comparable with that used in this assessment.

6 Conclusion

The effect of the proposed modification on traffic and transport related construction impacts are expected to be minor with the relevant levels of service comparable to the assessment presented in the M4-M5 Link EIS and SPIR.

The management and mitigation measures identified in Chapter E1 of the M4-M5 Link SPIR and the CoA for the project would appropriately manage impacts from the proposed construction modifications.

The operational traffic assessment has identified that the proposed modifications would cause the following changes to the operational performance of the surrounding road network:

- 'With project' scenario
  - During both AM and PM peak hours, the overall modelled network performance metrics are comparable or slightly better than those presented in the EIS
  - Intersection performances are also forecast to be comparable or better when compared with the EIS results, except for the Victoria Road/Darling Street intersection, which is forecast to perform slightly worse than in the EIS due to a higher total intersection throughput
  - Travel times from City West Link to Anzac Bridge are forecast to improve due to the proposed changes at the City West Link/The Crescent intersection, however, increased traffic volume able to enter the network is likely to impact parts of the network already forecast to be congested, such as Victoria Road northbound in the AM peak
  - Public transport travel time impacts reflect those of general traffic, with travel time impacts northbound on Victoria Road in the AM peak.
- 'Cumulative' scenario
  - During both AM and PM peak hours, the modelled network performance metrics are very similar to those in the EIS models.
  - Intersection performances are forecast to be comparable or better when compared with the EIS results
  - Travel times from City West Link to Anzac Bridge are forecast to improve due to the proposed changes at the City West Link/The Crescent intersection, however, increased traffic volume able to enter the network is likely to impact parts of the network already forecast to be congested, such as Victoria Road northbound in the AM peak
  - Public transport travel time impacts reflect those of general traffic, with travel time impacts northbound on Victoria Road in the AM peak.

Operational traffic impacts would be managed via the existing environmental management measures and CoA.

Regarding public transport facilities, the bus bay on the west side of The Crescent would be relocated slightly further south on The Crescent to just north of the Johnston Street intersection. The realignment of the green link to the west of The Crescent would provide an improved connection between the Rozelle Rail Yards and the Rozelle Bay light rail stop.

Regarding active transport facilities, the green link and shared user path bridge as part of the proposed modification would provide the same connectivity as described in the EIS for pedestrians and cyclists from the Rozelle Rail Yards to the existing Rozelle Bay light rail stop, Rozelle Bay foreshore and Bicentennial Park.

As a result of the proposed modification. pedestrians currently accessing Bicentennial Park from Johnston Street would be required to use the new signalised pedestrian crossing, which would not provide as direct an access to Bicentennial Park. The total number of traffic lanes crossed on The

Crescent would be the same as presented in the EIS (five lanes), but moving it to the eastern side, would split the crossing into two sections – one crossing of three lanes and one crossing of two lanes.

Regarding potential future crashes, the forecast daily changes in traffic volumes indicates a minimal change in daily volumes across the network. Based on these forecasts, a minimal change in crashes is also forecast on the roads assessed in the EIS. The proposed grade separated right turn overpass from The Crescent (northbound) to The Crescent (eastbound) at the City West Link / The Crescent intersection would remove the at grade right turn movement, which would remove safety issues related to conflicting movements to this right turn at the intersection.

There is no proposed direct impact on local property access in the suburbs of Rozelle and Annandale as part of the proposed modification. Local access to 300 Johnston Street just south of The Crescent / Johnston Street / Chapman Road intersection would need to be incorporated into the intersection design. The movement of vehicles into and out of the property is unlikely to affect the intersection performance and is an operational matter that would be addressed during detailed design.

The proposed The Crescent / Johnston Street / Chapman Road intersection upgrade would temporarily remove four on-street parking spaces on the northern side of Chapman Road, but these would be reinstated, and permanently remove two on-street parking spaces at the very northern end of the northbound carriageway of Johnston Street.

The proposed The Crescent / Johnston Street / Chapman Road intersection upgrade would also remove the right turn movement from Johnston Street (northbound) onto The Crescent (southbound). Depending on their origin and destination, motorists that would have made this right turn would in the future travel through Annandale, east of Johnston Street, to access The Crescent / Minogue Crescent / Ross Street or use Parramatta Road, if their origin or destination is further south. Traffic surveys indicate fewer than 100 vehicles currently make this right turn in the AM peak hour and fewer than 50 vehicles in the PM peak hour.

The proposed grade separated right turn overpass from The Crescent (northbound) to The Crescent (eastbound) at the City West Link / The Crescent intersection would remove the ability for motorists to turn right from The Crescent (northbound) onto The Crescent (eastbound) and then turn right onto James Craig Road. Motorists wanting to access James Craig Road from the south would need to use another route to access City West Link from the west and then turn right into James Craig Road or access the Anzac Bridge from the east to then turn left into James Craig Road. The maximum forecast peak hour demand from Johnston Street and The Crescent (south) to James Craig Road in the ‘with project’ scenario is about 40 vehicles in the 2033 AM peak hour. The impact of these vehicles relocating to other routes is likely to be minimal, especially if they are spread across more than one route.

7 References

WestConnex M4-M5 Link: Environmental Impact Statement, Roads and Maritime Services, August 2017

WestConnex M4-M5 Link: Submissions and preferred infrastructure report, Roads and Maritime Services, January 2018

WestConnex M4-M5 Link: Infrastructure approval, Department of Planning & Environment, April 2018

WestConnex M4-M5 Link

Rozelle Interchange – Modification: The Crescent overpass and active transport links

Modification report

Appendix C

Noise and vibration assessment

Roads and Maritime Services

WestConnex - M4-M5 Link

Rozelle Interchange - Modification: The Crescent overpass and active transport links

Modification report

Appendix C Modification – Noise and vibration assessment

August 2019

Prepared for

NSW Roads and Maritime Services

Prepared by

SLR Consulting

Contents

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Glossary of terms and abbreviations

Term	Definition
AS	Australian Standard
BS	British Standard
CEMP	Construction Environmental Management Plan
CNVMP	Construction Noise and Vibration Management Plan
CORTN	Calculation of Road Traffic Noise
CSSI	Critical State Significant Infrastructure
dB	Decibels
dBA	A-weighted decibels
dBL	Linear weighted decibels
DECC	Department of Environment and Climate Change NSW
DECCW	Department of Environment, Climate Change and Water NSW
DGA	Dense Graded Asphalt
DIN	Deutsches Institut für Normung
DPIE	(NSW) Department of Planning, Industry and Environment
ECRTN	Environmental Criteria for Road Traffic Noise (replaced by the RNP)
EIS	Environmental Impact Statement
ENMM	Environmental Noise Management Manual
EPA	(NSW) Environment Protection Authority
EPL	Environment Protection Licence
HGV	Heavy goods vehicle (Austroads vehicle class 3 to 12)
ICNG	Interim Construction Noise Guideline
$L_{A1(1minute)}$	The “typical maximum noise level” for an event, used in the assessment of potential sleep disturbance during night-time periods. Alternatively, assessment may be conducted using the L_{Amax} or maximum noise level
L_{A90}	The “background noise level” in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively. The $L_{Aeq(15minute)}$ construction Noise Management Levels (NMLs) are based on the L_{A90} background noise levels.
$L_{Aeq(1hour)}$	The ‘energy average noise level’ evaluated for a specific one-hour period.
$L_{Aeq(9hour)}$	The ‘energy average noise level’ evaluated over the night-time period (10.00 pm to 7.00 am).
$L_{Aeq(15hour)}$	The ‘energy average noise level’ evaluated over the daytime period (7.00 am to 10.00 pm). The L_{Aeq} can be likened to the average of all the noise events occurring in the relevant time period.
$L_{Aeq(15minute)}$	The “energy average noise level” evaluated over a 15-minute period. This parameter is used to assess the potential construction noise impacts
L_{AFmax}	The maximum fast time weighted noise level from road traffic noise occurring at a particular location.
LPI	NSW Land and Property Information
LV	Light vehicle (Austroads vehicle class 1 to 2)
MIC	Maximum Instantaneous Charge
NATA	National Association of Testing Authorities
NCA	Noise Catchment Area
NCG	Noise Criteria Guideline
NMG	Noise Mitigation Guideline
NML	Noise Management Level.
OEH	Office of Environment and Heritage
OGA	Open Graded Asphalt
OOHW	Out of Hours Work
RIC	Relative Increase Criteria as described in the NMG

Term	Definition
RBL	Rating Background Level
RMS	Root Mean Square
Roads and Maritime	(NSW) Roads and Maritime Services
RTA	(NSW) Roads and Traffic Authority (now Roads and Maritime)
SEARs	Secretary's Environmental Assessment Requirements
SLR	SLR Consulting Australia
SPL	Sound Pressure Level
SWL	Sound Power Level
VDV	Vibration Dose Value

1 Introduction

NSW Roads and Maritime Services (Roads and Maritime) is seeking to modify the existing project approval for the construction and operation of the WestConnex M4-M5 Link project (the project), which is part of the WestConnex program of works. Approval for the construction and operation of the project was granted on 17 April 2018 by the NSW Minster for Planning (application number SSI_7485). **Figure 1-1** provides an overview of the approved project.

1.1 Overview of M4-M5 Link project

The EIS for the project described construction and operation of the M4-M5 Link project in two stages:

- Stage 1[1]: A new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters (Mainline Tunnels)
- Stage 2[2]: An interchange at Lilyfield and Rozelle (the Rozelle Interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link).

Stage 2 works are expected to commence in 2019 with these components of the project opening to traffic in 2023.

A more comprehensive overview of the M4-M5 Link project, as well as other aspects of the WestConnex program of works is provided within the Environmental Impact Statement (EIS) and the Submissions and Preferred Infrastructure Report (SPIR).

[1] M4-M5 Link Stage 1 (the Mainline Tunnels)
[2] M4-M5 Link Stage 2 (the Rozelle Interchange and Iron Cove Link)

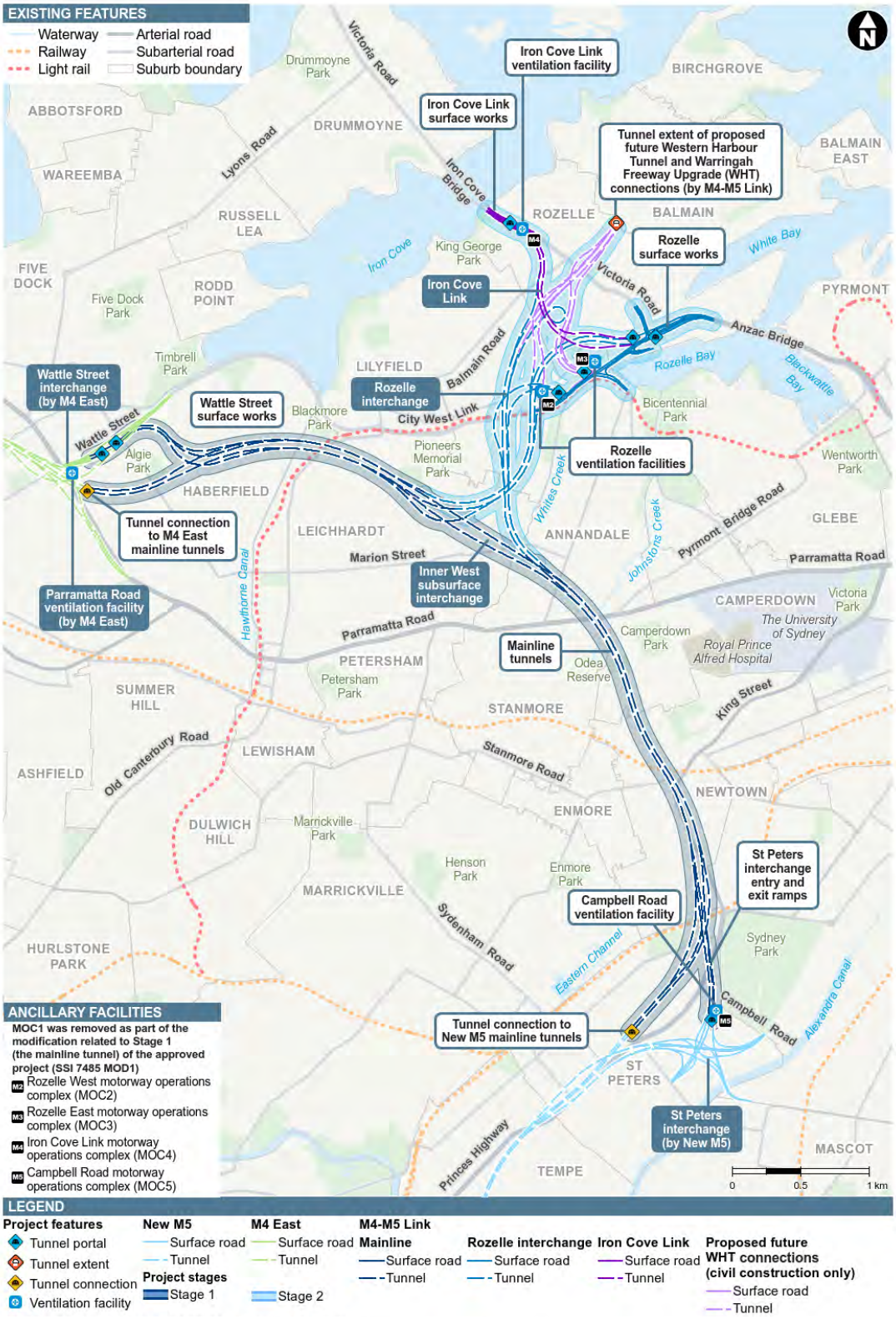


Figure 1-1 Overview of the M4-M5 Link project

1.2 Overview of proposed modification

Since Planning Approval (April 2018 Infrastructure Approval) was granted, a contractor has been appointed to construct Stage 2 of the approved project on behalf of Roads and Maritime. The contractor has reviewed the concept design for the approved project and in discussions with Roads and Maritime has identified a number of potential design and constructability improvements.

The proposed modification relates to Stage 2 of the approved project. The following key components are proposed as part of the proposed modification (refer to **Figure 1-2**):

- A new elevated vehicular overpass ('The Crescent overpass') that would allow eastbound traffic heading north on The Crescent from Annandale to bypass the signalised intersection at The Crescent / City West Link junction and continue east on The Crescent towards Victoria Road and the Anzac Bridge.
- Modifications to the eastbound lanes of the City West Link and The Crescent on either side of the intersection and northbound lanes on The Crescent at Annandale to provide space for the tie-in of The Crescent overpass.
- Upgrades to the intersection of The Crescent/Johnston Street/Chapman Road (including lane reconfiguration and marking, signal phasing, adjusting positions of traffic signals kerb works etc.).
- Realignment of the Pedestrian and Cycling Green Link ('green link') to the west of The Crescent, providing a connection between the Rozelle Rail Yards and the Rozelle Bay light rail stop.
- A new shared user path bridge spanning The Crescent to the east of The Crescent / City West Link intersection. The shared user path bridge provides a connection between Rozelle Rail Yards and the shared user path to Bicentennial Park along the east side of The Crescent and adjacent to Rozelle Bay. The shared user path bridge and shared user path would provide the pedestrian and cyclist connectivity required by Conditions E120 and E121, albeit in a different arrangement to that shown in the EIS
- Minor changes to the layout of the approach roads leading to the Anzac Bridge from Victoria Road, The Crescent and the Rozelle Interchange to improve traffic merging arrangements.
- Use of a minor construction ancillary facility, established in accordance with Condition C24, as a construction ancillary facility. The proposed construction ancillary facility (C6a) is located on the south side of The Crescent to the west of James Craig Road and adjacent to Rozelle Bay. The proposed modification would allow use of the site for a limited number of additional purposes which are not permitted by Condition C24 including:
  - Light vehicle parking for workers (around 9 spaces) and
  - Material laydown areas and a limited number of associated vehicle movements (small delivery vans and rigid trucks).

  These additional purposes would support the various construction activities at the C6 civil site.

As outlined in Chapter 1 (Introduction) of the Modification report, the proposed modification would:

- Improve intersection performance on this congested section of the road network including at the City West Link/The Crescent and The Crescent/Johnston Street/Chapman Road intersections
- Adjust the alignment of active transport links to avoid conflict with The Crescent overpass while improving the overall connectivity proposed within the EIS and Conditions of Approval (CoA) for the project by providing a direct connection between the suburbs of Rozelle and Annandale and public transport infrastructure including the Rozelle Bay light rail stop
- Improve the efficiency of construction and minimise the duration of construction impacts on nearby residents by reducing the need for further construction activities to accommodate the proposed Western Harbour Tunnel and Warringah Freeway Upgrade project (Western Harbour Tunnel project) at City West Link and The Crescent, should that project proceed in the future

- Improve capacity at the intersections so that they can maintain performance with traffic generation from future development proposed in the vicinity of the project including the Western Harbour Tunnel project if that future development proceeds.

1.3 Purpose of this report

The purpose of the noise and vibration assessment is to support the environmental assessment for the proposed modification by assessing and reporting changes to the previous noise and vibration impacts assessed for the project approval. Specifically, this report includes an assessment of:

- construction noise and vibration impacts associated with the construction of The Crescent overpass and relocation of the shared user paths
- construction noise and vibration impacts associated with works at the Johnston Street and The Crescent intersection.
- operational road traffic noise associated with the operation of The Crescent overpass.

This report is to be read in conjunction with Appendix J (Technical working paper: Noise and vibration) of the M4-M5 Link EIS (2017) which contains detailed descriptions and explanations of the assessment guidelines and methodologies used.

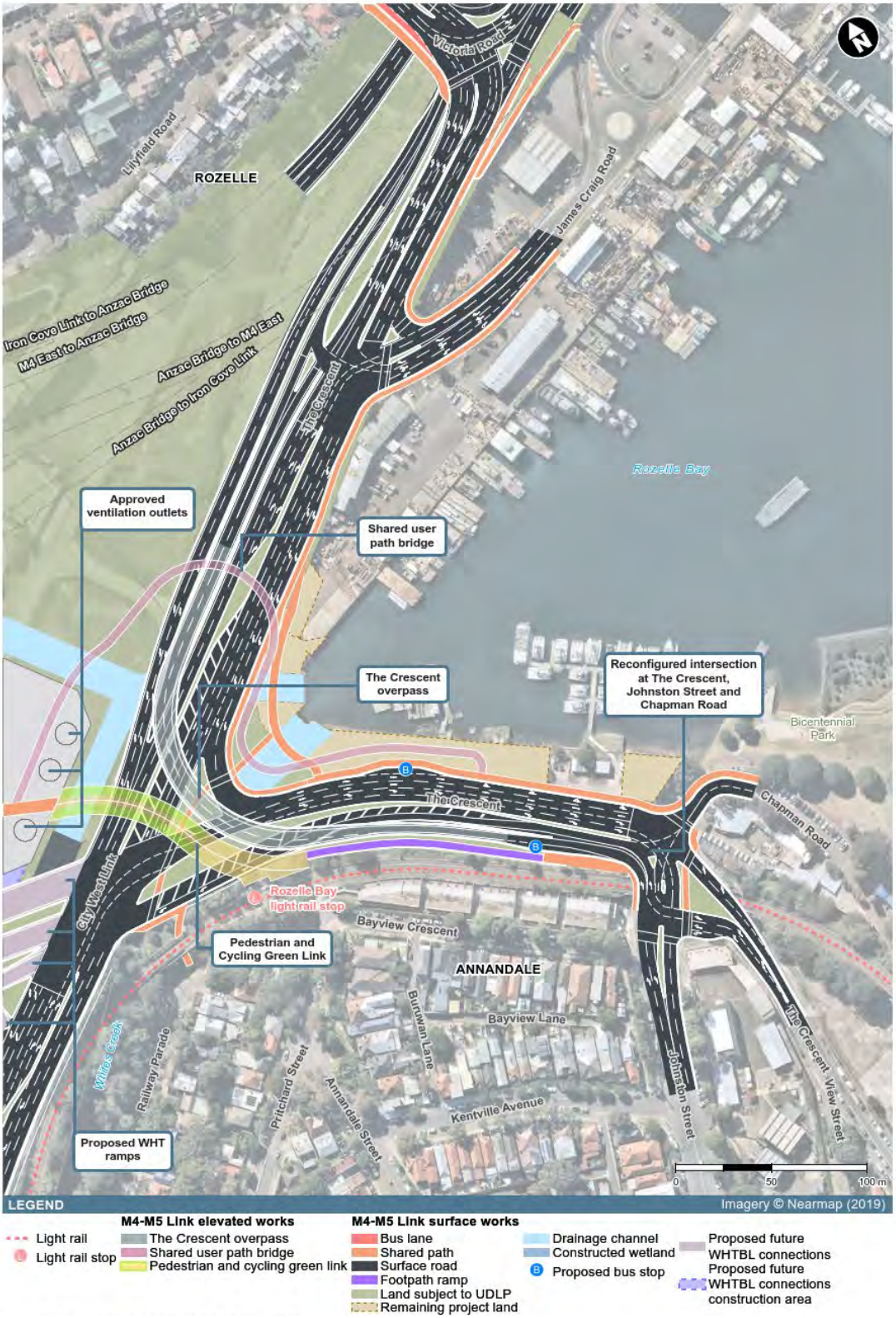


Figure 1-2 Overview of proposed modification

1.4 Assessment requirements

In preparing this assessment, the Secretary's Environmental Assessment Requirements (SEARs), issued for the proposed modification have been reviewed.

Table 1-1 presents environmental assessment requirements as proposed by Roads and Maritime for the M4-M5 Link Rozelle Interchange Modification: The Crescent overpass and active transport links Noise and Vibration Assessment

Table 1-1 Environmental assessment requirements for the Modification as proposed by Roads and Maritime

Matter	Environmental Assessment Requirement	Where addressed
3. Noise and vibration	(a) Assessment of construction and operational noise and vibration impacts including sleep disturbance associated with the proposed modification. This assessment must be in accordance with relevant NSW noise and vibration guidelines and potential noise and vibration mitigation measures should be identified. (b) An assessment of construction noise and vibration impacts which addresses: a. the nature of construction activities (including transport, tonal or impulsive noise-generating works as relevant); b. the likely intensity and duration of potential noise and vibration impacts (both air and ground-borne); c. the potential for works outside standard construction hours, including estimated duration and timing, predicted levels, exceedances and number of potentially affected receivers and justification for the activity in terms of the Interim Construction Noise Guideline (DECCW, 2009); d. figures illustrating the existing, previously assessed and predicted noise levels related to the proposed modification; and e. As relevant to the proposed modification, a cumulative noise and vibration assessment of other key infrastructure projects preparing for or commencing construction, including but not limited to other stages of WestConnex where potential impacts are likely to differ from those that were previously assessed under the EIS for SSI 7485.	**Section 6 & 7**

Table 1-2 presents other relevant matters for assessment of the M4-M5 Link Rozelle Interchange Modification: The Crescent overpass and active transport links as relevant to the Noise and vibration assessment as proposed by DPIE.

Table 1-2 Other relevant matter to be assessed as proposed by DPIE for the Proposed Modification

Other relevant matter		Where addressed
Noise and Vibration – Amenity and Structural	The construction and operational noise and vibration assessment must be quantitative assessments. The assessments must identify any sensitive receivers not previously affected by the modified activities and those where the level of impact is predicted to increase. The assessment must describe the management measures that will be implemented to mitigate noise impacts. In particular, it must indicate whether noise barriers will be required on the overpass to reduce operational traffic noise and if so, any requirements that would be placed on the types of barriers e.g. wind shear strengths, transparent barriers to reduce visual impacts.	**Section 6 & 7**

1.5 Structure of this report

This report has been structured as follows:

- **Chapter 2** presents ambient noise surveys to understand the existing noise environment within the study area
- **Chapter 3** details the legislative and policy context relevant to noise and vibration
- **Chapter 4** provides and overview of the assessment methodology and approach
- **Chapter 5** provides an assessment of predicted noise and vibration impacts during construction related to the proposed modification and consideration of potential mitigation and management measures
- **Chapter 6** provides an assessment of predicted noise impacts due to the operation of the relevant components of the proposed modification and consideration of potential mitigation measures
- **Annexure A** provides a site plan showing receiver classifications
- **Annexure B** details the operational noise inputs.

1.6 Terminology

The technical terminology used in this report is explained in Appendix J (Technical working paper: Noise and vibration) of the M4-M5 Link EIS.

2 Existing environment

The existing ambient noise environment was described in Appendix J (Technical working paper: Noise and vibration) of the M4-M5 Link EIS. This section provides details of the existing ambient noise environment specifically relating to the proposed modification.

2.1 Noise catchment areas

The study area for the proposed modification has been divided into multiple Noise Catchment Areas (NCAs). These NCAs include a variety of land uses within and surrounding the project and assist in the identification of impacts upon groups of receivers likely to be affected by the same works. The NCAs are consistent with the NCAs described in the EIS.

A description of each NCA relevant to the proposed modification is provided in **Table 2-1** and shown in **Figure 2-1**.

Table 2-1 Noise catchment areas and surrounding land uses

NCA description		
Reference	**Min. distance (m)[1]**	**Description**
Rozelle		
NCA20	45	South of City West Link between Whites Creek, Moore Street and Starling Street/Paling Street. Land use comprises of a mix of residential receivers, isolated commercial receivers and passive recreation areas.
NCA21	20	West of Johnston Street between Piper Street, Railway Parade and Whites Creek. Land use comprises of a mix of residential receivers, isolated commercial receivers and an educational facility.
NCA23	90	East of Johnston Street between The Crescent, Piper Street and Johnstons Creek, including commercial premises on the east side of The Crescent. Land use comprises of a mix of residential receivers, commercial receivers, an educational facility and a passive recreation area.
Lilyfield, Annandale, Glebe and Pyrmont		
NCA15	30	South of City West Link between Balmain Road, Moore Street and Starling Street/Paling Street. Land use comprises of a mix of residential receivers, isolated commercial receivers, a childcare centre and passive recreation area.
NCA16	35	North of Lilyfield Road between Balmain Road, Lamb Street and O'Neill Street. Land use comprises of a mix of residential receivers, isolated commercial receivers and a medical centre.
NCA17	30	North of City West Link between Lilyfield Road, Balmain Road and the boundary of the project in the Rozelle Rail Yard. Land use consists of commercial receivers and the Sydney Light Rail Lilyfield Depot.
NCA18	<5	North of City West Link between Lilyfield Road, Victoria Road and the Sydney Light Rail Lilyfield Depot. Land use consists of commercial receivers and the Rozelle Rail Yard.
NCA19	25	North of Lilyfield Road between Lamb Street, Foucart Street and Balmain Road. Land use comprises of a mix of residential receivers, isolated commercial receivers and a childcare centre.
NCA24	20	North of Lilyfield Road between Foucart Street, Gordon Street, Victoria Road and Darling Street. Land use comprises of a mix of residential and commercial receivers, special use facilities and active and passive recreation areas.

NCA description		
Reference	**Min. distance (m)[1]**	**Description**
NCA25	<5	West of Victoria Road between Gordon Street and Lilyfield Road, including residences on the south side of Lilyfield Road. Land use comprises of a mix of residential receivers, isolated commercial receivers and special use facilities.
NCA26	<5	Catchment area adjoins either side of the western approach to Anzac Bridge, between Victoria Road, Robert Street, White Bay, Johnstons Bay and Rozelle Bay. Land use consists of a mix of commercial and industrial receivers including port facilities.
NCA27	90	East of The Crescent between Rozelle Bay and Blackwattle Bay. Land use comprises of a mix of residential receivers, isolated commercial receivers, special use facilities and active and passive recreation areas.
NCA28	400	Catchment area adjoins either side of the eastern approach to Anzac Bridge, between Johnstons Bay and Blackwattle Bay. Land use comprises of a mix of residential and commercial receivers.
NCA29	50	North of Victoria Road between Robert Street and Evans Street. Land use comprises of a mix of residential and commercial receivers and special use facilities.
NCA39	n/a[2]	South of Moore Street/Booth Street between Norton Street and Johnston Street. Land use comprises of a mix of residential receivers and commercial receivers, special use facilities and a passive recreation area.
Iron Cove		
NCA30	200	North of Victoria Road between Evans Street and Darling Street. Land use comprises of a mix of residential and commercial receivers and special use facilities.
NCA31	20	North of Victoria Road between Darling Street and Wellington Street. Land use comprises of a mix of residential and commercial receivers, special use facilities and an active recreation area.
NCA32	10	South of Victoria Road between Darling Street and Moodie Street residences. Land use comprises of a mix of residential and commercial receivers and special use facilities.
NCA33	<5	South of Victoria Road between Moodie Street residences and Toelle Street. Land use comprises of a mix of residential and commercial receivers.
NCA34	<5	North of Victoria Road between Wellington Street and Terry Street. Land use comprises of a mix of residential and commercial receivers.
NCA35	10	North of Victoria Road between Terry Street and Parramatta River. Land use comprises of a mix of residential receivers, isolated commercial receivers, an educational facility and active and passive recreation areas.
NCA36	<5	South of Victoria Road between Toelle Street and Parramatta River. Land use comprises of a mix of residential receivers, isolated commercial receivers and active and passive recreation areas.
NCA37	300	North of Balmain Road between Wharf Street, Manning Street and Parramatta River. Land use comprises of a mix of special use facilities and active and passive recreation areas.
NCA38	400	Catchment area adjoins either side of Victoria Road, north of Parramatta River. Land use comprises of a mix of residential and commercial receivers, special use facilities and active and passive recreation areas.

Notes:

1. Approximate minimum horizontal offset distance from the nearest receiver building facade (receiver of any type) to the nearest point that construction works are occurring
2. No surface works are proposed in this NCA. Receivers in this catchment would therefore only be potentially affected by impacts from tunnelling works during construction

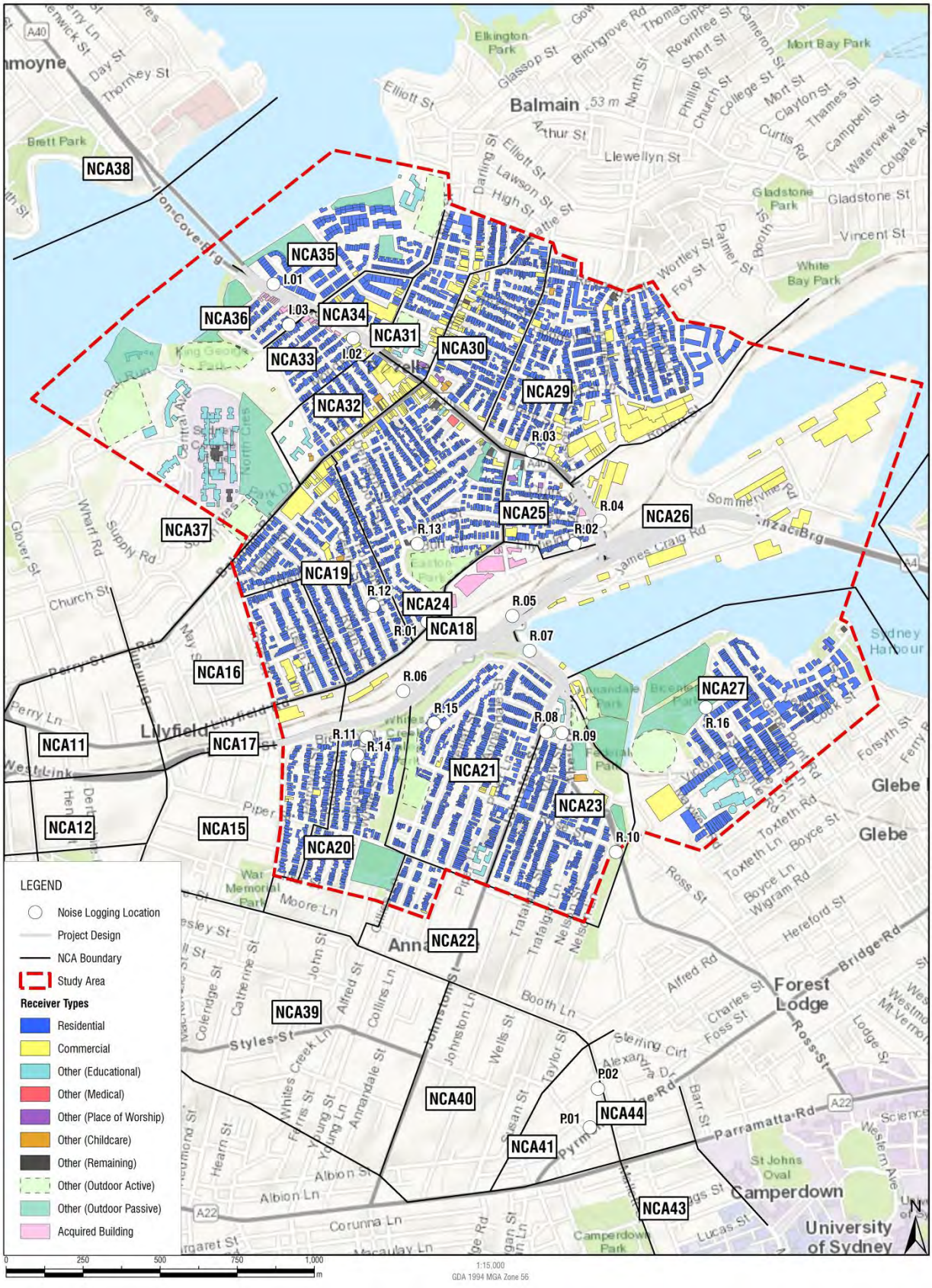


Figure 2-1 NCA boundary map and monitoring locations

2.2 Ambient noise levels

The existing ambient noise environment across the study area around Rozelle varies, however, road noise is generally the primary contributor to background noise levels, largely due to the presence of major roads such as City West Link Victoria Road and The Crescent. The broader road network also contributes to background noise levels, albeit to a lesser degree than major roads.

The measured ambient noise levels applicable to the modification study area are outlined in **Table 2-2.** No additional monitoring at representative locations was required for the assessment of potential noise impacts as a result of the proposed modification.

The results of the unattended ambient noise surveys are summarised in **Table 2-2** as the Rating Background Level (RBL) noise levels for the *Interim Construction Noise Guideline* (ICNG) daytime, evening and night-time periods, and the L_{Aeq} (energy averaged) noise levels for the *Road Noise Policy* (RNP) daytime (15-hour) and night-time (9-hour) periods. The daily noise levels at each location are shown in Appendix J of the M4-M5 Link EIS.

Table 2-2 Summary of unattended noise logging results

Noise monitoring							
Noise monitoring location	**Noise level (dBA)**						
	ICNG defined time periods[1]			**RNP defined time periods[2]**			
	Daytime RBL	Evening RBL	Night-time RBL	Daytime $L_{Aeq(15hour)}$	Night-time $L_{Aeq(9hour)}$	Daytime $L_{Aeq(1hour)}$	Night-time $L_{Aeq(1hour)}$
R.01	54	52	44	64	58	66	66
R.02	51	51	45	57	54	58	59
R.03	61	60	44	70	68	72	72
R.04	65	63	51	71	67	72	72
R.05	61	60	51	70	67	71	71
R.06	57	55	47	63	60	64	64
R.07	55	52	43	65	60	66	67
R.08	49	46	38	63	58	65	65
R.09	49	45	36	61	55	62	62
R.10	54	45	39	65	58	67	66
R.11[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a
R.12	37	38	32	n/a	n/a	n/a	n/a
R.13	41	39	32	n/a	n/a	n/a	n/a
R.14	44	42	35	n/a	n/a	n/a	n/a
R.15	48	48	42	n/a	n/a	n/a	n/a
R.16[3]	n/a	n/a	n/a	n/a	n/a	n/a	n/a
I.01	65	60	46	72	68	74	73
I.02	63	58	43	73	69	75	74
I.03	44	40	31	n/a	n/a	n/a	n/a

Notes:

1. ICNG Governing Periods – Day: 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening: 6.00 pm to 10.00 pm; Night: 10.00 pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday
2. RNP Assessment Time Periods – Day: 7.00 am to 10.00 pm; Night: 10.00 pm to 7.00 am (weekly data)

The noise monitoring locations were generally selected to measure background noise levels at the nearest front row receivers in each NCA. These locations would likely be most affected during construction of the project and whilst background noise levels may reduce for receivers which are further back from the works, construction noise generally reduces at a quicker rate than background noise level (from general road noise) with increasing distance. Worst-case noise impacts are therefore generally at the front row and control the mitigation requirements.

3 Legislative and policy context

3.1 Construction noise and vibration guidelines and policies

The Roads and Maritime *Construction Noise and Vibration Guideline,* August 2016 (CNVG) outlines Roads and Maritime's approach to assessing and mitigating construction noise. This guideline should be read in conjunction with other relevant policy and guidelines discussed in this section. Guidelines referenced in this noise and vibration assessment are listed in **Table 3-1**.

Table 3-1 Construction noise and vibration guidelines and policies

Noise and vibration guidelines and policies	
Construction noise and vibration	
Guideline/policy name	**When guideline is used**
Construction Noise and Vibration Guideline (Roads and Maritime 2016)	Assessment of airborne noise, ground-borne noise and vibration impacts on sensitive receivers
Interim Construction Noise Guideline (DECC 2009)	Assessment of airborne noise and ground-borne noise impacts on sensitive receivers
Assessing Vibration: a technical guideline (DECC 2006)	Assessment of vibration impacts on sensitive receivers
BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings* Part 2, BSI, 1993	Assessment of vibration impacts on non-heritage sensitive structures (damage)
DIN 4150:Part 3-1999 *Structural vibration - Effects of vibration on structures*, Deutsches Institut für Normung, 1999	Screening assessment of vibration impacts on heritage sensitive structures (damage)
Australian Standard AS 2187: Part 2-2006 *Explosives - Storage and Use - Part 2: Use of Explosives*	Assessment of blasting impacts on sensitive receivers

3.1.1 Airborne noise

The NSW ICNG is used to assess and manage impacts from construction noise on residences and other sensitive land uses in NSW.

The ICNG contains procedures for determining project specific Noise Management Levels (NMLs) for sensitive receivers based on the existing background noise in the area. The 'worst-case' noise levels from construction of a project are predicted and then compared to the NMLs in a 15 minute assessment period to determine the likely impact of the project.

The NMLs are not mandatory limits, however where construction noise levels are predicted or measured to be above the NMLs, feasible and reasonable work practices to minimise noise emissions are to be investigated. The project specific $L_{Aeq(15minute)}$ NMLs are provided in **Table 3-2**.

Table 3-2 NMLs for other sensitive receivers

Land use	NML $L_{Aeq(15minute)}$ (Applied when the property is in use)
Residential	Standard construction hours[1] measured RBL[2] + 10 Outside standard construction hours RBL + 5 Highly Noise affected > 75 dBA NMLs for residential receivers are presented in the assessment section.
Commercial / Industrial	Commercial 70 dBA Industrial 75 dBA
Child care	External NML 65 dBA for play areas External NML 50 dBA for sleeping areas
Classrooms at schools and other education institutions	Internal noise level 45 dBA
Hospital wards and operating theatres	Internal noise level 45 dBA
Places of worship	Internal noise level 45 dBA
Active recreation areas (characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion)	External noise level 65 dBA
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion, e.g. reading, meditation)	External noise level 60 dBA
Community centres	Depends on the intended use of the centre. Refer to the recommended 'maximum' internal levels in AS 2107 for specific uses.

Notes:

1. ICNG Governing Periods – Day: 7.00 am to 6.00 pm Monday to Saturday, 8.00 am to 6.00 pm Sunday; Evening: 6.00 pm to 10.00 pm; Night: 10.00 pm to 7.00 am Monday to Saturday, 10.00 pm to 8.00 am Sunday
2. Measured Rating Back Ground Level (RBL)

For sensitive receivers such as schools and places of worship, the NMLs presented in **Table 3-2** are based on internal noise levels. For the purpose of this assessment, it is conservatively assumed that all schools and places of worship have windows that can open. On the basis that external noise levels are typically 10 dBA higher than internal noise levels when windows are open sufficiently for ventilation, an external NML of 55 dBA LAeq(15minute) has been adopted.

Other noise-sensitive receivers require separate project specific noise goals and, as per the guidance in the ICNG, NMLs for these receivers have been derived from the internal levels presented in AS 2107.

Summary of residential NMLs

The residential NMLs for the project are determined using the results from the unattended ambient noise monitoring (see Section 2) and are shown in **Table 3-3**.

Table 3-3 Residential NMLs

NCA	Representative monitoring location	Receiver type	Noise Management Levels				Sleep disturbance screening (RBL+15dBA)
			Standard construction hours (RBL+10dBA)	Out of hours (RBL+5dBA)[1]			
			Daytime period	Daytime period	Evening period	Night period	
NCA15	R.14	Residential	54	49	47	40	50
NCA16	R.01	Residential	64	59	57	49	59
NCA19	R.01	Residential	64	59	57	49	59
NCA20	R.14	Residential	54	49	47	40	50
NCA21	R.15	Residential	58	53	53	47	57
NCA23	R.09	Residential	59	54	50	41	51
NCA24	R.01	Residential	64	59	57	49	59
NCA25	R.02	Residential	61	56	56	50	60
NCA27	R.16	Residential	59	54	54	47	57
NCA28	n/a[2]	Residential	55	50	45	40	50
NCA29	R.03	Residential	71	66	65	49	59
NCA30	R.03	Residential	71	66	65	49	59
NCA31	I.02	Residential	73	68	63	48	58
NCA32	I.03	Residential	73	68	63	48	58
NCA33	I.01	Residential	54	49	45	36	46
NCA34	I.01	Residential	75	70	65	51	61
NCA35	I.01	Residential	75	70	65	51	61
NCA36	I.03	Residential	54	49	45	36	46
NCA38	AS2107	Residential	55	50	45	40	50

Notes:

1. Out of Hours construction hours – Evening hours are 6.00 pm to 10.00 pm. Night-time hours are 10.00 pm to 7.00 am Sunday to Saturday and 10.00 pm Saturday to 8.00 am Sunday

3.1.2 Sleep disturbance

The assessment of sleep disturbance impacts followed the same approach as was carried out for the approved project. This included a night-time sleep disturbance 'screening criterion' noise goal of RBL +15 dBA. The term 'screening criterion' indicates a noise level that is intended as a guide to identify the likelihood of sleep disturbance. It is not a limit to be met, however where the criterion is met sleep disturbance is considered to be unlikely. Rather, when the screening criterion is not met, this triggers the requirement for a more detailed analysis to determine if an impact is likely.

With regard to reaction to potential sleep disturbance awakening events, the RNP gives the following guidance:

> *From the research on sleep disturbance to date it can be concluded that:*
>
> - *maximum internal noise levels below 50–55 dBA are unlikely to awaken people from sleep*
> - *one or two noise events per night, with maximum internal noise levels of 65–70 dBA, are not likely to affect health and wellbeing significantly.*

3.1.3 Vibration

The assessment of vibration impacts followed the same approach as was carried out for the approved project. The recommended minimum working distances for construction plant in **Table 3-4** are referenced from the CNVG and DIN 4150.

Consistent with BS 7385 and the Assessing Vibration guideline, the recommendations are for the practical management of potential vibration to minimise the likelihood of cosmetic damage to buildings and disturbance or annoyance in humans. The human comfort (response) minimum working distances are conservative, developed with reference to the more stringent objectives for continuous vibration for typical residential building constructions.

Table 3-4 Recommended minimum working distances for vibration intensive plant

Plant item	Rating/description	Minimum working distance			
		Cosmetic damage			Human response[1]
		Residential and light commercial[1]	Group 2 (typical)[2]	Group 3 (structurally unsound)[2]	
Vibratory roller	< 50 kn (Typically 1-2t)	5 m	7 m	11 m	15 m to 20 m
	< 100 kn (Typically 2-4t)	6 m	8 m	13 m	20 m
	< 200 kn (Typically 4-6t)	12 m	16 m	15 m	40 m
	< 300 kn (Typically 7-13t)	15 m	20 m	31 m	100 m
	> 300 kn (Typically 13-18t)	20 m	26 m	40 m	100 m
	> 300 kn (Typically > 18t)	25 m	33 m	50 m	100 m
Small hydraulic hammer	300 kg - 5 to 12t excavator	2 m	3 m	5 m	7 m
Medium hydraulic hammer	900 kg - 12 to 18t excavator	7 m	10 m	15 m	23 m
Large hydraulic hammer	1600 kg - 18 to 34t excavator	22 m	29 m	44 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	3 m to 26 m[4]	5 m to 40 m[4]	20 m to 100 m[4]
Pile boring	≤ 800 mm	2 m (nominal)	3 m	5 m	4 m
Jackhammer	Hand held	1 m (nominal)	2 m	3 m	2 m
Road-header[3]	Tunnelling	2 m	3 m	5 m	7 m

Notes:

1. Criteria referenced from Roads and Maritime CNVG
2. Criteria referenced from DIN 4150
3. Measurement from SLR Database
4. Corresponds to the higher guideline range

3.2 Operation road traffic noise guidelines and policy

The guidelines used to assess the potential operational road traffic impacts from the project are listed in **Table 3-5**. The guidelines aim to protect the community and environment from excessive noise and vibration impacts from the long-term operation of the project.

Table 3-5 Operational road noise and vibration guidelines and policies

Noise and vibration guidelines and policies	
Operational Road Noise	
Guideline/policy name	**When guideline is used**
Road Noise Policy (RNP) (NSW EPA, 2011)	Operational road traffic noise assessment
Noise Criteria Guideline (NCG) (Roads and Maritime, 2014)	Defines Roads and Maritime's interpretation of the RNP and details how criteria is applied to sensitive receivers
Noise Mitigation Guideline (NMG) (Roads and Maritime, 2014)	Details how additional mitigation measures are to be applied to road infrastructure projects
Model Validation Guideline (Roads and Maritime, 2016)	Contains procedures for validating operational road traffic noise models
Environmental Noise Management Manual (ENMM) (Roads and Traffic Authority, 2001)	Additional information for operational road traffic noise assessment, including maximum noise assessments
Preparing an Operational Noise and Vibration Assessment (Roads and Maritime, 2011)	Defines how to complete operational road traffic noise and vibration assessments
AS2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*	Provides recommended design sound levels for internal areas of occupied spaces
At-Receiver Noise Treatment Guideline (Roads and Maritime, 2017)	Provides an overview and discussion of feasible and reasonable at-receiver noise mitigation measures

3.2.1 Airborne Noise – Road Noise Policy and Noise Criteria Guideline

The RNP is used to assess and manage potential airborne noise impact from new and redeveloped road projects.

This assessment is undertaken with guidance from the *Noise Criteria Guideline* (NCG) which is Roads and Maritime's interpretation of the RNP and provides a consistent approach to identifying road noise criteria for infrastructure projects.

The RNP and NCG provide non-mandatory criteria for residential and 'other sensitive' land uses. Where a project results in road traffic noise levels which are predicted to be above the criteria, the project should investigate feasible and reasonable noise mitigation measures to minimise the impacts.

The RNP and NCG use the following terms to describe and assess the impacts from road projects:

- 'No Build' – the assessment scenario used to predict noise levels if the project were not to go ahead
- 'Build' – the assessment scenario used to predict noise levels with the project.

The difference between the 'Build' and the 'No Build' noise levels is used to determine the impact of the project.

Residential receivers

The project is a mixture of both redeveloped roads and new roads. A road is redeveloped where works are in an existing road corridor and the existing road is not substantially realigned. Roads are classed as new where the road construction is in an undeveloped corridor, where an existing road is substantially realigned or where the functional class of a road changes, such as where a road that was previously local becomes a larger collector road. The relevant noise criteria for residential receivers are shown in **Table 3-6**.

Table 3-6 NCG Criteria for residential receivers

Road Category	Type of Project/Land Use	Assessment Criteria (dBA)	
		Daytime (7 am 10 pm)	**Night time (10 pm 7 am)**
Freeway/ arterial/ sub-arterial roads	1. Existing residences affected by noise from **new** freeway/arterial/sub-arterial road corridors	$L_{Aeq(15\ hour)}$ 55 (external)	$L_{Aeq(9\ hour)}$ 50 (external)
	2. Existing residences affected by noise from **redevelopment** of existing freeway/arterial/sub-arterial roads	$L_{Aeq(15\ hour)}$ 60 (external)	$L_{Aeq(9\ hour)}$ 55 (external)
	3. Existing residences affected by **additional traffic** on existing freeways/arterial/sub-arterial roads generated by land use developments		
	4. Existing residences affected by both new roads and the redevelopment of existing freeway/arterial/sub-arterial roads in a **transition zone**[1]	Between $L_{Aeq(15hour)}$ 55-60 (external)	Between $L_{Aeq(9hour)}$ 50-55 (external)
	5. Existing residences affected by increases in traffic noise of 12 dB or more from redevelopment of existing freeway/arterial/sub-arterial roads[2]	Between $L_{Aeq(15hour)}$ 42-55 (external)	Between $L_{Aeq(9hour)}$ 42-50 (external)

Note 1: The criteria assigned to the entire residence depend on the proportion of noise coming from the new and redeveloped roads.

Note 2: The criteria at each facade are determined from the existing traffic noise level plus 12 dB.

The criteria are lower for the night-time due to the greater sensitivity of communities to noise impacts during this period.

The RNP and NCG require noise to be assessed at project opening and for a future design year, which is typically ten years after opening. For this project, the at opening year is 2023 and the future design year is 2033.

The NCG requires transition zones to be applied at the point where road categories change to provide a smooth transition in noise criteria.

Other sensitive land uses

A number of 'other sensitive' non-residential land uses have been identified in the study area. The noise criteria for these receivers are shown in **Table 3-7**. Roads and Maritime does not consider commercial and industrial receivers as being sensitive to operational airborne road traffic noise impacts.

Table 3-7 NCG Criteria for residential receivers

Existing Sensitive Land Use	Assessment Criteria (dB)		Additional Considerations
	Daytime (7 am 10 pm)	**Night time (10 pm 7 am)**	
1. School classrooms	$L_{Aeq(1\ hour)}$ 40 (internal)[1]	-	In the case of buildings used for education or health care, noise level criteria for spaces other than classrooms and wards may be obtained by interpolation from the 'maximum' levels shown in Australian Standard 2107:2000 (Standards Australia 2000).
2. Hospital wards	$L_{Aeq(1\ hour)}$ 35 (internal)	$L_{Aeq(1\ hour)}$ 35 (internal)	

Existing	Assessment Criteria (dB)		Additional Considerations
3. Places of worship	$L_{Aeq(1\ hour)}$ 40 (internal)[1]	$L_{Aeq(1\ hour)}$ 40 (internal)[1]	The criteria are internal, i.e. the inside of a church. Areas outside the place of worship, such as a churchyard or cemetery, may also be a place of worship. Therefore, in determining appropriate criteria for such external areas, it should be established what is in these areas that may be affected by road traffic noise.
4. Open space (active use	$L_{Aeq(15\ hour)}$ 60 (external)	-	Active recreation is characterised by sporting activities and activities which generate their own noise or focus for participants, making them less sensitive to external noise intrusion.
5. Open space (passive use)	$L_{Aeq(15\ hour)}$ 55 (external)	-	Passive recreation is characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (eg playing chess, reading).
6. Child care facilities	Sleeping rooms $L_{Aeq(1\ hour)}$ 35 (internal)[1] Indoor play areas $L_{Aeq(1\ hour)}$ 40 (internal)[1] Outdoor play areas $L_{Aeq(1\ hour)}$ 55 (internal)	-	Multipurpose spaces (eg shared indoor play/sleeping rooms) should meet the lower of the respective criteria. Measurements for sleeping rooms should be taken during designated sleeping times for the facility, or if these are not known, during the highest hourly traffic noise level during the opening hours of the facility.
7. Aged care facilities	-	-	The criteria for residential land uses should be applied to these facilities.

Note 1: The criteria are specified as an internal noise level for this receiver category. As the noise model predicts external noise levels, it has been conservatively assumed that all schools and places of worship have openable windows and external noise levels are 10 dB higher than the corresponding internal level, which is representative of windows being partially open to provide ventilation.

Potential road traffic noise impacts on the surrounding road network

Where a project results in traffic redistribution, noise impacts can occur on the surrounding road network due to vehicles using different routes after the project is complete. The NCG criteria (**Table 3-6**) are therefore to be applied to the surrounding road network where a road project generates an increase in road traffic noise of more than 2.0 dB.

Operational vibration

The RNP notes that vehicles operating on roadways are unlikely to cause vibration impacts at adjacent receivers unless there are significant road irregularities, such as can occur at poorly maintained bridge joints. Often, vibration of lightweight building elements such as windows is mistakenly thought to be caused by ground-borne vibration from passing traffic travelling into buildings via the foundations. This phenomenon is however often caused by low frequency airborne noise from heavy vehicles which can cause lightweight building elements to vibrate.

As the new and upgraded roads in the project site would be designed and constructed to avoid significant road surface irregularities, significant impacts from operational vibration are not expected and have not been assessed any further.

3.2.2 Conditions of Approval

The CoA that address the control and management of noise and vibration relevant to this proposed modification are listed below in **Table 3-8**. A cross reference and / or comment is also included to indicate where the condition applies within this proposed modification. It is important to note that CoA apply to all works associated with the construction of the project.

Table 3-8 Conditions of Approval

CoA	Condition Requirements	Document reference/ Comment
E 68	Works must be undertaken during the following hours: a. 7:00 am to 6:00 pm Mondays to Fridays, inclusive; b. 8:00 am to 1:00 pm Saturdays; and c. at no time on Sundays or public holidays.	**Section 4.1.2**
E 69	Notwithstanding Condition E68, works may be undertaken between 1:00 pm to 6:00 pm on Saturday.	
E 72	Except as permitted by an EPL, highly noise intensive works that result in an exceedance of the applicable NML at the same receiver must only be undertaken: a. between the hours of 8:00 am to 6:00 pm Monday to Friday; b. between the hours of 8:00 am to 1:00 pm Saturday; and c. in continuous blocks not exceeding three (3) hours each with a minimum respite from those activities and works of not less than one (1) hour between each block. d. For the purposes of this condition, 'continuous' includes any period during which there is less than a one (1) hour respite between ceasing and recommencing any of the work that are the subject of this condition.	**Section 4.1.2**
E 73	Notwithstanding Conditions E68 to E72 works may be undertaken outside the hours specified under those conditions in the following circumstances: a. for the delivery of materials required by the NSW Police Force or other authority for safety reasons; or b. where it is required in an emergency to avoid injury or the loss of life, to avoid damage or loss of property or to prevent environmental harm; or c. where different construction hours are permitted or required under an EPL in force in respect of the CSSI; or d. works approved under an Out-of-Hours Work Protocol for works not subject to an EPL as required by Condition E77; or e. construction that causes LAeq (15 minute) noise levels: i. no more than 5 dB(A) above the rating background level at any residence in accordance with the Interim Construction Noise Guideline (DECC, 2009), and ii. no more than the 'Noise affected' noise management levels specified in Table 3 of the Interim Construction Noise Guideline (DECC, 2009) at other sensitive land uses, and iii. continuous or impulsive vibration values, measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.2 of Assessing Vibration: a technical guideline (DEC, 2006), and iv. intermittent vibration values measured at the most affected residence are no more than the maximum values for human exposure to vibration, specified in Table 2.4 of Assessing Vibration: a technical guideline (DEC, 2006). Note: Section 5.24(1)(e) of the EP&A Act requires that an EPL be substantially consistent with this approval.	**Section 4.1.2**
E 75	Out-of-hours works that are regulated by an EPL as per Condition E73(c) or through the Out-of-Hours Work Protocol as per Condition E77 include: a. works which could result in a high risk to construction personnel or public safety, based on a risk assessment carried out in accordance with AS/NZS ISO 31000:2009 "Risk Management – Principles and Guidelines"; or b. where the relevant road network operator has advised the Proponent in writing that carrying out the works and activities could result in a high risk to road network operational performance; or c. where the relevant utility service operator has advised the Proponent in writing that carrying out the works and activities could result in a high risk to the operation and integrity of the utility network; or d. (d) where the TfNSW Transport Management Centre (or other road authority) has advised the Proponent in writing that a road occupancy licence is required and will not be issued for the works or activities during the hours specified in Condition E68 and Condition E69; or e. where Sydney Trains (or other rail authority) has advised the Proponent in writing that a Rail Possession is required. Note: Other out-of-hours works can be undertaken with the approval of an EPL, or through the project's Out-of-Hours Work Protocol for works not subject to an EPL.	**Section 4.1.2**

CoA	Condition Requirements	Document reference/ Comment
E 76	In order to undertake out-of-hours work described in Condition E75, the Proponent must identify appropriate respite periods for the out-of-hours works in consultation with the community at each affected location. This consultation must include (but not be limited to) providing the community with: a. a schedule of likely out-of-hours work for a period no less than three (3) months; b. the potential works, location and duration; c. the noise characteristics and likely noise levels of the works; and d. likely mitigation and management measures. The outcomes of the community consultation, the identified respite periods and the scheduling of the likely out-of-hour works must be provided to the AA, EPA and the Secretary.	**Section 4.1.2**
E 78	All works undertaken for the delivery of the CSSI, including those undertaken by third parties, must be coordinated to ensure respite periods are provided. The Proponent must: (a) reschedule any works to provide respite to impacted noise sensitive receivers so that the respite is achieved in accordance with Condition E76; or (b) consider the provision of alternative respite or mitigation to impacted noise sensitive receivers; and (c) provide documentary evidence to the AA in support of any decision made by the Proponent in relation to respite or mitigation.	**Section 4.1.2**
E 79	Construction Noise and Vibration Impact Statements must be prepared for construction ancillary facility(s) before any works that result in noise and vibration impacts commence, and include specific mitigation measures identified through consultation with affected sensitive receivers. The Statements must supplement the Construction Noise and Vibration Management Sub-plan or Site Establishment Management Plan(s) and are to be implemented for the duration of the works. The Construction Noise and Vibration Impact Statement for the White Bay Civil Site (C11) must be prepared in consultation with the Port Authority of NSW and NSW Heritage Council.	n/a
E 80	Noise generating works in the vicinity of potentially-affected community, religious, educational institutions and noise and vibration-sensitive businesses and critical working areas (such as theatres, laboratories and operating theatres) resulting in noise levels above the NMLs must not be timetabled within sensitive periods, unless other reasonable arrangements with the affected institutions are made at no cost to the affected institution.	**Section 4.1.2** **Section 5**
E 81	Mitigation measures must be implemented with the aim of achieving the following construction noise management levels and vibration criteria: a. construction 'Noise affected' noise management levels established using the Interim Construction Noise Guideline (DECC, 2009); b. vibration criteria established using the Assessing vibration: a technical guideline (DEC, 2006) (for human exposure); c. Australian Standard AS 2187.2 - 2006 "Explosives - Storage and Use - Use of Explosives"; d. BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings Part 2" as they are "applicable to Australian conditions"; and e. the vibration limits set out in the German Standard DIN 4150-3: Structural Vibration- effects of vibration on structures (for structural damage). Any works identified as exceeding the noise management levels and/or vibration criteria must be managed in accordance with the Construction Noise and Vibration Management Sub-plan. Note: The Interim Construction Noise Guideline identifies 'particularly annoying' activities that require the addition of 5 dB(A) to the predicted level before comparing to the construction Noise Management Level.	**Section 3**
E 82	Mitigation measures must be applied when the following residential ground-borne noise levels are exceeded: a. evening (6:00 pm to 10:00 pm) — internal LAeq (15 minute): 40 dB(A); and b. night (10:00 pm to 7:00 am) — internal LAeq (15 minute): 35 dB(A). c. The mitigation measures must be outlined in the Construction Noise and Vibration Management Sub-plan, including in any Out-of-Hours Work Protocol, required by Condition E77.	n/a
E 83	Owners and occupiers of properties at risk of exceeding the screening criteria for cosmetic damage must be notified before works that generate vibration commences in the vicinity of those properties. If the potential exceedance is to occur more than once or extend over a period of 24 hours, owner and occupiers are to be provided a schedule of potential exceedances on a monthly basis for the duration of the potential exceedances, unless otherwise agreed by the owner and occupier. These properties must be identified and considered in the Construction Noise and Vibration Management Sub-plan.	**Section 3** and **5**
E84	The Proponent must conduct vibration testing before and during vibration generating activities that have the potential to impact on heritage items to identify minimum working distances to prevent cosmetic damage. In the event that the vibration testing and monitoring shows that the preferred values for vibration are likely to be exceeded, the Proponent must review the construction methodology and, if necessary, implement additional mitigation measures.	
E85	The Proponent must seek the advice of a heritage specialist on methods and locations for installing equipment used for vibration, movement and noise monitoring at heritage-listed structures.	

CoA	Condition Requirements	Document reference/ Comment
E 87	For out-of-hours work undertaken in accordance with Condition E75, at-receiver noise mitigation in the form of at-property treatment must be offered to the land owner for habitable living spaces, or other mitigation or management measures as agreed by the occupier, to properties identified in Appendix D. Mitigation must be offered prior to out-of-hours work commencing. This requirement does not apply if the sensitive receiver has been provided with noise mitigation under the RMS Noise Abatement Program or the State Environment Planning Policy (Infrastructure) 2007 (clause 102(3)). The adequacy of at-property treatments will be reviewed where previous treatments have been installed as part of other SSI or CSSI projects. Note: This condition does not preclude the application of other noise and vibration mitigation and management measures.	**Section 5.2.3, 5.3.3** and **5.4.3**
E89	A Noise Insulation Program must be prepared and implemented for the duration of CSSI works for receivers at/to which the requirements of Conditions E87 and E88 apply. The Program must be incorporated into the Construction Noise and Vibration Management Sub-plan. The Noise Insulation Program must detail the following matters: a. receivers eligible for the scheme; b. the scope of the insulation package; c. responsibility for the noise insulation works; d. procedure and the terms of the noise insulation works; e. program monitoring; and (f) program review and amendment. The Noise Insulation Program must be endorsed by the AA	**Section 5.2.3, 5.3.3** and **5.4.3**
E 90	Receivers which are eligible for receiving treatment under the Noise Insulation Program required under Condition E89 must have treatment implemented within six (6) months following the commencement of construction which would affect the receiver. The implementation of the Noise Insulation Program must be prioritised based on the degree and duration of exceedance with high priority exceedances undertaken within three (3) months of the commencement of construction.	**Section 5.2.3, 5.3.3** and **5.4.3**
E 92	The Proponent must prepare an Operational Noise and Vibration Review (ONVR) to confirm noise and vibration control measures that would be implemented for the operation of the CSSI. The ONVR must be prepared in consultation with the Department, relevant council(s), other relevant stakeholders and the community and must: a. confirm the appropriate operational noise and vibration objectives and levels for adjoining development, including existing sensitive receivers; b. confirm the operational noise predictions based on the final design. Confirmation must be based on an appropriately calibrated noise model (which has incorporated noise monitoring, and concurrent traffic counting, where necessary for calibration purposes). The assessment must specifically include verification of noise levels at all fixed facilities, based on noise monitoring undertaken at appropriately identified noise catchment areas surrounding the facilities; c. confirm the operational noise and vibration impacts at adjoining development based on the final design of the CSSI, including operational daytime LAeq,15 hour and night-time LAeq, 9 hour traffic noise contours; d. review the suitability of the operational noise mitigation measures identified in the EIS and SPIR and, where necessary, investigate and identify additional noise and vibration mitigation measures required to achieve the noise criteria outlined in the NSW Road Noise Policy (DECCW, 2011) and NSW Industrial Noise Policy (EPA, 2000), including the timing of implementation; e. include a consultation strategy to seek feedback from directly affected landowners on the noise and vibration mitigation measures; and f. procedures for the management of operational noise and vibration complaints. The ONVR is to be verified by a suitably qualified and experienced noise and vibration expert. The ONVR is to be undertaken at the Proponent's expense and submitted to the Secretary for approval prior to the implementation of mitigation measures. The Proponent must implement the identified noise and vibration control measures and make the ONVR publicly available.	**Section 6** and **6.3**
E93	Noise mitigation measures as identified in Condition E92 that will not be physically affected by works, or which have not been implemented in accordance with Conditions E87 and E88 must be implemented within six (6) months of the commencement of construction in the vicinity of the impacted receiver to minimise construction noise impacts, and detailed in the Construction Noise and Vibration Management Sub-plan for the CSSI.	**Section 6** and **6.3**
E94	Where implementation of operational noise mitigation measures are not proposed early in accordance with Condition E93, the Proponent must submit to the Secretary a report providing justification as to why, along with details of temporary measures that would be implemented to reduce construction noise impacts, until such time that the operational noise mitigation measures identified in Condition E92 are implemented. The report must be endorsed by the AA and submitted to the Secretary prior to the commencement of construction which would affect the identified sensitive receivers.	**Section 6** and **6.3**

CoA	Condition Requirements	Document reference/ Comment
E95	Within 12 months of the commencement of operation of the CSSI, the Proponent must undertake monitoring of operational noise to compare actual noise performance of the CSSI against the noise performance predicted in the review of noise mitigation measures required by Condition E92. The Proponent must prepare an Operational Noise Compliance Report to document this monitoring. The Report must include, but not necessarily be limited to: noise monitoring to assess compliance with the operational noise levels predicted in the review of operational noise mitigation measures required under Condition E92; a. a review of the operational noise levels in terms of criteria and noise goals established in the NSW Road Noise Policy 2011; b. methodology, location and frequency of noise monitoring undertaken, including monitoring sites at which CSSI noise levels are ascertained, with specific reference to locations indicative of impacts on sensitive receivers; c. details of any complaints and enquiries received in relation to operational noise generated by the CSSI between the date of commencement of operation and the date the report was prepared; d. any required recalibrations of the noise model taking into consideration factors such as noise monitoring and actual traffic numbers and proportions; e. an assessment of the performance and effectiveness of applied noise mitigation measures together with a review and if necessary, reassessment of mitigation measures; and f. identification of additional measures to those identified in the review of noise mitigation measures required by Condition E92, that would be implemented with the objective of meeting the criteria outlined in the NSW Road Noise Policy (EPA, 2011) and Industrial Noise Policy (EPA, 2000), when these measures would be implemented and how their effectiveness would be measured and reported to the Secretary and the EPA. The Operational Noise Report must be submitted to the Secretary and the E	**Section 6** and **6.3**
E105	The Proponent must offer pre-dilapidation surveys and must undertake and prepare pre-dilapidation reports where the offer is accepted, on the current condition of surface and sub-surface structures identified as at risk from settlement or vibration by the geotechnical model described in Condition E101. The pre-dilapidation surveys and reports must be prepared by a suitably qualified and experienced person(s) and must be provided to the owners of the surface and sub-surface structures for review prior to the commencement of potentially impacting works.	**Section 5**

4 Methodology

4.1 Construction airborne noise assessment methodology

A noise model of the study area has been used to predict noise levels from the proposed construction works to all identified surrounding receivers to around 600 metres from the works areas, which is sufficient to cover the area of potential impacts from the project. The model uses ISO 9613 algorithms in SoundPLAN software which is consistent with the approach taken in M4-M5 Link EIS.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the construction sites and surrounding areas.

4.1.1 Works description

The Appendix J (Technical working paper: Noise and vibration) of the M4-M5 Link EIS assessed several construction scenarios within the Rozelle construction footprint. The construction scenarios associated with the proposed modification are consistent in terms of plant and equipment and largely consistent in terms of locality with the exception of elevated works associated with The Crescent overpass, works at the Johnston Street/Chapman Road/The Crescent intersection and the use of a minor construction ancillary facility, established in accordance with Condition C24, as a construction ancillary facility (proposed construction ancillary facility (C6a)).

These scenarios are shown in **Table 4-1** together with a high level description of each works activity, and a discussion on how the proposed modification is different to the scenarios assessed in the EIS. The location of the various work scenarios are shown in **Figure 4-1.**

Table 4-1 Construction scenario description

ID	Scenario	Description	Comparison with EIS scenarios
Construction of The Crescent overpass, green link and shared user path bridge			
1	Piling	• Piling works and bridge foundations	• The construction scenarios and equipment are consistent with scenario assessed in the EIS. • The general locality of the works for piling, general earthworks, bridge works and concrete works are largely in the same location as assessed in the EIS. • Adjustments to the extents of the works have been included to account for the relocation of the green link and shared user path bridge, and the inclusion of the new overpass. • The roadworks scenario has been modelled on the elevated structure of The Crescent overpass, which was not part of the EIS.
2	General earthworks	• Ground works to excavate, backfill and compact formation layer • Construct piling platforms or retaining walls	
3	Bridge works	• Installation of girders and fit out.	
4	Concrete works	• Construct access ramps • Construct piers and abutments	
5	Roadworks	• Laying road surface • Tie-ins to existing pavement. • Installation of street furniture (ie lighting, safety barriers, etc) • Line marking • Installation of urban design treatments and features and landscaping works. • Finishing works generally have no requirement for noise intensive equipment.	

ID	Scenario	Description	Comparison with EIS scenarios
Proposed construction ancillary facility (C6a)			
6	Site clearing	• Removal of vegetation • General earthworks including landform creation	• The construction scenarios and equipment are consistent with scenario assessed in the EIS. • A construction ancillary facility site has been introduced to the north east of the C6 civil site assessed in the EIS.
7	Installation of environmental controls	• Installation of safety and environmental controls	
8	Establishment of construction facilities	• Establishment of site offices, amenities storage areas and parking areas.	
9	Site operations and car parking	• Operation of the site	
Johnston Street, Chapman Road and The Crescent intersection upgrade			
10	General earthworks	• Ground works to excavate, backfill and compact formation layer	• The construction scenarios and equipment are consistent with scenario assessed in the EIS. • The construction footprint has been extended to consider works on Johnston Street.
11	Roadworks	• Laying road surface • Tie-ins to existing pavement. • Installation of street furniture (ie lighting, safety barriers, etc) • Line marking • Installation of urban design treatments and features and landscaping works. Finishing works generally have no requirement for noise intensive equipment.	

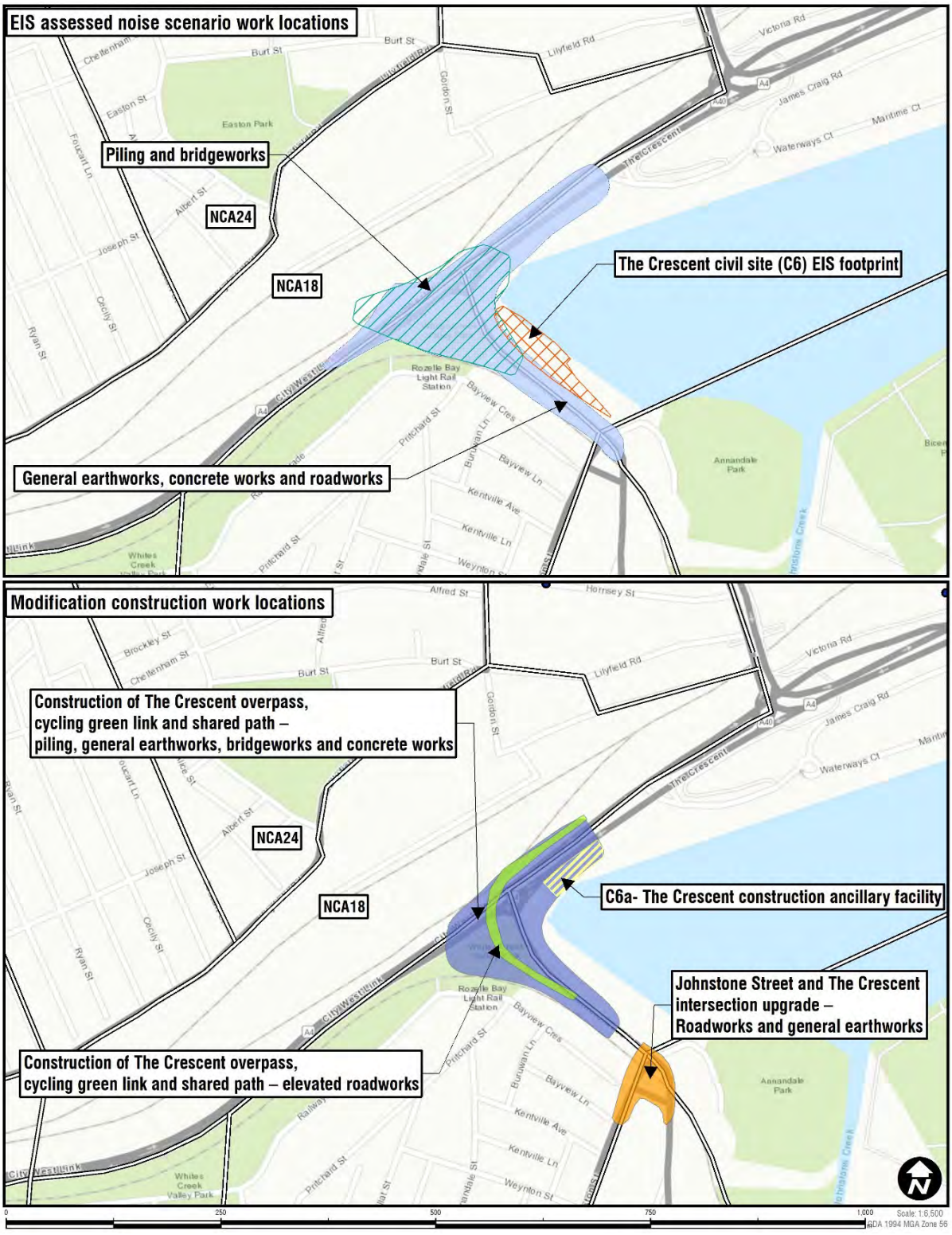


Figure 4-1 Construction works locations

As shown in **Figure 4-1**, the works associated with the addition of The Crescent overpass and relocation of the shared user paths are largely within the assessed EIS works extents for the approved project. The exception is the elevated roadworks for The Crescent overpass.

Whilst the noise and vibration roadworks scenario assessed in the EIS included construction works near to the Johnston Street, Chapman Road and The Crescent intersection, the proposed modification includes works along the very northern end Johnston Street which were not assessed in the EIS. The construction assessment for the proposed modification has therefore extended the construction works area along the northern end of Johnston Street to account for these changes.

The footprint of the C6a construction ancillary facility site on The Crescent has also been included as part of this proposed modification.

4.1.2 Working hours

Construction of the project would be carried out during 'Standard Construction Hours' where practicable. Standard Construction Hours are defined in the ICNG and shown in **Table 4-2**.

Table 4-2 Standard construction hours

Hour commencing	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
Monday																								
Tuesday																								
Wednesday									Standard										OOH					
Thursday		OOH							Construction Hours										Period 1					
Friday		Period 2																	Evening					
Saturday																								
Sunday										OOH Period 1										OOH				
Public Holiday										Day										Period 2				

Note 1: Taken from the TfNSW *Construction Noise and Vibration Strategy*.

Note 2: Standard Construction Hours are Monday to Friday 7 am to 6 pm and Saturdays from 8 am to 1 pm, as defined in the ICNG.

Note 3: OOH = Out of Hours (ie not during Standard Construction Hours).

Works hours for the M4-M5 Link project are outlined in Conditions E68 and E69. Condition E68 requires works to be undertaken during Standard Construction Hours as outlined in the ICNG, while Condition E69 allows works to be undertaken between 1:00 pm and 6:00 pm on Saturdays. Daytime works for this proposed modification would be undertaken during these hours.

To ensure worker safety or to minimise traffic disruptions, a number of works would be required to be undertaken outside of standard construction hours. Out of hours works (or night works) include works outside of the approved hours under Condition E68 and E69 outlined above.

Works would be required outside of Standard Construction Hours to:

- minimise disruptions to the road network
- minimise disturbance to surrounding landowners and commercial properties
- ensure the safety of the construction workers, motorists and the general public.

Justification for the activities required to be completed out of hours is provided in **Table 4-3**.

Table 4-3 Works outside of standard construction hours

Activity	Justification for Out of Hours Activities
Use of construction ancillary facilities to support out of hours works	Some activities at construction ancillary facilities would be required to support out of hours works. Where possible, activities would be kept to a minimum with only those required to support the works to be undertaken.
Delivery of oversized material, plant and equipment	Delivery of some materials and equipment may require oversized loads. Such activities would be undertaken in-line with NSW Police and TfNSW requirements, which may include out of hours movements when vehicle numbers on the network are lower.
Craneage of bridge beams and precast deck units under live traffic	Some bridge works might require locating a crane on or adjacent to roads or require large bridge components to be installed above live traffic. Such works may require lane occupancy or lane/road closure, which would be required outside Standard Construction Hours when traffic volumes are lower.

The periods in which the construction works are expected to be required are shown in **Table 4-4**.

Table 4-4 Construction scenarios – working hours

ID	Scenario	Hours of works			
		Day	**Day OOH**	**Evening**	**Night time**
Construction of The Crescent overpass, green link and shared user path bridge					
1	Piling	✓	-	-	-
2	General earthworks	✓	-	-	-
3	Bridge works	✓	✓	✓	✓
4	Concrete works	✓	-	-	-
5	Roadworks	✓	-	-	-
C6a construction ancillary facility					
6	Site clearing	✓	-	-	-
7	Installation of environmental controls	✓	-	-	-
8	Establishment of construction facilities	✓	-	-	-
9	Site operations Car parking	✓	✓	✓	✓
Johnston Street, Chapman Road and The Crescent intersection upgrade					
10	General earthworks	✓	-	-	-
11	Roadworks	✓	✓	✓	✓

4.1.3 Working schedule

An indicative program of works for the proposed modification is provided in **Table 4-5**. The construction program shows construction activities commencing in Q1 2021 and continuing through to the end of Q2 2023.

Table 4-5 Indicative program of works

Works area	Year															
	2020				2021				2022				2023			
Site establishment and enabling works					■	■	■	■								
The Crescent Overpass construction										■	■	■	■			
Green link and shared user path bridge							■	■	■	■						
The Crescent/Johnston Street/Chapman Road intersection upgrade							■	■	■	■						
Finishing works											■	■	■	■		
Anzac Bridge approach roads	■	■	■	■	■	■	■	■			■	■	■			

4.1.4 Construction mitigation

The ICNG acknowledges that due to the nature of construction works in urban areas it is inevitable that there will be impacts where construction is near to sensitive receivers. This section summarises the approaches used on major infrastructure projects to minimise the potential noise and vibration impacts as far as reasonably practicable.

Standard mitigation

The CNVG contains a number of 'standard mitigation measures' for mitigating and managing noise and vibration impacts during construction of road infrastructure projects.

These standard measures include items such as requiring construction contractors to complete site inductions to make workers aware of noise and vibration specifics on the project, completing regular monitoring to check noise and vibration levels are as expected, and checking noise emission levels from construction equipment to ensure they remain within manufacturers' specifications.

Additional mitigation measures

Where noise impacts remain after the use of 'standard mitigation measures', the CNVG requires 'additional mitigation measures' to be applied, where feasible and reasonable. The 'additional mitigation measures' are determined on the basis of the exceedance of the appropriate management levels and are shown in **Table 4-6**.

Table 4-6 CNVG additional mitigation measures

Additional Mitigation Measure	Description
Notification (letterbox drop or equivalent)	Advanced warning of works and potential disruptions can assist in reducing the impact on the community. The notification may consist of a letterbox drop (or equivalent) detailing work activities, time periods over which these will occur, impacts and mitigation measures. Notification should be a minimum of five working days prior to the start of works.

Additional Mitigation Measure	Description
Specific notifications (SN)	Specific notifications are letterbox dropped (or equivalent) to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. The specific notification provides additional information when relevant and information to more highly affected receivers than covered in general letterbox drops.
Phone calls (PC)	Phone calls detailing relevant information made to affected stakeholders within seven calendar days of proposed work. Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and specific needs.
Individual briefings (IB)	Individual briefings are used to inform stakeholders about the impacts of high noise activities and mitigation measures that will be implemented. Project representatives would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the project.
Respite Offers (RO)	Respite Offers should be considered where there are high noise and vibration generating activities near receivers. As a guide work should be carried out in continuous blocks that do not exceed three hours each, with a minimum respite period of one hour between each block. The actual duration of each block of work and respite should be flexible to accommodate the usage of and amenity at nearby receivers. The purpose of such an offer is to provide residents with respite from an ongoing impact. This measure is evaluated on a project-by-project basis, and may not be applicable to all projects.
Respite Period 1 (R1)	Out of hours construction noise in 'out of hours period 1' shall be limited to no more than three consecutive evenings per week except where there is a Duration Respite. For night work these periods of work should be separated by not less than one week and no more than six evenings per month.
Respite Period 2 (R2)	Night time construction noise in 'out of hours period 2' shall be limited to two consecutive nights except for where there is a Duration Respite. For night work these periods of work should be separated by not less than one week and six nights per month. Where possible, high noise generating works shall be completed before 11pm.
Duration Respite (DR)	Respite offers and respite periods 1 and 2 may be counterproductive in reducing the impact on the community for longer duration projects. In this instance and where it can be strongly justified it may be beneficial to increase the work duration, number of evenings or nights worked through Duration Respite so that the project can be completed more quickly. The project team should engage with the community where noise levels are expected to exceed the NML to demonstrate support for Duration Respite.
Alternative Accommodation (AA)	Alternative accommodation may be offered to residents living in close proximity to construction works that are likely to experience highly intrusive noise levels. The specifics of the offer should be identified on a project-by-project basis. Additional aspects for consideration shall include whether the highly intrusive activities occur throughout the night or before midnight.
Verification (V)	Verification of construction noise and vibration levels should occur to ensure the actual impacts are consistent with the predicted levels. Appendix F of the CNVG contains further details about verification of Noise and Vibration levels as part of routine checks of noise levels or following reasonable complaints.

4.2 Construction vibration prediction methodology

The propagation of vibration emitted from a source is site specific with the level of vibration experienced at a receiver dependent upon the vibration energy generated by the source, the predominant frequencies of vibration, the localised geotechnical conditions and the interaction of structures and features which can dampen vibration.

The potential impacts during vibration intensive works have been assessed using the nominated minimum working distances for cosmetic damage and human response shown in **Table 4-7**. This approach is consistent with the methodology used to assess the approved project in the EIS.

Table 4-7 Recommended minimum working distances for vibration intensive plant

Plant item	Rating/description	Minimum working distance			
		Cosmetic damage			Human response[1]
		Residential and light commercial[1]	Group 2 (typical)[2]	Group 3 (structurally unsound)[2]	
Vibratory roller	< 50 kn (Typically 1-2t	5 m	7 m	11 m	15 m to 20 m
	< 100 kn (Typically 2-4t)	6 m	8 m	13 m	20 m
	< 200 kn (Typically 4-6t)	12 m	16 m	15 m	40 m
	< 300 kn (Typically 7-13t)	15 m	20 m	31 m	100 m
	> 300 kn (Typically 13-18t)	20 m	26 m	40 m	100 m
	> 300 kn (Typically > 18t)	25 m	33 m	50 m	100 m
Small hydraulic hammer	300 kg - 5 to 12t excavator	2 m	3 m	5 m	7 m
Medium hydraulic hammer	900 kg - 12 to 18t excavator	7 m	10 m	15 m	23 m
Large hydraulic hammer	1600 kg - 18 to 34t excavator	22 m	29 m	44 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	3 m to 26 m[4]	5 m to 40 m[4]	20 m to 100 m[4]
Pile boring	≤ 800 mm	2 m (nominal)	3 m	5 m	4 m
Jackhammer	Hand held	1 m (nominal)	2 m	3 m	2 m
Road-header[3]	Tunnelling	2 m	3 m	5 m	7 m

Notes:

1. Criteria referenced from Roads and Maritime CNVG
2. Criteria referenced from DIN 4150
3. Measurement from SLR Database
4. Corresponds to the higher guideline range

4.3 Operational noise modelling methodology

4.3.1 Noise model

A noise model of the study area has been used to predict noise levels from the operation of the project to all surrounding receivers. The model uses Calculation of Road Traffic Noise (CoRTN) (UK Department of Transport, 1988) algorithms in SoundPLAN software.

Local terrain, receiver buildings and structures were digitised in the noise model to develop a three-dimensional representation of the project site and surrounding areas.

The '**No Build**' scenarios use the existing road alignment geometry, with all existing structures and features within the road corridor being included.

The '**Build**' scenarios use the proposed design of the project, which includes all new roads, widening works, new bridges and changes to existing ground levels such as cuttings and embankments.

4.3.2 Project and non-project roads

Roads where design or engineering changes are proposed as part of the project are considered as 'project' roads. Existing roads with no works are considered 'non-project'.

All major roads in the project site have been modelled together with major roads on the surrounding road network to determine the contributions from 'project' and 'non-project' roads at individual receivers, as required by the NCG.

Changes to traffic redistribution on the surrounding road network can result in altered noise impacts after a project is complete. The NCG criteria have been applied to the surrounding road network where an increase in road traffic noise of more than 2.0 dB is predicted.

The modelled 'project' and 'non-project' roads are shown in **Annexure B**.

4.3.3 Road types

The NCG classifies project roads as either 'new' or 'redeveloped'. The road classifications used in the assessment are shown in **Annexure B**.

4.3.4 Assessment area and transition zones

The RNP defines the operational road traffic noise assessment area width as 600 m from the centre line of the outermost traffic lane on each side of the project alignment.

The principles under which the study area boundary for the assessment has been defined are as follows:

- A 600 metre boundary width either side of the main project road alignment.
- A boundary length up to the physical extent of the works. While not required under the NCG, due to the relatively small gap between the Rozelle Interchange area and the Iron Cove interchange area, the length of the boundaries have been extended in order to include receivers on Victoria Road located between these two areas.

The NCG also requires transition zones to be applied at the point where road categories change from 'new' to 'redeveloped' to provide a smooth transition in noise criteria. The transition zone for the assessment area is shown in **Annexure B**.

4.3.5 Traffic data

The traffic data used in the noise modelling was provided by the project team and is provided in **Annexure B**.

A number of other major road infrastructure projects are located near to M4-M5 Link project and have the potential to influence traffic volumes in the study area. To assess the potential impact from the combined effect of these projects a number of modelling scenarios have been investigated.

The projects which have been included in the various assessment scenarios are shown in **Table 4-8**. The traffic scenarios are:

- **Do Nothing** (ie without the project or other approved WestConnex stages): This scenario represents the existing road network in the study area in the absence of the project. The traffic data for this scenario does not include any stages of WestConnex or the interfacing projects.
- **Do Minimum** (ie without the project): This scenario represents the existing road network in the study area in the absence of the project. The traffic data includes the approved WestConnex stages.
- **Do Something** (ie with the project): This scenario assumes that the project goes ahead and includes the proposed project design. The traffic data includes the M4-M5 Link and the approved WestConnex stages.
- **Do Something Plus 2023 -** (ie with the project and other projects that interface, overlap or have potentially concurrent impacts): This scenario assumes that the project goes ahead and includes the proposed project design. The traffic data includes the M4-M5 Link and the approved WestConnex stages, together with Western Harbour Tunnel project and Sydney Gateway.
- **Do Something Plus 2033** (ie with the project and other projects that interface, overlap, or have potentially concurrent impacts): This scenario assumes that the project goes ahead and includes the proposed project design. The traffic data includes the M4-M5 Link and the approved WestConnex stages, together with Western Harbour Tunnel project, Beaches Link, Sydney Gateway and F6 Extensions.

Table 4-8 Traffic scenarios and interfacing projects

Assessment scenario	Traffic scenario	WCX M4-M5 Link	Other WCX stages	Sydney Gateway	Western Harbour Tunnel	Beaches Link	F6 Extensions
2023							
No Build	Do Nothing	-	-	-	-	-	-
	Do Minimum	-	✓	-	-	-	-
Build	Do Something	✓	✓	-	-	-	-
	Do Something Plus	✓	✓	✓	✓	-	-
2033							
No Build	Do Nothing	-	-	-	-	-	-
	Do Minimum	-	✓	-	-	-	-
Build	Do Something	✓	✓	-	-	-	-
	Do Something Plus	✓	✓	✓	✓	✓	✓

Due to the short term nature of the 'Do Minimum' interim scenario, the assessment of project impacts and cumulative impacts uses the 'Do Nothing' traffic as the No Build baseline for the assessment.

4.3.6 Noise modelling parameters

Further details on the noise modelling parameters used in the assessment are shown in **Table 4-9**.

Table 4-9 Summary of noise model inputs and parameters

Input parameter	Source of data
Ground topography	The noise model includes a 'digital ground model' which is an accurate 3D representation of the terrain in the study area. The ground model was constructed from a combination of surveyed road corridor data and LIDAR point cloud data.
Buildings, receiver locations and floors	Buildings can provide screening to more distant locations of the project. The level of screening and associated noise attenuation is dependent on the height and width of the intervening buildings. The buildings in the noise model were generated from a combination of aerial photography and site inspections, with heights derived from LIDAR data. The model predicts noise to every facade of every identified receiver in the assessment area using the following heights: • Ground floor1 – 1.5 m • First floor1 – 4.3 m. All floors of multi-storey receivers are included in the assessment.
Study area	A 600 metre boundary width either side of the main project road alignment. A boundary length up to the physical extent of the works. While not required under the NCG, due to the relatively small gap between the Rozelle Interchange area and the Iron Cove interchange area, the length of the boundaries have been extended in order to include receivers on Victoria Road located between these two areas.
Assessment timeframes	The project is assessed 'at-opening' in 2023 and in the 'future design' year in 2033.
Traffic volumes	Existing traffic volumes were measured at the same time as the noise monitoring survey. This data was used to model the existing situation and validate the operational model. The predicted traffic volumes for the 2023 and 2033 assessment years were provided by the project team. All major roads in the study area were included in the noise model.
Vehicle speed	Existing vehicle speeds were measured during the noise monitoring survey and used to validate the noise model. Existing and future posted vehicle speeds were used in the operational assessment.
Source heights and source correction	Vehicles generally emit road traffic noise at four source heights. These are represented in the noise model by the following: • Cars (at 0.5 m height with a source correction of 0.0 dB) • Truck tyres (at 0.5 m height with a source correction of -5.4 dB) • Truck engines (at 1.5 m height with a source correction of -2.4 dB) • Truck exhausts (at 3.6 m height with a source correction of -8.5 dB).
Road surface corrections	The existing and proposed future road surface in the study area is Dense Grade Asphalt (DGA), which has a 0 dB surface correction.
Ground absorption	Noise levels at receivers can be influenced by the type of ground between the source of noise and the receiver. Soft ground such as vegetation can reduce noise to a greater degree than hard ground, such as concrete or road surfaces. A ground absorption factor of 50% has been used in the noise model for residential areas[2].

Input parameter	Source of data
General corrections	The model also includes the following corrections to convert the noise model outputs to the appropriate assessment noise levels: • Facade reflections +2.5 dB2 • LA10 to LAeq -3 dB2 • LAeq(15hour) to LAeq(1hour) +1.3 dB3 • LAeq(9hour) to LAeq(1hour) +5.2 dB3 • ARRB -1.7 dB for facade conditions • ARRB -0.7 dB for free-field conditions.

Notes:

1. These are typical heights above ground level, the height of some receivers were adjusted according to site survey information.
2. Taken from the Roads and Maritime *Model Validation Guideline*.
3. Derived from the monitoring data in **Section 2**. Corrections are based on the average difference between the peak 1 hour results and the corresponding daytime/night results, at monitoring locations R01 to R10 and I01 to I02.

4.3.7 Noise model validation

The validated EIS noise model was used to assess the proposed modification. Refer to the Noise and Vibration Technical Paper (Appendix J of the M4-M5 Link EIS) for model validation discussion.

4.3.8 Noise mitigation

The Roads and Maritime *Noise Mitigation Guideline* (NMG) provides guidance in managing and controlling road traffic noise and describes the principles to be applied when reviewing noise mitigation. The NMG recognises that the NCG criteria are not always practicable and that it is not always feasible or reasonable to expect that they are achieved.

As projects progress through the early design stages, various road design features are evaluated to assist with minimising road traffic noise. The NMG defines these 'integrated noise reduction measures' as including:

- Adjustments to vertical and horizontal alignments
- Road gradient modifications
- Traffic management.

Following use of the above measures, site specific 'additional noise mitigation measures' are then required to be investigated for receivers which have residual exceedances of the criteria. When evaluating if a receiver qualifies for consideration of 'additional noise mitigation measures' the NMG considers how far above the criterion the noise level is and also how much a project increases noise levels. These considerations provide a feasible and reasonable approach to identifying qualifying receivers.

The NMG provides three triggers where a receiver may qualify for consideration of 'additional noise mitigation' (beyond the use of 'integrated noise reduction measures'). These are:

- Trigger 1 – the predicted 'Build' noise level exceeds the NCG controlling criterion and the noise level increase due to the project (ie the noise predictions for the 'Build' minus the 'No Build') is greater than 2.0 dB
- Trigger 2 – the predicted 'Build' noise level is 5 dB or more above the NCG controlling criterion (ie exceeds the cumulative limit) and the receiver is significantly influenced by project road noise, regardless of the incremental impact of the project
- Trigger 3 – the noise level contribution from the road project is acute (daytime $L_{Aeq(15hour)}$ 65 dBA or higher, or night-time $L_{Aeq(9hour)}$ 60 dBA or higher) even if noise levels are controlled by a non-project road.

The eligibility of receivers for consideration of 'additional noise mitigation' is determined before the benefit of low noise pavement and noise barriers is included. The requirement for the project is to provide feasible and reasonable additional mitigation to eligible receivers with the aim of meeting the NCG controlling criterion.

For receivers that qualify for consideration of' additional noise mitigation', potential noise mitigation measures are to be considered in the following order of preference:

- At-source mitigation:
  - Quieter road pavement surfaces
- In-corridor mitigation:
  - Noise mounds
  - Noise barriers
- At-receiver mitigation:
  - At-property treatments.

4.3.9 Maximum noise levels

Maximum noise levels near to roads are generally controlled by noise from trucks. Where roads are located close to residential receivers there is potential for sleep disturbance impacts from maximum noise level events.

The RNP and ENMM both state that whilst a maximum noise level assessment is required to be undertaken for new and redeveloped road infrastructure projects, it should only be used as a tool to help prioritise and rank mitigation strategies and should not be applied as a decisive criterion. In situations where there may be impacts attributable to maximum noise events, traffic management or other long-term noise management opportunities should be investigated even if the $L_{Aeq(9hour)}$ noise level is less than the $L_{Aeq(9hour)}$ noise criterion. The purpose of a maximum noise level assessment is to determine where maximum noise levels are likely to change as a result of a project and may assist in managing the concerns of affected residents in localised areas where traffic is slow moving, accelerating and decelerating.

The maximum noise level assessment includes an evaluation of the number and distribution of night-time events in accordance with the ENMM. A maximum noise level event is defined as being any passby where:

- The maximum noise level of the event is greater than 65 dBA L_{AFmax}

  and

- The $L_{AFmax} – L_{Aeq(1hour)}$ is greater than or equal to 15 dB.

Existing maximum noise levels were monitored in the study area during the unattended noise monitoring survey (see **Section 6.2.6**). The potential for changes in maximum noise levels to nearby sensitive receivers are then evaluated where the project introduces new or redeveloped roads.

The potential for altered maximum noise levels from the project has been predicted using the same noise model as described in **Section 4.3.1**. The noise model uses a line string, with point source propagation to represent the location of trucks in both the Build (ie 'with project') and No Build (ie 'without project') scenarios. The difference between the Build and No Build is then evaluated to determine where the project may alter existing maximum noise levels.

5 Assessment of construction impacts

This assessment considers the potential impacts during construction of the proposed modification works only. These works are limited to the area near City West Link, The Crescent, Johnston Street and Chapman Road, as shown in **Figure 1-2**. The impacts from the approved project in the wider study area were discussed in detail in the EIS and are not considered further in this assessment.

5.1 Overview of construction impacts at residential receivers

The following impact assessment presents predicted noise impacts at the most affected receivers in each NCA and is representative of the worst-case situation where construction equipment is at the closest point to each receiver.

When reviewing the noise impacts it is important to take into account that for most works, the construction noise impacts would frequently be lower than predicted as the worst-case situation is typically only apparent for a relatively short period when noisy equipment is in use nearby. This concept is illustrated in **Figure 5-1** which shows indicative noise levels measured next to major construction works and how construction noise levels typically vary over the works period.

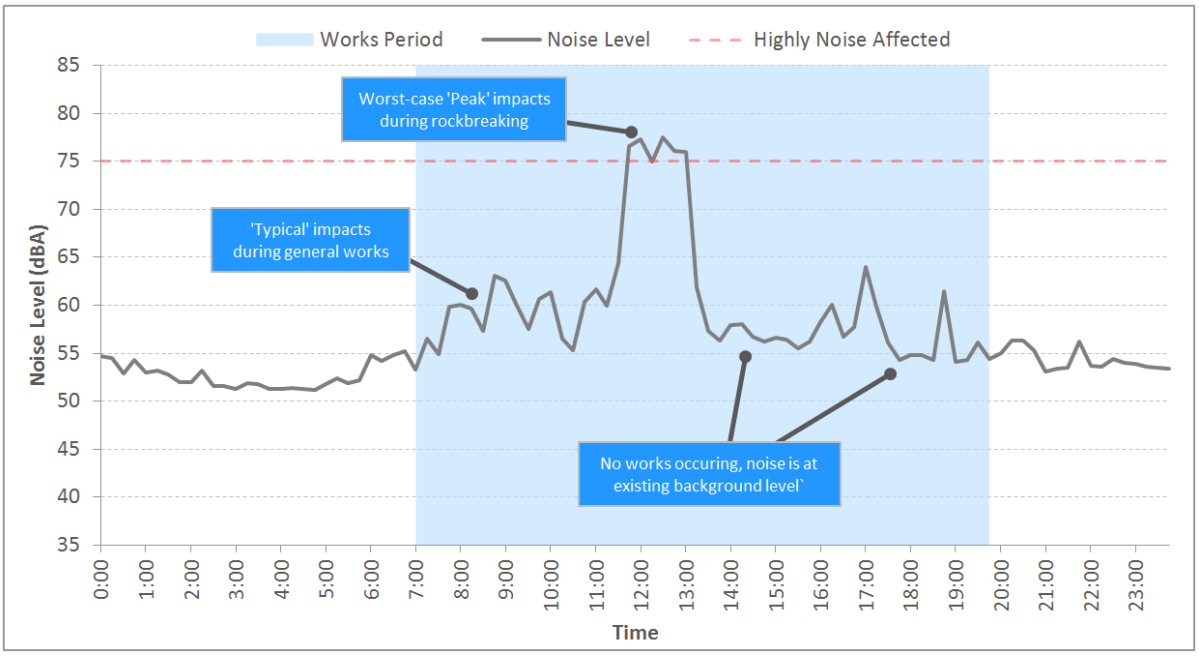


Figure 5-1 Example of indicative construction noise levels

In the above example, whilst the worst-case levels result in Highly Noise Affected impacts, these only last for part of the works period during the 'peak' impacts and the noise levels during the remaining works are generally much lower. There are also periods when no works are occurring, and noise levels are at the existing ambient noise level (eg road traffic and general urban hum).

5.2 Construction of The Crescent overpass, green link and shared user path bridge

Construction scenarios and work locations for the construction of The Crescent overpass, green link and shared user path bridge are presented in **Section 4.1.1**. The applicable NMLs for each NCA are presented in **Table 3-2** and **Table 3-3**.

5.2.1 Activity source noise levels

Sound power levels for the typical operation of construction equipment used in the modelling are listed in **Table 5-1** . The activities are representative of works which have the potential to impact nearby sensitive receivers.

Table 5-1 Activity sound power levels

Works ID	Activity (ie equipment split)	Equipment (realistic worst case)	Worst case items in same location	Sound power level (dBA)[1]		
				LWA		LWAmax
				Item	Activity[2]	Activity
1	Piling works	Piling rig (bored)	1	108	**113**	**118**
		Mobile crane	1	104		
		Shotcrete rig	1	106		
		Rock anchor drill	1	108		
		Concrete truck / agitator	1	106		
2	General Earthworks	Back hoe	1	102	**116**	**118**
		Excavator	1	109		
		Bobcat	1	104		
		Truck	1	98		
		Dozer	1	110		
		Grader	1	108		
		Generator	1	95		
		Vibratory roller	1	109		
		Water tanker	1	98		
3	Bridge work	Mobile crane	1	104	**111**	**115**
		Mobile crane	1	104		
		Truck	1	98		
		Excavator	1	109		
4	Concrete works	Concrete pump	1	106	**106**	**112**
		Concrete truck / agitator	1	106		
5	Roadworks	Slip Form Machine	1	102	**113**	**115**
		Bitumen Spray Truck	1	100		
		Roller (non-vibratory)[1]	1	100		
		Excavator (5t)	1	99		
		Concrete Truck / Agitator	1	106		
		Paving Machine	1	104		
		Water Tanker	1	98		
		Back Hoe	1	102		
		Truck	1	98		
		Suction Truck	1	100		
		Bobcat	1	104		
		Generator	1	101		
		Franna Crane	1	99		
		Kanga Hammer	1	105		
		Auger	1	103		
		Line Marking Plant	1	98		

1. In accordance with the EPA ICNG for activities identified as particularly annoying (such as jackhammering, rock-breaking and power saw operation), a 5 dBA 'penalty' is added to predicted noise levels when using the quantitative method.
2. Activity sound power levels account for the amount of time an item of plant is anticipated to operate within each 15 minute period.

5.2.2 Predicted noise levels

A summary of the predicted noise levels (without additional mitigation) in each of the NCAs for the various work activities is presented in **Table 5-3** for residential, commercial and 'other sensitive' receivers. The noise levels are representative of impacts where works are closest to each NCA and are intended to give an overview of the noise from the proposed works.

Shading in the following tables denotes the predicted noise levels based on the exceedance of the NML during that period and for that receiver type. A qualitative description of the NML exceedance bands is given below in **Table 5-2**, noting that the impact of these potential exceedances would depend on the period in which they were to occur (ie the night-time period is typically more sensitive to changes in noise levels than the daytime or evening for most people). The perception from the CNVG are also provided in the table.

Table 5-2 NML Exceedance Bands and Corresponding Subjective Response to Impacts

Exceedance of NML	Likely Subjective Response	CNVG Perception Category[1]	Shading
Compliance	Noticeable	Noticeable	
1 to 10 dB	Marginal to minor	Clearly Audible	
11 dB to 20 dB	Moderate	Moderately Intrusive	
>20 dB	High	Highly Intrusive	

1. Categories correspond to impacts from works during Standard Construction Hours.

For most construction activities, it is expected that the actual construction noise level would generally be lower than the worst-case prediction made at the most-exposed receiver. This is because noise level varies with the position of plant items and the distance to noise sensitive receivers as well as across different stages of construction.

The predicted NML exceedances in this area are summarised in **Table 5-4.** The assessment presented in this table takes into consideration the assessed construction scenarios in this area. The number of receivers predicted to experience exceedances of the NMLs is shown in bands and are separated into day, evening and night-time periods, as appropriate.

Table 5-3 Predicted worst case noise levels

NCA	NML	Predicted LAeq(15minute) Noise Level (dBA)[1]				
		W.0001 Piling works	W.0002 General earthworks	W.0003 Bridge works	W.0004 Concrete Works	W.0005 Roadworks
Residential - Standard Daytime						
NCA15	54	46	49	44	39	45
NCA16	64	45	48	43	38	45
NCA17	-	-	-	-	-	-
NCA18	-	-	-	-	-	-
NCA19	64	54	57	52	47	52
NCA20	54	47	50	45	40	47
NCA21	58	75	78	73	68	72
NCA22	-	-	-	-	-	-
NCA23	59	46	49	44	39	46
NCA24	64	57	60	55	50	56
NCA25	61	59	62	57	52	58
NCA26	-	-	-	-	-	-
NCA27	59	48	51	46	41	47
NCA28	55	<30	<30	<30	<30	<30
NCA29	71	45	48	43	38	45
NCA30	71	45	48	43	38	44
Residential - Evening						
NCA15	47	-	-	44	-	-
NCA16	57	-	-	43	-	-
NCA17	-	-	-	-	-	-
NCA18	-	-	-	-	-	-
NCA19	57	-	-	52	-	-
NCA20	47	-	-	45	-	-
NCA21	53	-	-	73	-	-
NCA22	-	-	-	-	-	-
NCA23	50	-	-	44	-	-
NCA24	57	-	-	55	-	-
NCA25	56	-	-	57	-	-
NCA26	-	-	-	-	-	-
NCA27	54	-	-	46	-	-
NCA28	45	-	-	<30	-	-
NCA29	65	-	-	43	-	-
NCA30	65	-	-	43	-	-
Residential - Night-time						
NCA15	40	-	-	44	-	-
NCA16	49	-	-	43	-	-
NCA17	-	-	-	-	-	-
NCA18	-	-	-	-	-	-
NCA19	49	-	-	52	-	-
NCA20	40	-	-	45	-	-
NCA21	47	-	-	73	-	-
NCA22	-	-	-	-	-	-
NCA23	41	-	-	44	-	-
NCA24	49	-	-	55	-	-
NCA25	50	-	-	57	-	-
NCA26	-	-	-	-	-	-
NCA27	47	-	-	46	-	-
NCA28	40	-	-	<30	-	-
NCA29	49	-	-	43	-	-
NCA30	49	-	-	43	-	-

NCA	NML	Predicted LAeq(15minute) Noise Level (dBA)1				
		W.0001 Piling works	W.0002 General earthworks	W.0003 Bridge works	W.0004 Concrete Works	W.0005 Roadworks
Commercial						
NCA15	70	40	43	38	33	40
NCA16	70	43	46	41	36	42
NCA17	70	42	45	40	35	<30
NCA18	70	-	-	-	-	-
NCA19	70	46	49	44	39	46
NCA20	70	43	46	41	36	43
NCA21	70	44	47	42	37	45
NCA22	70	-	-	-	-	-
NCA23	70	48	51	46	41	45
NCA24	70	53	56	51	46	53
NCA25	70	53	56	51	46	54
NCA26	70	76	79	74	69	64
NCA27	70	62	65	60	55	56
NCA28	70	<30	<30	<30	<30	<30
NCA29	70	44	47	42	37	44
NCA30	70	45	48	43	38	44
Other Sensitive						
NCA15	-Refer to note 2	<30	<30	<30	<30	<30
NCA16	-	42	45	40	35	42
NCA17	-	-	-	-	-	-
NCA18	-	-	-	-	-	-
NCA19	-	45	48	43	38	46
NCA20	-	40	43	38	33	40
NCA21	-	43	46	41	36	45
NCA22	-	-	-	-	-	-
NCA23	-	51	54	49	44	52
NCA24	-	55	58	53	48	54
NCA25	-	49	52	47	42	49
NCA26	-	-	-	-	-	-
NCA27	-	57	60	55	50	54
NCA28	-	-	-	-	-	-
NCA29	-	40	43	38	33	40
NCA30	-	43	46	41	36	43

Notes:

1. Colouring indicates the range of predicted worst case NML exceedances without any additional mitigation based on nearest receiver (red >20 dBA, orange 11-20 dBA, green 1-10 dBA) based on the controlling time period
2. The NML is dependent on the classification of a given sensitive receiver. As the table represents the highest predicted noise level for a particular activity, the most affected “other sensitive” receiver may change between each activity depending on the location of the works. No NMLs can be provided in this table for “other sensitive receivers as result of the various types of “other sensitive” receivers within each NCA which may be affected by different activities

Table 5-4 Overview of NML exceedances The Crescent overpass, green link and shared user path bridge

Activity ID	Activity	Weeks[1]	Activity duration within overall project program[2]				Number of receivers																
							Total	Highly noise affected[4]	NML exceedance receiver count[3]														
									Daytime			Daytime (out of hours)			Evening			Night-time			Sleep disturbance		
			25	50	75	100			1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA
1	Piling	48					5678	4	36	17	-	-	-	-	-	-	-	-	-	-	-	-	-
2	General earthworks	48					5678	13	55	18	-	-	-	-	-	-	-	-	-	-	-	-	-
3	Bridge works	61					5678	-	27	15	-	53	18	-	52	18	-	393	30	16	53	18	-
4	Concrete works	61					5678	-	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	Roadworks	61					5678	-	38	9	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes

1. Approximate overall duration of the activity in all areas of the site. The duration of these impacts is less than the overall duration, and depends on the rate of progress in the works areas
2. Approximate percentage (to nearest 1/8th of full project) of activity duration within overall proposal program. Where percentage is less than 1/8th of the overall program, 12.5 per cent is shown for illustrative purposes
3. Based on worst case noise works area (closest to receivers)
4. Based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater)

The above assessment for residential receivers shows that:

- The predicted daytime impacts are limited to NCA21 and NCA25. The other catchments either have no residential receivers or receivers are sufficiently far from the works to be compliant with the daytime NMLs.
- Worst-case noise levels at the nearest receivers are around 68 to 78 dBA. Worst-case noise levels in NCAs where receivers are more distant are typically around 45 to 55 dBA.
- The highest impacted residential receivers are in NCA21 (to the west of The Crescent) along Bayview Crescent where the nearest receivers are around 30 m from the works associated with the construction of The Crescent overpass.
- During the daytime, the worst-case impacts are predicted to be 'moderate' in NCA21 and 'minor' in NCA25, with noise levels expected to be compliant in all other catchments. During the night-time, the worst-case impacts are predicted to be 'high' in NCA21, with 'minor' impacts in the surrounding NCAs.
- Out of Hours (OOH) works are limited to bridgeworks which require the craning of bridge spans over trafficable lanes. Noise impacts associated with this scenario would be due to the use of large cranes and would only be required sporadically throughout the project. The impacts during this activity are more widespread, however they are predicted to generally be 'minor', with the exception of the nearest receivers in NCA21 which are predicted to have 'moderate' worst-case impacts during the noisiest works.

It is noted that some of the affected receivers are adjacent, or near, to major existing roads and are subject to relatively high existing noise levels. The operational road noise modelling (without the project) indicates that existing noise levels next to major roads are in the region of L_{Aeq} 60 to 65 dB during the daytime and 55 to 60 dB during the night-time. This is comparable to the predicted construction noise levels for many of the assessed work scenarios.

Noise management exceedance maps for all work activities are presented in **Figure 5-2** to **Figure 5-7.**

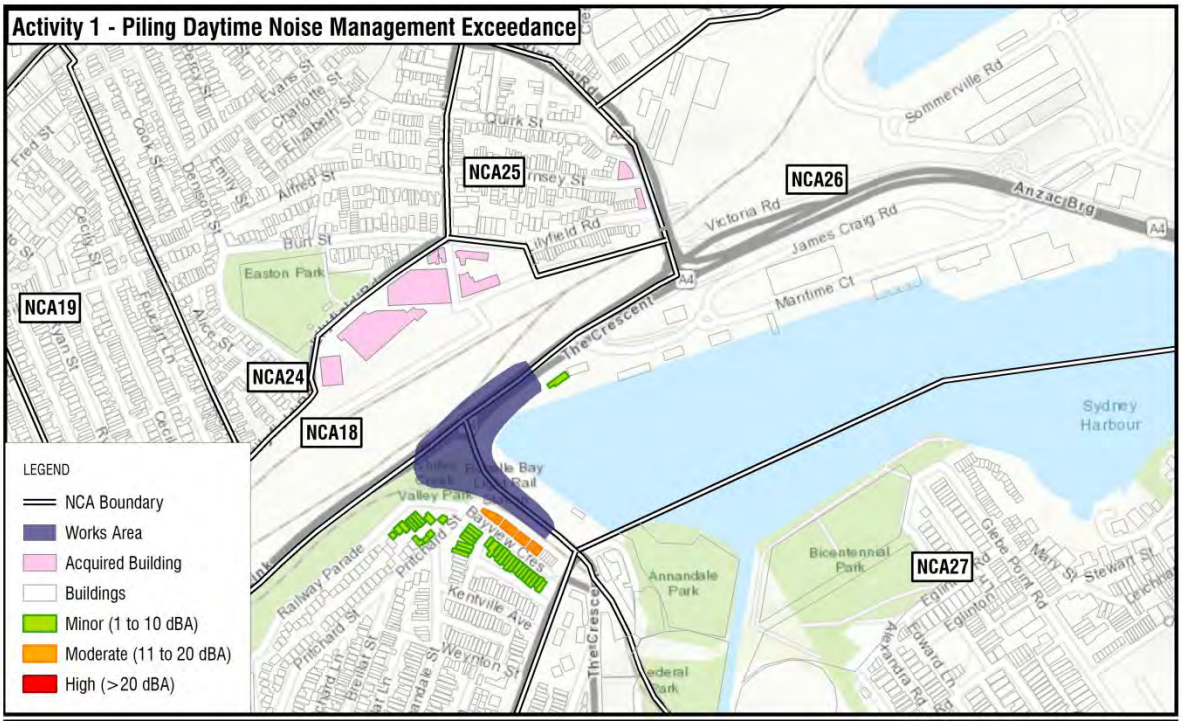


Figure 5-2 Activity 1 – Piling daytime NML exceedances

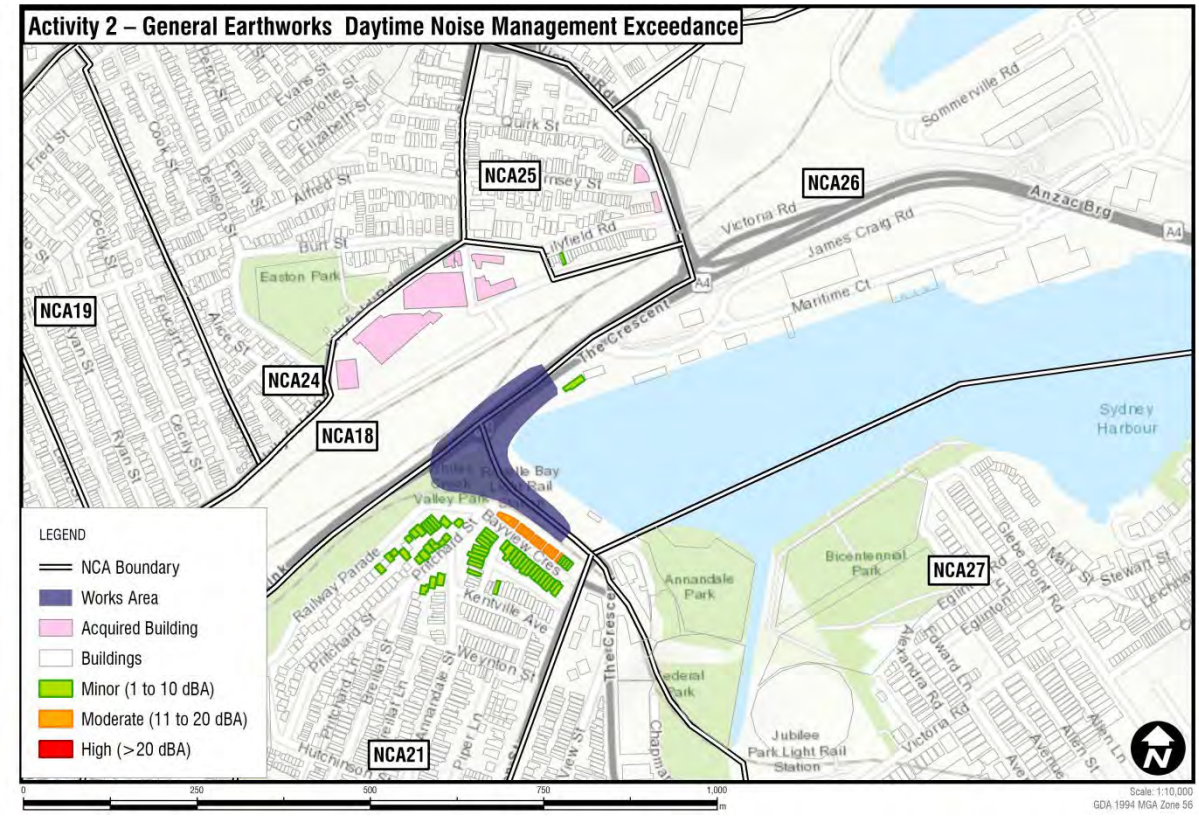


Figure 5-3 Activity 2 – General earthworks daytime NML exceedances

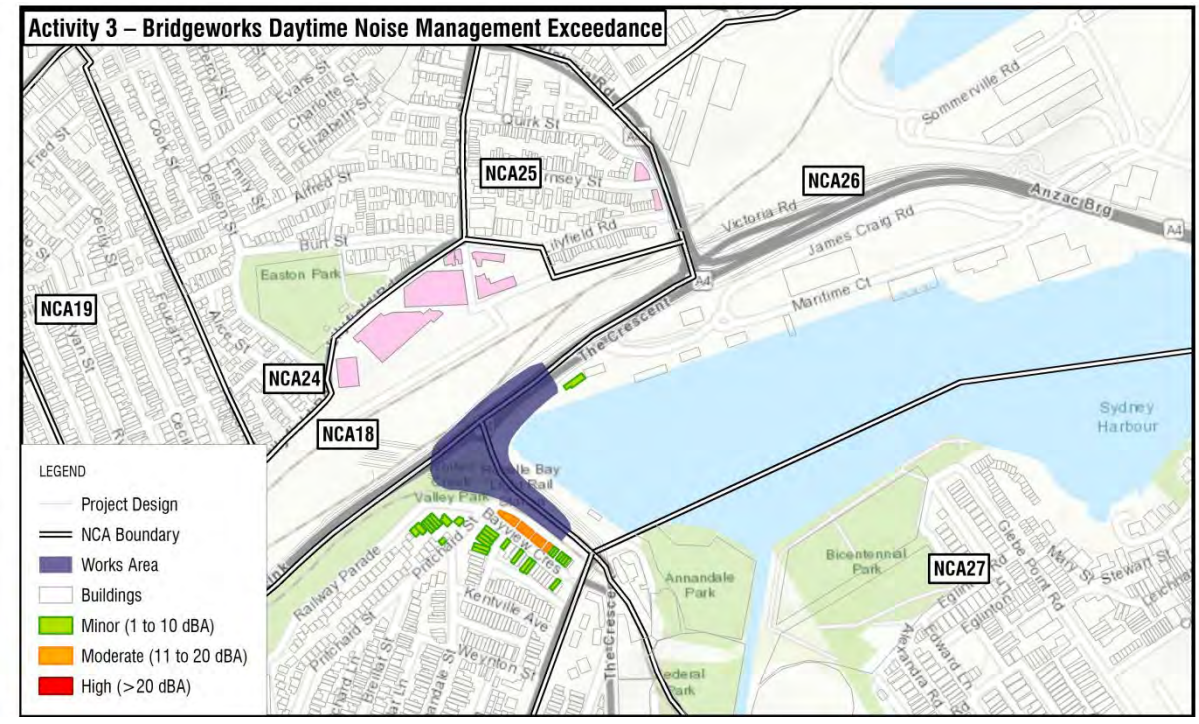


Figure 5-4 Activity 3 – Bridgeworks daytime NML exceedances

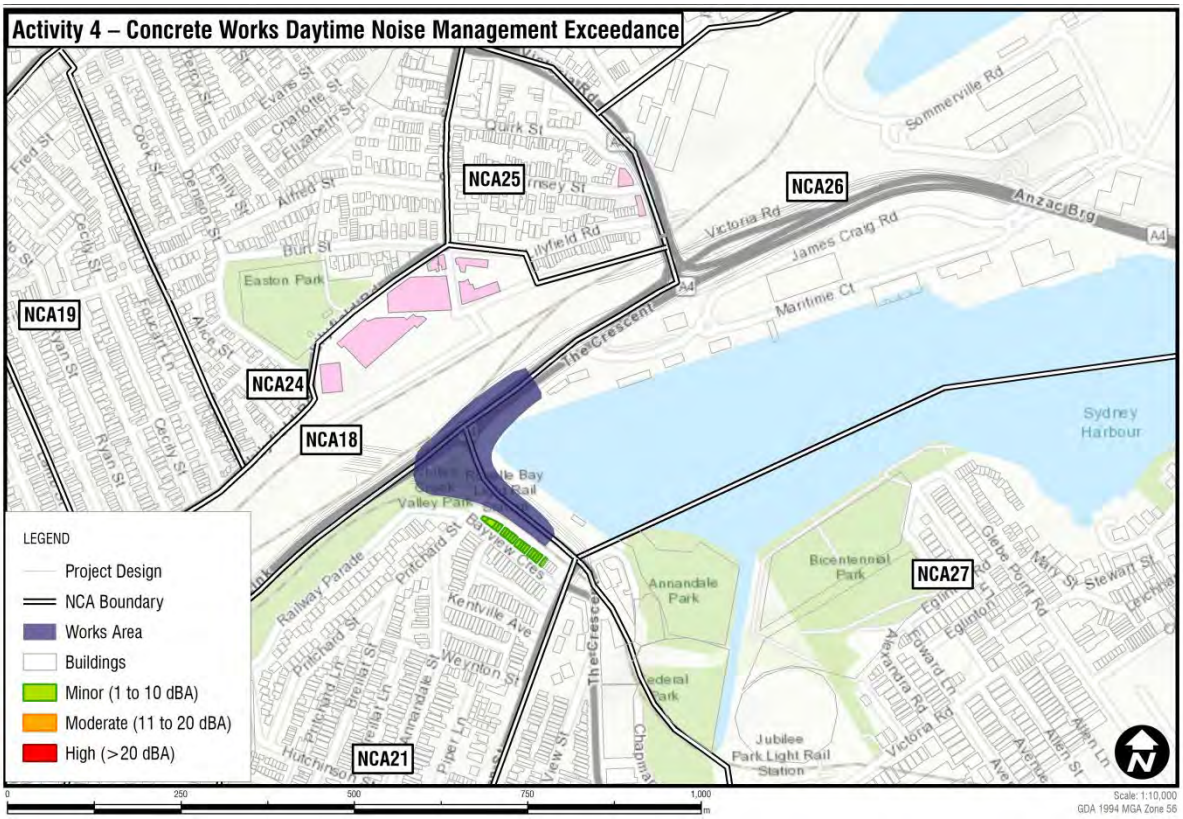


Figure 5-5 Activity 4 – Concrete works daytime NML exceedances

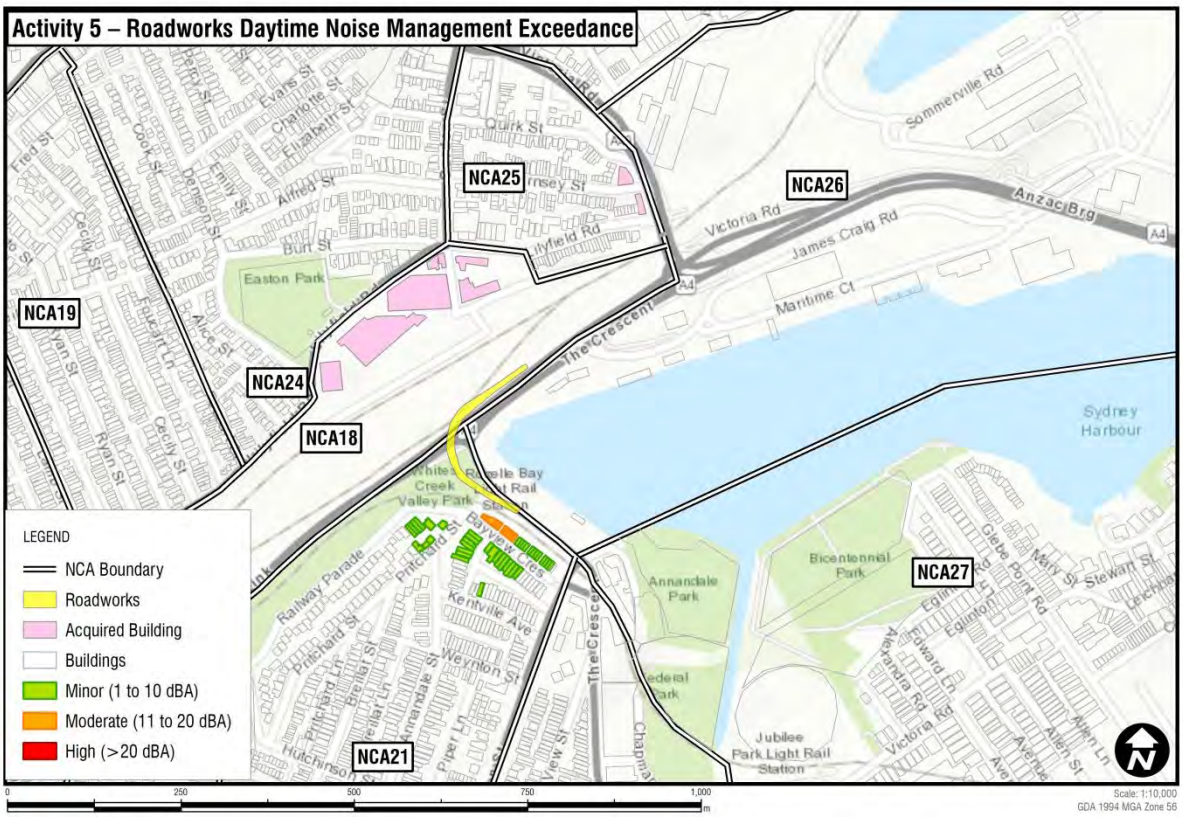


Figure 5-6 Activity 5 – Roadworks daytime NML exceedances

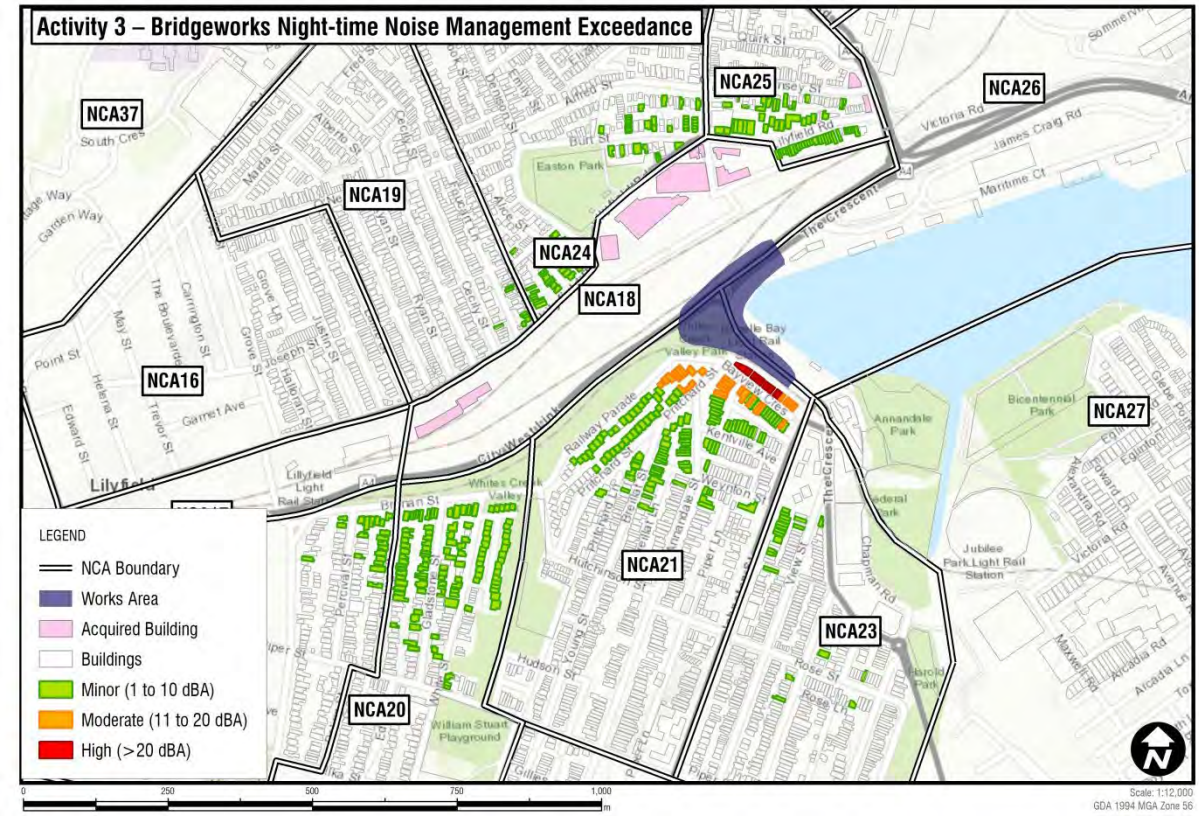


Figure 5-7 Activity 3 – Bridge works night-time NML exceedances

As shown above, the worst-case impacts are predicted at residential buildings situated between Bayview Crescent and Railway Parade in NCA21. The worst-case impacts at this location are predicted to be 'moderate' during the daytime and 'high' in night-time, however these impacts are generally limited to the first two rows of receivers which is consistent with the impacts presented in the EIS.

All construction works associated with the M4-M5 Link project are required to be completed in accordance with the project CoA. Conditions which relate directly to the works associated with the proposed modification are shown in **Section 3.2.2**. These include:

- E76 which requires appropriate respite periods to be identified and the community consulted with prior to any out of hours works which may require road occupancy or other works noted in E75
- E72 which defines the time periods as to when highly noise intensive works can be completed on the site.

Condition E87 requires mitigation in the form of 'at-property treatment' to be offered to habitable spaces identified within the Appendix D of the CoA. This condition is discussed further in the following section.

5.2.3 Out of hours works – Mitigation CoA 87

The purpose of Condition E87 is to provide mitigation for works occurring outside the nominated 'standard' construction hours. At-property treatments to mitigate noise impacts at residential and 'other sensitive' receivers are to be offered to properties identified within the 'treatment zones' in Appendix D of the CoA.

The zones were defined to include receivers that have potential to be impacted by long-term out of hours works (OOHWs) from the project. **Figure 5-8** shows the treatment zone in relation the proposed modification works.

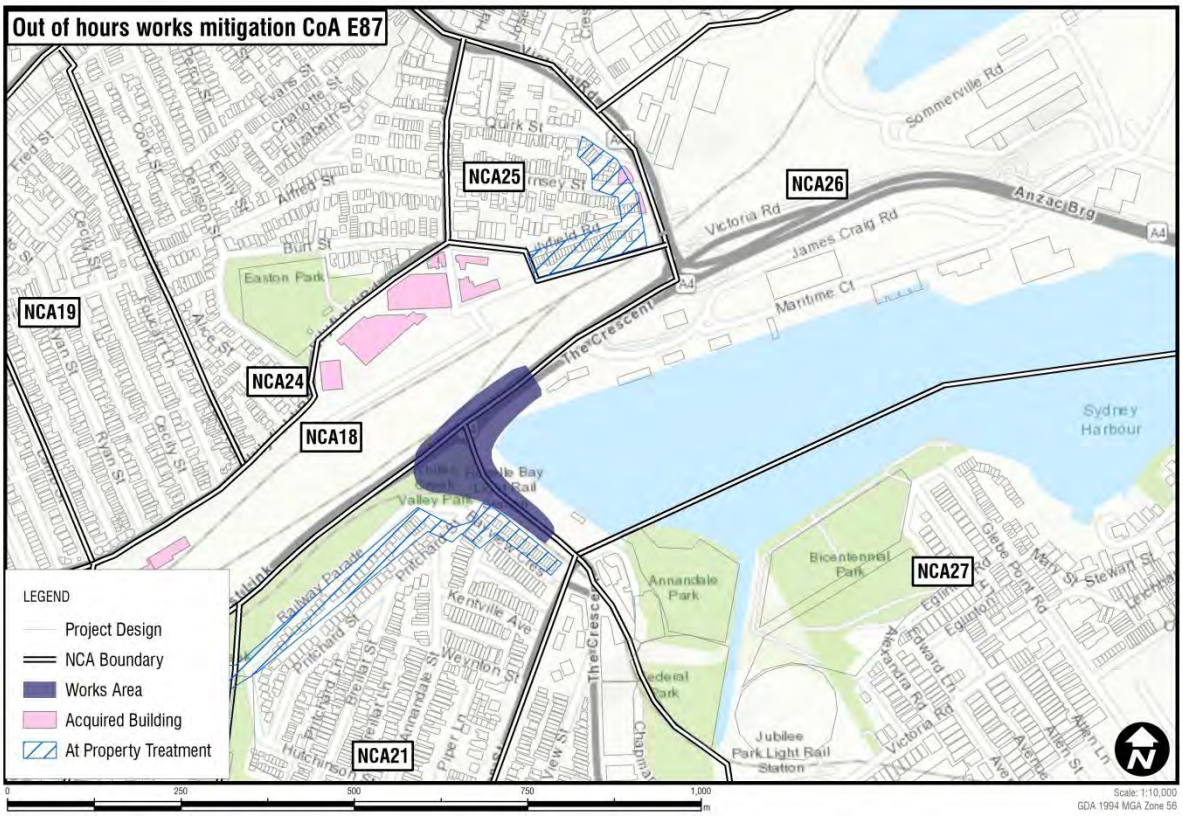


Figure 5-8 CoA 87 treatment zone and OOH bridge works impacts

As indicated in **Figure 5-8**, the proposed modification is adjacent to properties already identified in Appendix D of the project CoA and no additional receivers are predicted to be impacted by long-term works as a result of the construction of The Crescent overpass and the relocation of the green link and shared user path bridge.

5.2.4 Sleep disturbance

A sleep disturbance screening assessment has been undertaken for the construction works and a summary is provided in **Table 5-4**. A review of the predictions shows that the sleep disturbance screening criterion is likely to be exceeded when night works occur near residential receivers. The receivers potentially affected by sleep disturbance are generally consistent with those receivers where 'high' night-time impacts have been predicted (refer to **Figure 5-7)**.

The requirements for night-time works would be confirmed as the project progresses. Construction mitigation and management measures are discussed further in **Section 5.6**.

5.3 C6a construction ancillary facility

Construction scenarios and work locations for the proposed C6a construction facility site on The Crescent are presented in **Section 4.1.1**. The applicable NMLs for each NCA is presented in **Table 3-2** and **Table 3-3**.

5.3.1 Activity source noise levels

Sound power levels for the typical operation of construction equipment used in the modelling are listed in **Table 5-5** . The activities are representative of works which have the potential to impact nearby sensitive receivers.

Table 5-5 Activity sound power levels

Works ID	Activity (ie equipment split)	Equipment (realistic worst case)	Worst case items in same location	Sound power level (dBA)[1]		
				LWA		LWAmax
				Item	Activity[2]	Activity
6	Site clearing	Excavator	1	104	113	118
		Dozer	1	110		
		Grader	1	108		
		Dumper	1	95		
		Truck	1	98		
7	Installation of environment controls	Excavator	1	104	108	113
		Franna crane	1	99		
		Truck	1	98		
		Bobcat	1	104		
8	Establishment of construction facility	Exactor	1	109	114	117
		Back hoe	1	102		
		Mobile crane	1	100		
		Concrete Truck / agitator	1	106		
		Concrete pumps	1	106		
		Piling rig (bored)	1	108		
		Roller (non vibratory)	1	100		
		Water tanker	1	98		
		Bobcat	1	104		
		Truck	1	103		
9	Site Operation	Air Conditioning	1	63	97	108
		Car parking	3	94		
		Franna crane	1	99		
		Truck – Rigid	1	98		

1. In accordance with the EPA ICNG for activities identified as particularly annoying (such as jackhammering, rock-breaking and power saw operation), a 5 dBA 'penalty' is added to predicted noise levels when using the quantitative method.
2. Activity sound power levels account for the amount of time an item of plant is anticipated to operate within each 15 minute period.

5.3.2 Predicted noise levels

A summary of the predicted noise levels (without additional mitigation) in each of the NCAs for the various work activities is presented in **Table 5-6** for residential, commercial and other sensitive receivers. The noise levels are representative of impacts where works are closest to each NCA and are intended to give an overview of the noise from the proposed works.

Shading in the following tables denotes the predicted noise levels based on the exceedance of the NML during that period and for that receiver type.

For most construction activities, it is expected that the actual construction noise level would generally be lower than the worst-case prediction made at the most-exposed receiver. This is because noise level varies with the position of plant items and the distance to noise sensitive receivers as well as across different stages of construction.

The predicted NML exceedances in this area are summarised in **Table 5-7.** The assessment presented in this table takes into consideration the assessed construction scenarios in this area. The number of receivers predicted to experience exceedances of the NMLs is shown in bands and are separated into day, evening and night-time periods, as appropriate.

Table 5-6 Predicted worst case noise levels

NCA	NML	Predicted LAeq(15minute) Noise Level (dBA)[1]			
		W.0006 Site clearing	W.0007 Installation of environment controls	W.0008 Establishment of construction facility	W.0009 Site Operation
Residential - Standard Daytime					
NCA15	54	45	40	46	<30
NCA16	64	44	39	45	<30
NCA17	-	-	-	-	-
NCA18	-	-	-	-	-
NCA19	64	52	47	53	36
NCA20	54	46	41	47	<30
NCA21	58	62	57	63	46
NCA22	-	-	-	-	-
NCA23	59	45	40	46	<30
NCA24	64	55	50	56	39
NCA25	61	56	51	57	40
NCA26	-	-	-	-	-
NCA27	59	47	42	48	<30
NCA28	55	<30	<30	<30	<30
NCA29	71	45	40	46	<30
NCA30	71	45	40	46	<30
Residential - Evening					
NCA15	47	-	-	-	<30
NCA16	57	-	-	-	<30
NCA17	-	-	-	-	-
NCA18	-	-	-	-	-
NCA19	57	-	-	-	36
NCA20	47	-	-	-	<30
NCA21	53	-	-	-	46
NCA22	-	-	-	-	-
NCA23	50	-	-	-	<30
NCA24	57	-	-	-	39
NCA25	56	-	-	-	40
NCA26	-	-	-	-	-
NCA27	54	-	-	-	<30
NCA28	45	-	-	-	<30
NCA29	65	-	-	-	<30
NCA30	65	-	-	-	<30
Residential - Night-time					
NCA15	40	-	-	-	<30
NCA16	49	-	-	-	<30
NCA17	-	-	-	-	-
NCA18	-	-	-	-	-
NCA19	49	-	-	-	36
NCA20	40	-	-	-	<30
NCA21	47	-	-	-	46
NCA22	-	-	-	-	-
NCA23	41	-	-	-	<30
NCA24	49	-	-	-	39
NCA25	50	-	-	-	40
NCA26	-	-	-	-	-
NCA27	47	-	-	-	<30
NCA28	40	-	-	-	<30
NCA29	49	-	-	-	<30
NCA30	49	-	-	-	<30

NCA	NML	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)[1]			
		W.0006 Site clearing	W.0007 Installation of environment controls	W.0008 Establishment of construction facility	W.0009 Site Operation
Commercial					
NCA15	70	39	34	40	<30
NCA16	70	41	36	42	<30
NCA17	70	41	36	42	<30
NCA18	70	-	-	-	-
NCA19	70	45	40	46	<30
NCA20	70	42	37	43	<30
NCA21	70	43	38	44	<30
NCA22	70	-	-	-	-
NCA23	70	46	41	47	<30
NCA24	70	52	47	53	36
NCA25	70	52	47	53	36
NCA26	70	62	57	63	46
NCA27	70	53	48	54	37
NCA28	70	<30	<30	<30	<30
NCA29	70	42	37	43	<30
NCA30	70	45	40	46	<30
Other Sensitive					
NCA15	Refer to Note 2	<30	<30	<30	<30
NCA16	-	41	36	42	<30
NCA17	-	-	-	-	-
NCA18	-	-	-	-	-
NCA19	-	45	40	46	<30
NCA20	-	38	33	39	<30
NCA21	-	41	36	42	<30
NCA22	-	-	-	-	-
NCA23	-	50	45	51	<30
NCA24	-	53	48	54	37
NCA25	-	48	43	49	<30
NCA26	-	-	-	-	-
NCA27	-	51	46	52	35
NCA28	-	-	-	-	-
NCA29	-	37	32	38	<30
NCA30	-	43	38	44	<30

Notes:

1. Colouring indicates the range of predicted worst case NML exceedances without any additional mitigation based on nearest receiver (red >20 dBA, orange 11-20 dBA, green 1-10 dBA) based on the controlling time period
2. The NML is dependent on the classification of a given sensitive receiver. As the table represents the highest predicted noise level for a particular activity, the most affected “other sensitive” receiver may change between each activity depending on the location of the works. No NMLs can be provided in this table for “other sensitive receivers as result of the various types of “other sensitive” receivers within each NCA which may be affected by different activities

Table 5-7 Overview of NML exceedances for the C6a construction ancillary facility site

Activity ID	Activity	Weeks[1]	Activity duration within overall project program[2]				Number of receivers																
							Total	Highly noise affected[4]	NML exceedance receiver count[3]														
									Daytime			Daytime (out of hours)			Evening			Night-time			Sleep disturbance		
			25	50	75	100			1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA
6	Site clearing	8					5678	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7	Installation of environmental controls	3					5678	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	Establishment of construction facility	20					5678	-	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	Site operation	130					5678	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes

1. Approximate overall duration of the activity in all areas of the site. The duration of these impacts is less than the overall duration, and depends on the rate of progress in the works areas
2. Approximate percentage (to nearest 1/8th of full project) of activity duration within overall proposal program. Where percentage is less than 1/8th of the overall program, 12.5 per cent is shown for illustrative purposes
3. Based on worst case noise works area (closest to receivers)
4. Based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater)

The above assessment for residential receivers shows that:

- The impacts are limited to NCA21. The other catchments either have no residential receivers or receivers are sufficiently far from the works to generally be compliant with the NMLs.
- During the daytime, the worst-case impacts are predicted to be 'minor' in NCA21, with noise levels expected to be compliant in all other catchments. During the night-time, the worst-case impacts are predicted to be compliant across all catchments.

Noise management exceedance maps for all work activities are presented in **Figure 5-9** and **Figure 5-10**.

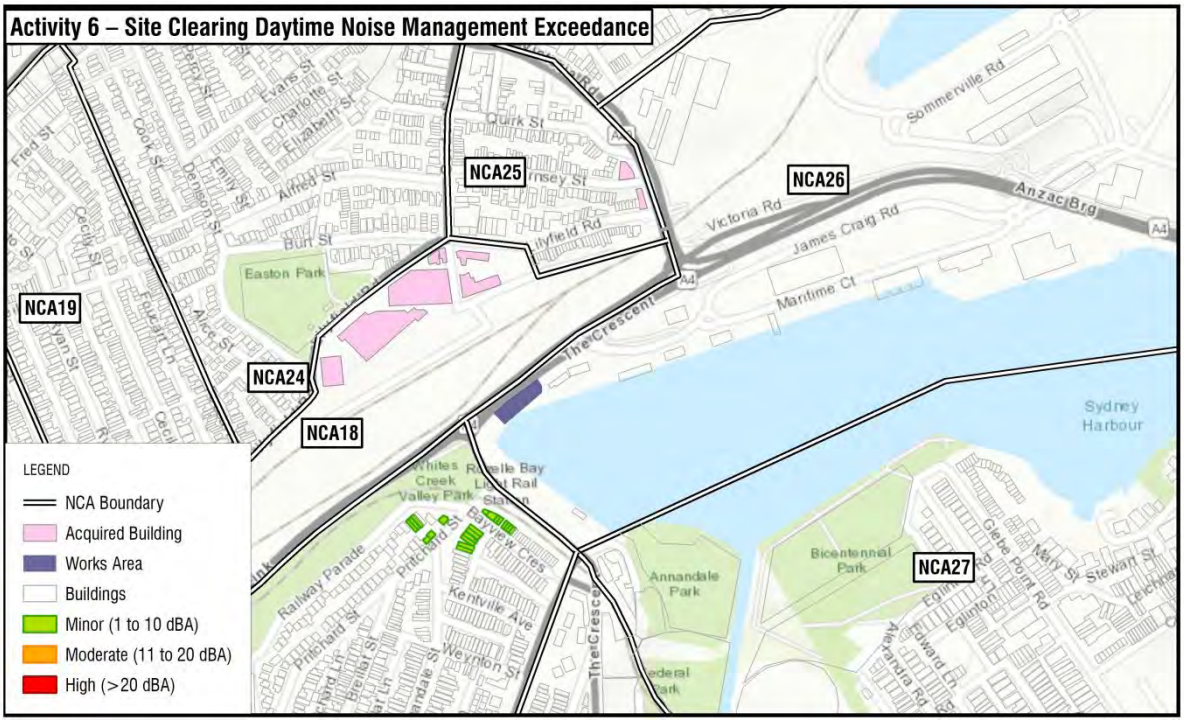


Figure 5-9 Activity 6 – Site clearing daytime NML exceedances

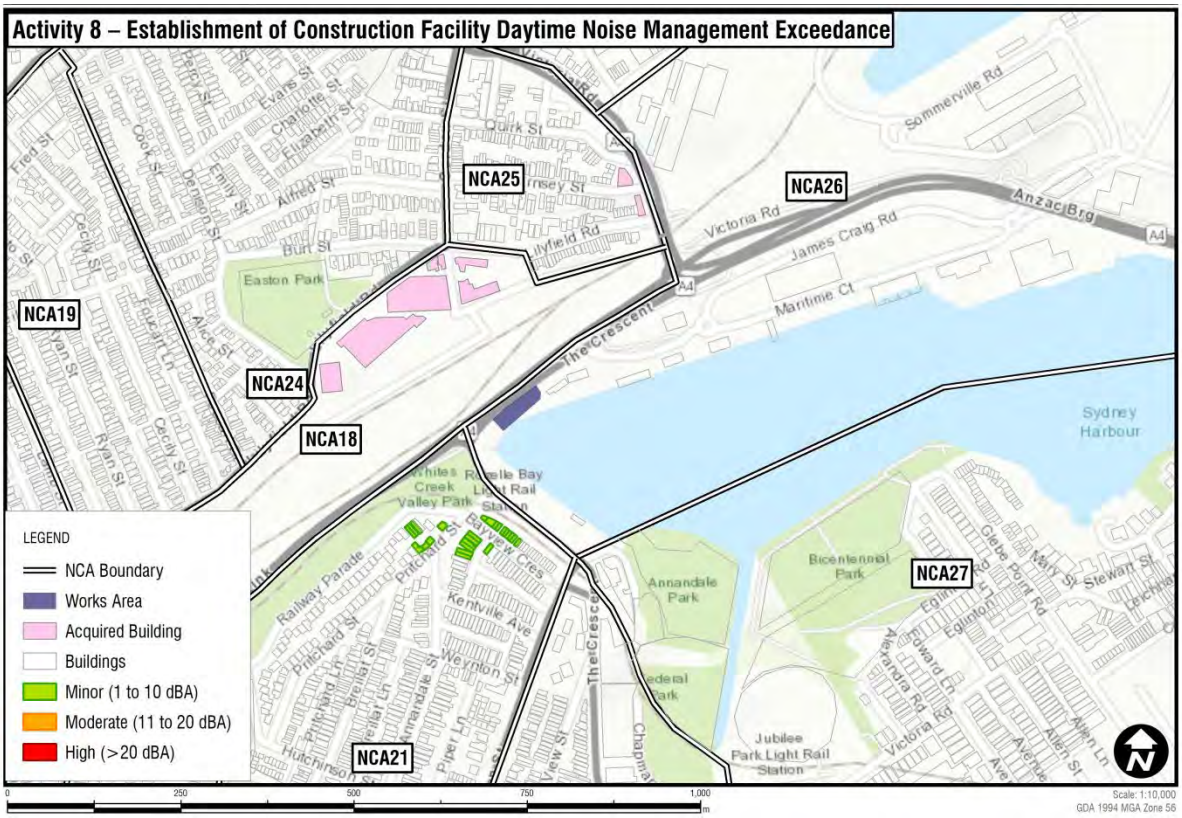


Figure 5-10 Activity 8 – Establishment of construction facilities daytime NML exceedances

As shown above, the worst-case impacts are predicted at residential buildings situated between Bayview Crescent and Railway Parade in NCA21. The worst-case impacts are predicted to be 'minor' and are generally limited to the first two rows of receivers.

As per all construction works associated with the M4-M5 Link project, the works are required to be completed in accordance with the project CoA. Conditions which relate directly to the works associated with the proposed modification are shown in **Section 3.2.2**.

Condition E87 requires mitigation in the form of 'at-property treatment' to be offered to habitable spaces identified within the Appendix D of the CoA. This condition is discussed in detail in the following section.

5.3.3 Out of hours works – Mitigation CoA 87

As indicated in **Table 5-7** the proposed modification does not result in any exceedances of the out of hours NMLs for the proposed construction ancillary facility (C6a). Therefore, there is no change to the properties identified within Appendix D of the CoA for these works.

It is noted that the receivers predicted to experience 'minor' daytime noise impacts from the works are generally within the CoA E87 treatment boundary.

5.3.4 Sleep disturbance

A sleep disturbance screening assessment has been undertaken for the construction works and a summary is provided in **Table 5-7**. A review of the predictions shows that the sleep disturbance screening criterion is not likely to be exceeded when night works occur and as such no further assessment is required.

5.4 The Crescent, Chapman Road and Johnston Street intersection works

Construction scenarios and work locations for the works at the intersection of The Crescent, Chapman Road and Johnston Street are presented in **Section 4.1.1**. The applicable NML for each NCA is presented in **Table 3-2** and **Table 3-3**.

5.4.1 Activity source noise levels

Sound power levels for the typical operation of construction equipment used in the modelling are listed in **Table 5-8**. The activities are representative of works which have the potential to impact nearby sensitive receivers.

Table 5-8 Activity sound power levels

Works ID	Activity (ie equipment split)	Equipment (realistic worst case)	Worst case items in same location	Sound power level (dBA)[1]		
				LWA		LWAmax
				Item	Activity[2]	Activity
10	General Earthworks (Johnston Street, Chapman Road and The Crescent intersection upgrade)	Back hoe	1	102	**116**	**118**
		Excavator	1	109		
		Bobcat	1	104		
		Truck	1	98		
		Dozer	1	110		
		Grader	1	108		
		Generator	1	95		
		Vibratory roller	1	109		
		Water tanker	1	98		
11	Roadworks (Johnston Street, Chapman Road and The Crescent intersection upgrade)	Slip Form Machine	1	102	**113**	**115**
		Bitumen Spray Truck	1	100		
		Roller (non-vibratory)[1]	1	100		
		Excavator (5t)	1	99		
		Concrete Truck / Agitator	1	106		
		Paving Machine	1	104		
		Water Tanker	1	98		
		Back Hoe	1	102		
		Truck	1	98		
		Suction Truck	1	100		
		Bobcat	1	104		
		Generator	1	101		
		Franna Crane	1	99		
		Kanga Hammer	1	105		
		Auger	1	103		
		Line Marking Plant	1	98		

1. In accordance with the EPA ICNG for activities identified as particularly annoying (such as jackhammering, rock-breaking and power saw operation), a 5 dBA 'penalty' is added to predicted noise levels when using the quantitative method.
2. Activity sound power levels account for the amount of time an item of plant is anticipated to operate within each 15 minute period.

5.4.2 Predicted noise levels

A summary of the predicted noise levels (without additional mitigation) in each of the NCAs for the assessed work activities is presented in **Table 5-9** for residential, commercial and 'other sensitive' receivers. The noise levels are representative of impacts where works are closest to each NCA and are intended to give an overview of the noise from the proposed works.

Shading in the following tables denotes the predicted noise levels based on the exceedance of the NML during that period and for that receiver type.

For most construction activities, it is expected that the actual construction noise level would generally be lower than the worst-case prediction made at the most-exposed receiver. This is because noise level varies with the position of plant items and the distance to noise sensitive receivers as well as across different stages of construction.

The predicted NML exceedances in this area are summarised in **Table 5-10.** The assessment presented in this table takes into consideration the assessed construction scenarios in this area. The number of receivers predicted to experience exceedances of the NMLs is shown in bands and are separated into day, evening and night-time periods, as appropriate.

Table 5-9 Predicted worst case noise levels

NCA	NML	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)[1]	
		W.0010 **General Earthworks** (Johnston Street, Chapman Road and The Crescent intersection upgrade)	W.0011 **Roadworks** (Johnston Street, Chapman Road and The Crescent intersection upgrade)
Residential - Standard Daytime			
NCA15	54	36	33
NCA16	64	41	38
NCA17	-	-	-
NCA18	-	-	-
NCA19	64	47	44
NCA20	54	36	33
NCA21	58	80	77
NCA22	-	-	-
NCA23	59	60	57
NCA24	64	53	50
NCA25	61	53	50
NCA26	-	-	-
NCA27	59	52	49
NCA28	55	<30	<30
NCA29	71	45	42
NCA30	71	44	41
Residential - Evening			
NCA15	47	-	33
NCA16	57	-	38
NCA17	-	-	-
NCA18	-	-	-
NCA19	57	-	44
NCA20	47	-	33
NCA21	53	-	77
NCA22	-	-	-
NCA23	50	-	57
NCA24	57	-	50
NCA25	56	-	50
NCA26	-	-	-
NCA27	54	-	49
NCA28	45	-	<30
NCA29	65	-	42
NCA30	65	-	41
Residential - Night-time			
NCA15	40	-	33
NCA16	49	-	38
NCA17	-	-	-
NCA18	-	-	-
NCA19	49	-	44
NCA20	40	-	33
NCA21	47	-	77
NCA22	-	-	-
NCA23	41	-	57
NCA24	49	-	50

NCA	NML	Predicted $L_{Aeq(15minute)}$ Noise Level (dBA)[1]	
		W.0010 **General Earthworks** (Johnston Street, Chapman Road and The Crescent intersection upgrade)	W.0011 **Roadworks** (Johnston Street, Chapman Road and The Crescent intersection upgrade)
NCA25	50	-	50
NCA26	-	-	-
NCA27	47	-	49
NCA28	40	-	<30
NCA29	49	-	42
NCA30	49	-	41
Commercial			
NCA15	70	34	31
NCA16	70	33	30
NCA17	70	32	<30
NCA18	70	-	-
NCA19	70	44	41
NCA20	70	32	<30
NCA21	70	50	47
NCA22	70	-	-
NCA23	70	61	58
NCA24	70	48	45
NCA25	70	49	46
NCA26	70	58	55
NCA27	70	83	80
NCA28	70	<30	<30
NCA29	70	46	43
NCA30	70	42	39
Other Sensitive			
NCA15	-	<30	<30
NCA16	-	<30	<30
NCA17	-	-	-
NCA18	-	-	-
NCA19	-	40	37
NCA20	-	31	<30
NCA21	-	48	45
NCA22	-	-	-
NCA23	-	81	78
NCA24	-	50	47
NCA25	-	48	45
NCA26	-	-	-
NCA27	-	62	59
NCA28	-	-	-
NCA29	-	41	38
NCA30	-	<30	<30

Notes:

1. Colouring indicates the range of predicted worst case NML exceedances without any additional mitigation based on nearest receiver (red >20 dBA, orange 11-20 dBA, green 1-10 dBA) based on the controlling time period
2. The NML is dependent on the classification of a given sensitive receiver. As the table represents the highest predicted noise level for a particular activity, the most affected "other sensitive" receiver may change between each activity depending on the location of the works. No NMLs can be provided in this table for "other sensitive receivers as result of the various types of "other sensitive" receivers within each NCA which may be affected by different activities

Table 5-10 Overview of NML exceedances for The Crescent, Chapman Road and Johnston Street intersection works

Activity ID	Activity	Weeks[1]	Activity duration within overall project program[2]				Number of receivers																
							Total	Highly noise affected[4]	NML exceedance receiver count[3]														
									Daytime			Daytime (out of hours)			Evening			Night-time			Sleep disturbance		
			25	50	75	100			1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA	1-10 dBA	11-20 dBA	>20 dBA
10	General earthworks (Johnston Street, Chapman Road and The Crescent intersection upgrade)	100					5678	3	46	12	4	-	-	-	-	-	-	-	-	-	-	-	-
11	Roadworks (Johnston Street, Chapman Road and The Crescent intersection upgrade)	100					5678	1	35	5	2	75	17	2	96	20	1	363	66	6	120	15	1

Notes

1. Approximate overall duration of the activity in all areas of the site. The duration of these impacts is less than the overall duration, and depends on the rate of progress in the works areas
2. Approximate percentage (to nearest 1/8th of full project) of activity duration within overall proposal program. Where percentage is less than 1/8th of the overall program, 12.5 per cent is shown for illustrative purposes
3. Based on worst case noise works area (closest to receivers)
4. Based on ICNG definition (ie predicted $L_{Aeq(15minute)}$ noise at residential receiver is 75 dBA or greater)

The above assessment for residential receivers shows that:

- The impacts are generally limited to NCA21, NCA23 and NCA27. The other catchments either have no residential receivers or receivers are sufficiently far from the works to generally be compliant with the NMLs.
- Worst-case noise levels at the nearest receivers are around 78 to 80 dBA. Worst-case noise levels in NCAs where receivers are more distant are typically around 45 to 57 dBA.
- The highest impacted residential receivers are in NCA21, along Bayview Crescent and Bayview Lane, and where receivers adjoin the project on Johnston Street.
- During the daytime, the worst-case impacts are predicted to be 'moderate' to 'high' in NCA21 and 'minor' in NCA23. Noise levels are generally expected to be compliant in all other catchments. During the night-time, the worst-case impacts are predicted to be 'high' in NCA21, 'moderate' in NCA23 and 'minor' in the surrounding NCAs.
- Noise impacts are predicted at the Petersham College, Annandale TAFE during the daytime period.
- Out of Hours (OOH) works are limited to roadworks which may be required where the upgrade ties into trafficable lanes. Noise impacts associated with this construction activity would be due to a mix of plant operating simultaneously. The impacts during this activity are more widespread, however they are generally predicted to be 'moderate' or 'minor', with the exception of the nearest receivers in NCA21 which are predicted to have 'high' worst-case impacts during the noisiest works.

It is noted that some of the affected receivers are adjacent, or near, to major existing roads and are subject to relatively high existing noise levels. The operational road noise modelling (without the project) indicates that existing noise levels next to major roads are in the region of L_{Aeq} 60 to 65 dB during the daytime and 55 to 60 dB during the night-time. This is comparable to the predicted construction noise levels for many of the assessed work scenarios.

The predicted NML exceedances are shown for each activity in **Figure 5-11** to **Figure 5-13**.

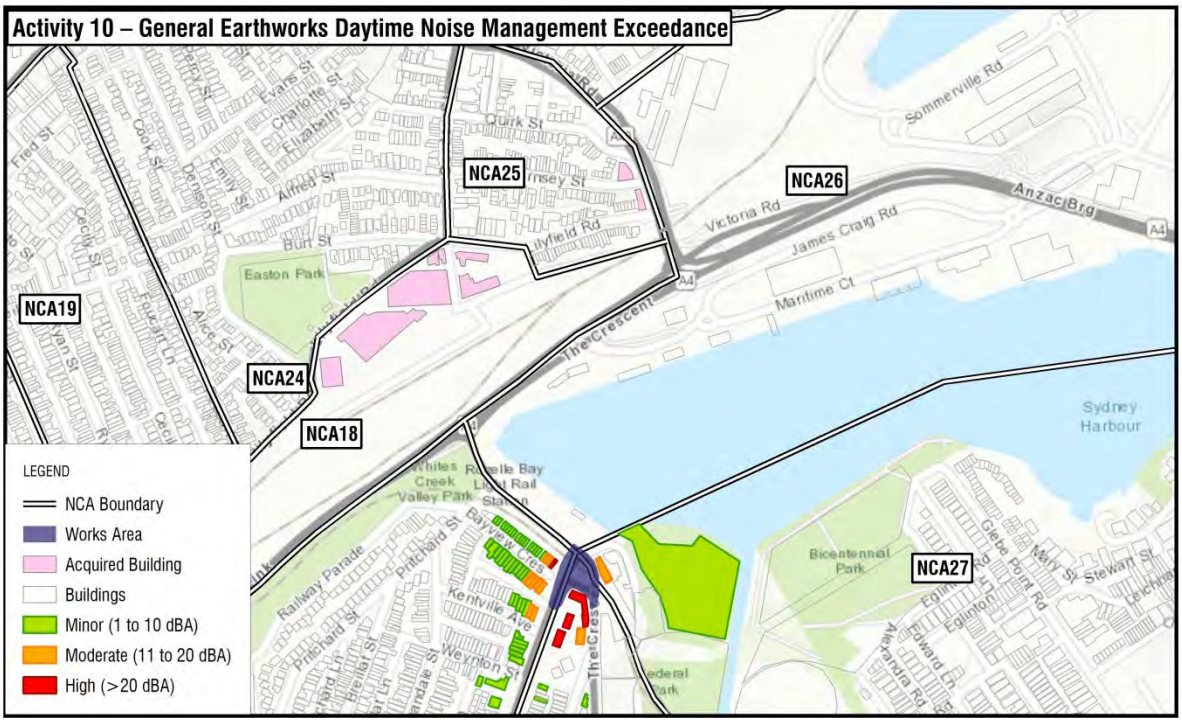


Figure 5-11 Activity 10 – General earthworks daytime NML exceedances

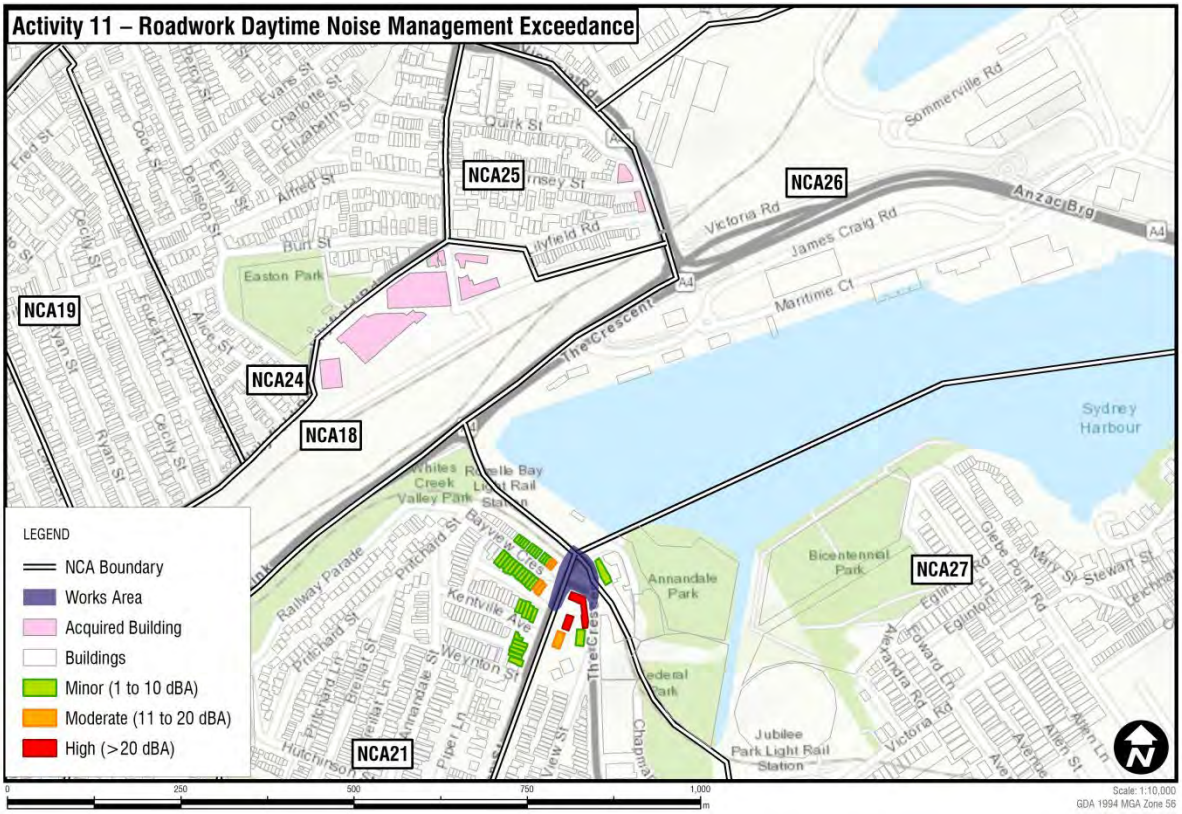


Figure 5-12 Activity 11 – Roadworks daytime NML exceedances

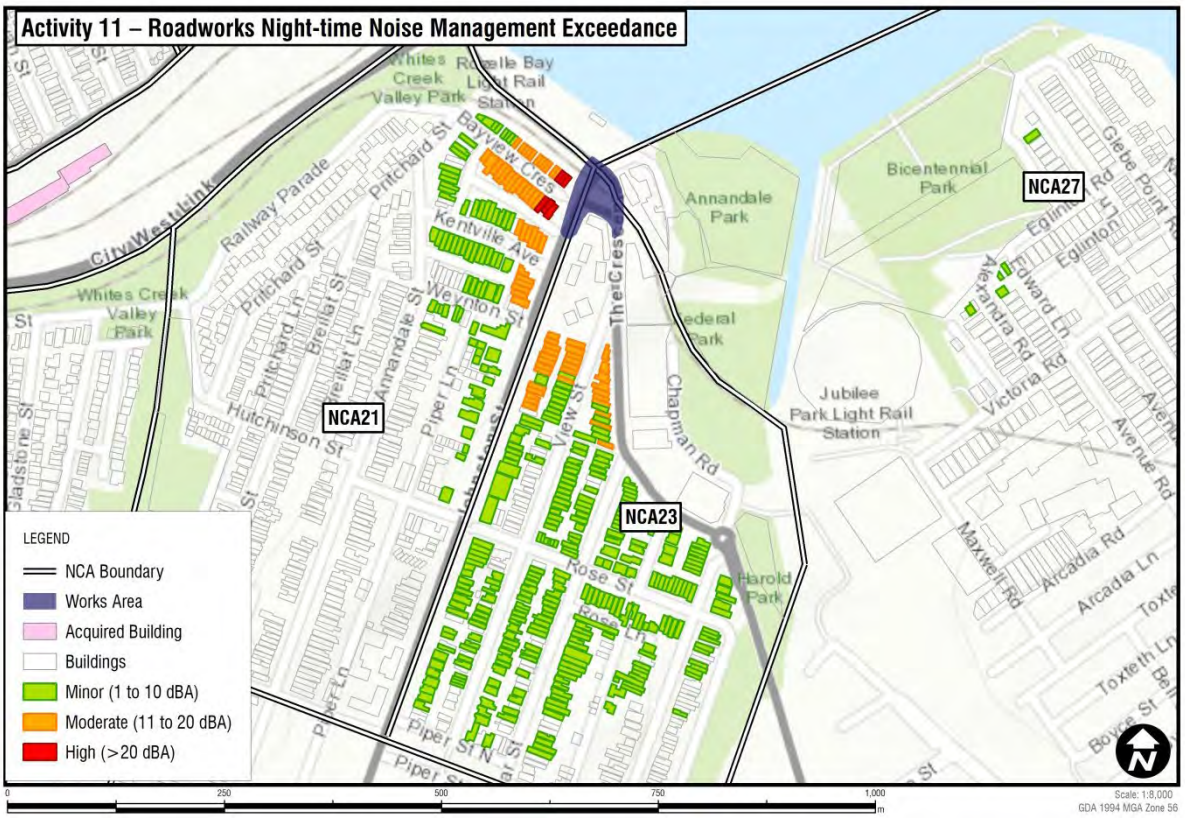


Figure 5-13 Activity 11 – Roadworks night-time NML exceedances

As shown above, the worst-case impacts are predicted at residential buildings situated between Bayview Crescent, Kentville Avenue and along Johnston Street in NCA21 and NCA23.

All construction works associated with the M4-M5 Link project are required to be completed in accordance with the project CoA. Conditions which relate directly to the works associated with the proposed modification are shown in **Section 3.2.2**. These include:

- E76 which requires appropriate respite periods to be identified and the community consulted with prior to any out of hours works which may require road occupancy or other works noted in E75
- E72 which defines the time periods as to when highly noise intensive works can be completed on the site.

In relation to impacts with the nearby Petersham College, Annandale TAFE, E80 requires the contractor to manage impacts so not to disrupt sensitive periods such as exam periods.

Condition E87 requires mitigation in the form of 'at-property treatment' to be offered to habitable spaces identified within the Appendix D of the CoA. This condition is discussed further in the following section.

5.4.3 Out of hours works – Mitigation CoA 87

The purpose of Condition E87 is to provide mitigation for works occurring outside the nominated 'standard' construction hours. At-property treatments to mitigate noise impacts at residential and 'other sensitive' receivers are to be offered to properties identified within the 'treatment zones' in Appendix D of the CoA.

The zones were defined to include receivers that have potential to be impacted by long-term out of hours works (OOHWs) from the project.

The nearest receivers to The Crescent, Chapman Road and Johnston Street modification works are predicted to be affected by 'high' impacts at certain times during the works. These receivers would also be impacted by noise from works associated with construction of the approved project at Rozelle Rail Yards.

On this basis the CoA 87 'treatment zone' is recommended to be extended to include the receivers adjacent to the modification works in this area, as shown in **Figure 5-14**.

A total of 19 receivers are additionally identified as being within the treatment zone and include properties on Kentville Avenue and the northern extent of Johnston Street.

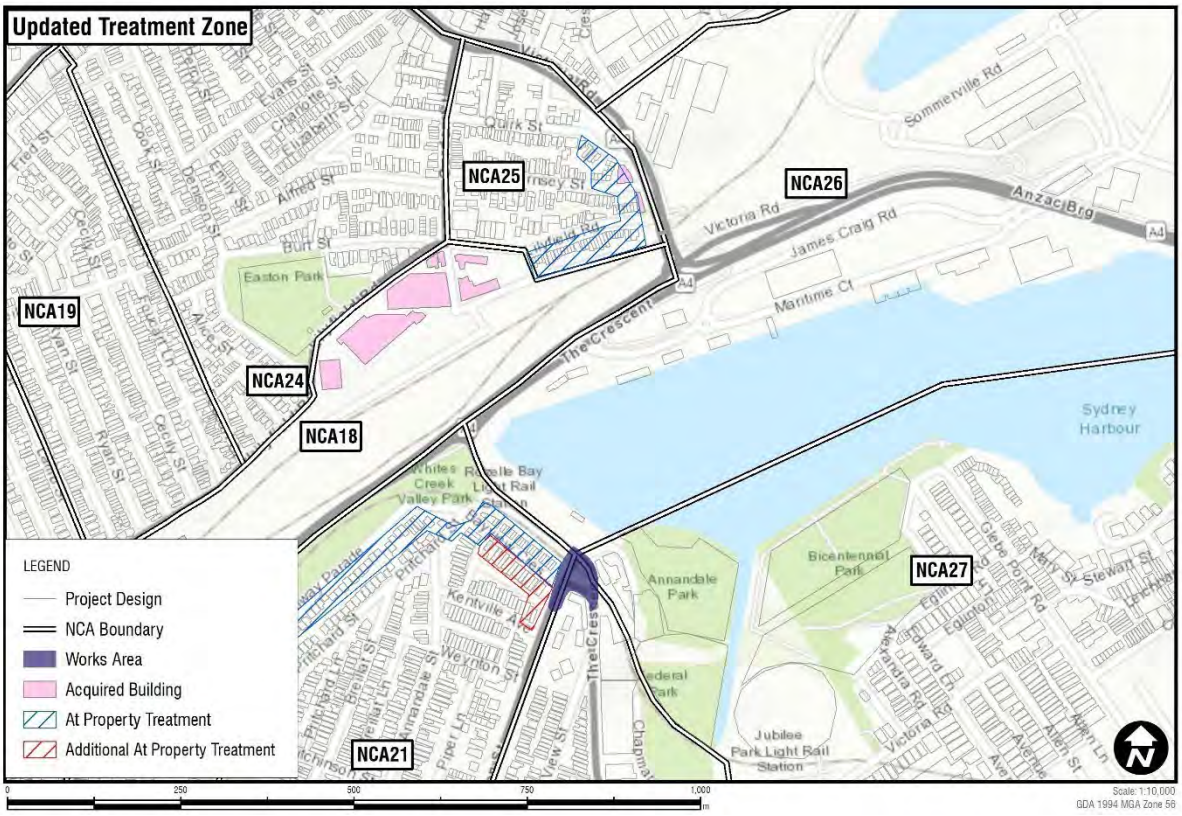


Figure 5-14 CoA 87 updated treatment zone

5.4.4 Sleep disturbance

A sleep disturbance screening assessment has been undertaken for The Crescent, Chapman Road and Johnston Street intersection upgrade construction works and a summary is provided in **Table 5-10**. A review of the predictions shows that the sleep disturbance screening criterion is likely to be exceeded when night works occur near residential receivers. The receivers which would potentially be affected by sleep disturbance impacts are generally consistent with receivers where 'high' night-time impacts have been predicted (refer to **Figure 5-13**).

The requirements for night-time works would be confirmed as the project progresses. Construction mitigation and management measures are discussed further in **Section 5.6**.

5.4.5 Cumulative construction activities

Cumulative noise impacts warrant assessment where more than one works activity operates at the same time and in the same location such that the same receiver is potentially impacted by noise from more than one works activity. The EIS assessed cumulative impacts for fixed sites such as compounds, spoil handing sites and tunnelling support sites which are restricted to within the same general locality and likely to affect the same nearby receivers. Where works are required outside of these confined localities such as the activities associated with the proposed modification, cumulative impacts would be dependent on timing and location of simultaneous construction activities and would require detailed scheduling information to accurately quantify.

Condition E76 of the CoA for the project requires the contractor to provide the community a 3 month schedule of the likely out of hours works (which is the period where cumulative impacts would be most noticeable), the location, duration and the likely noise levels. Cumulative impacts from multiple works locations would be included in the prediction of these noise levels and would inform the likely mitigation and management of impacts. These predictions would be based on detailed scheduling information and included in site-specific environmental impact's assessments.

Cumulative impacts from the construction activities associated with the Glebe Island concrete batching plant (not associated with the M4-M5 link project) would be included where suitable but noting that this site is located some distance to the east of the proposed modification.

5.5 Construction vibration assessment

The proposed works have been analysed to determine a best estimate of minimum working distances (refer to **Table 4-7**) for the vibration intensive construction equipment required to complete the works. The following assessment assumes a large rockbreaker could be used within the various construction areas. Construction with large rockbreakers has the potential to generate some of the most significant construction vibration impacts due to the vibration intensive characteristics of this plant item.

A summary of the number of buildings within the minimum working distances is provided in **Table 5-11** and an assessment of each site of works is shown in **Figure 5-15** to **Figure 5-17**.

Table 5-11 Construction vibration assessment summary

Works area	Vibration intensive equipment	NCA	Number of buildings within minimum working distance for highest vibration plant item			
			Cosmetic damage			Human response(Group 4)
			Residential and light commercial (Group 1)	Group 2 (typical)	Group 3 (structurally unsound)[1]	
The Crescent overpass, green link and shared path user bridge	Jackhammer Rockbreaker[2] Vibratory roller Piling Rig	NCA18	-	-	-	-
		NCA21	19	21	6	53
		NCA23	-	-	1	-
		NCA26	1	1	-	2
		NCA27	-	-	-	-
C6a construction ancillary facility site	Jackhammer Rockbreaker[2] Vibratory roller	NCA18	-	-	-	-
		NCA21	-	-	-	-
		NCA23	-	-	-	-
		NCA26	1	1	-	2
		NCA27	-	-	-	-
The Crescent, Chapman Road and Johnston Street intersection works	Jackhammer Rockbreaker[2] Vibratory roller	NCA18	-	-	-	-
		NCA21	8	12	2	39
		NCA23	1	2	2	3
		NCA26	-	-	-	-
		NCA27	1	1	1	1

Note

1. This group identifies heritage items only and represents a screening test applicable where a historic item is deemed to be sensitive to damage from vibration (following inspection) to be confirmed during detailed design.
2. Proposed highest vibration plant item for these works.

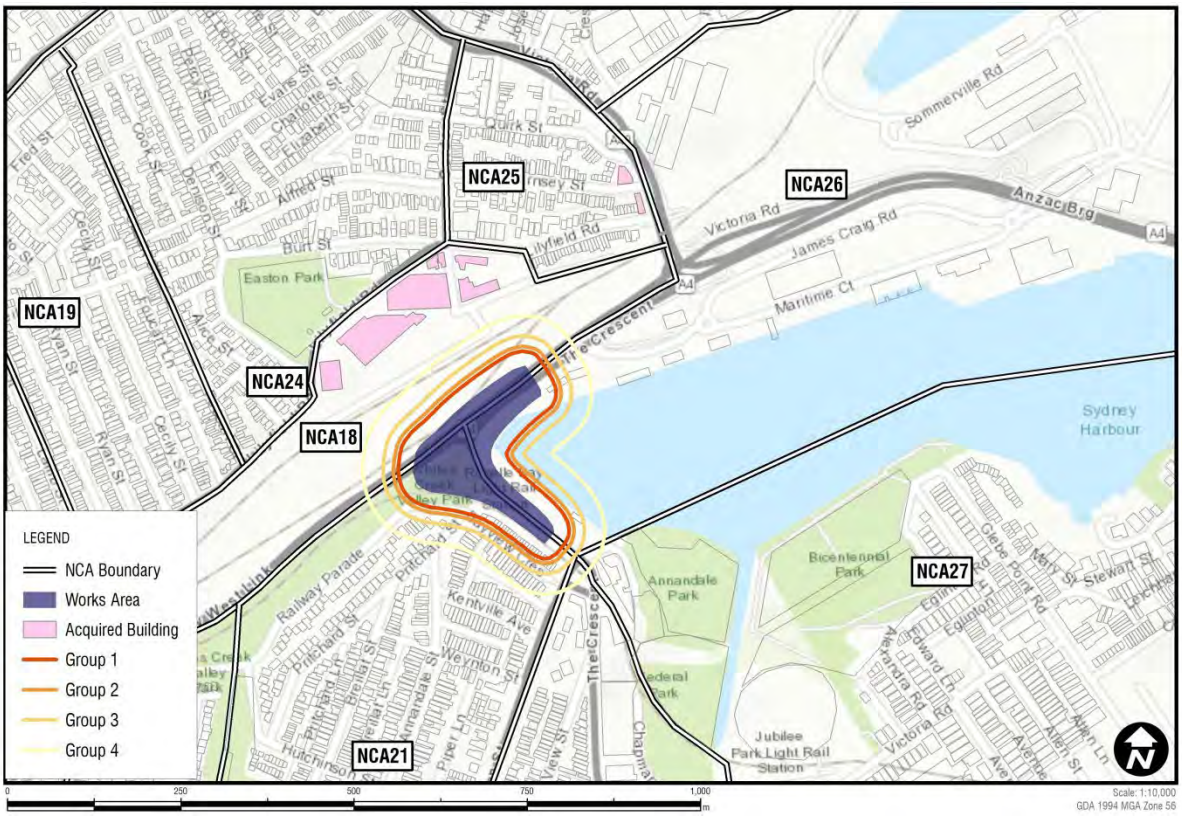


Figure 5-15 **Approximate minimum working distances for vibration intensive works during construction of The Crescent overpass, green link and shared path user bridge**

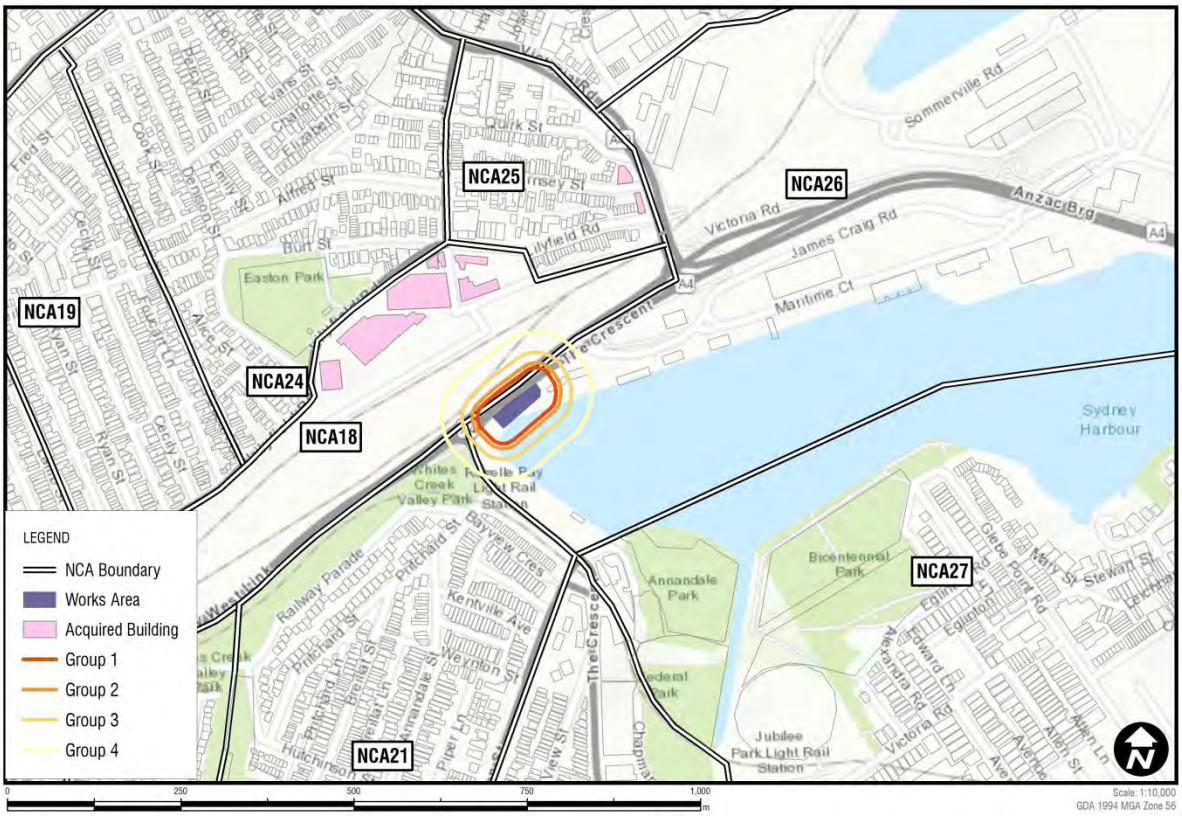


Figure 5-16 **Approximate minimum working distances for vibration intensive works at the proposed construction ancillary facility (C6a)**

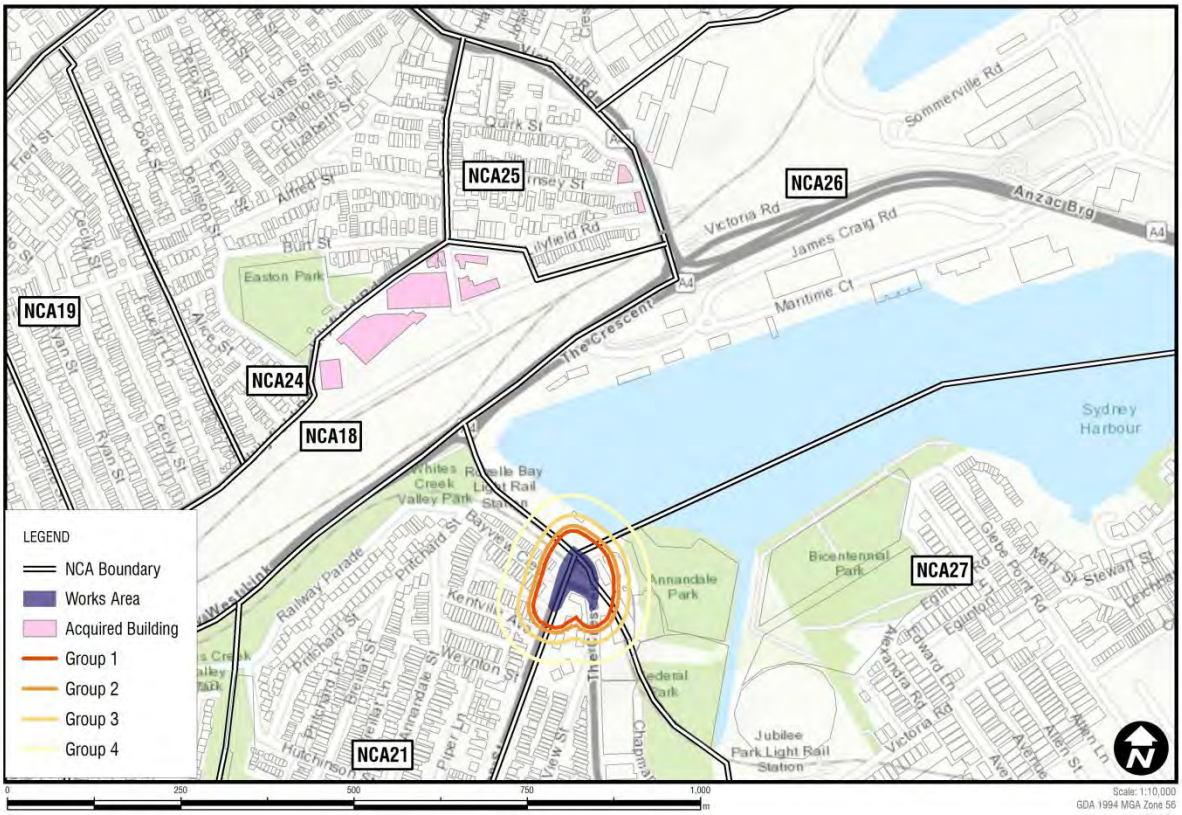


Figure 5-17 Approximate minimum working distances for vibration intensive works during The Crescent, Chapman Road and Johnston Street intersection works

Heritage listed items identified within the cosmetic damage minimum working distances are listed in **Table 5-12**.

Table 5-12 Heritage listed items within cosmetic damage minimum working distance

NCA	Item name[1]	Address[1]	Construction type[2]
NCA18, NCA20, NCA21	Whites Creek Stormwater Channel No 95	Railway Parade to Parramatta Road, Annandale	Stonework, concrete
NCA21	Annandale (Railway Parade) Railway Bridge	Railway Parade, Annandale	Steel structure
NCA21	Annandale Heritage Conservation Area	Annandale	n/a
NCA21	Avenue of *Phoenix canariensis*	Railway Parade, Annandale	n/a
NCA21	Street trees – row of palms	Railway Parade, Annandale	n/a
NCA21	Iron/sandstone palisade fence	Bayview Crescent, Annandale	Iron, sandstone
NCA21	Street trees – row of brush box	Bayview Crescent, Annandale	n/a
NCA23	Annandale (Johnston Street) Underbridge	Johnston Street, Annandale	Steel structure
NCA23	Sandstone retaining wall	Johnston Street, Annandale	Sandstone
NCA27	Glebe Railway Viaduct	The Crescent, Annandale	Brick, sandstone, concrete
NCA21	The Crescent Mural *(potential heritage item)*	The Crescent, Annandale	Stonework, concrete

Note

1. List of Heritage items extracted from WestConnex M4-M5 Link Non-Aboriginal Heritage Impact Assessment.
2. Estimated from photographic information and should be confirmed onsite.

5.5.1 Cosmetic damage assessment summary

The separation distance(s) between the proposed works and the nearest buildings would generally be sufficient so that nearby buildings are unlikely to suffer 'cosmetic damage' (defined as minor surface cracking but no impact that would affect the structural integrity of the building) for most of the proposed construction equipment. However, based on the arrangement of the work zones, some items of construction equipment have the potential to be operated closer to sensitive buildings than the recommended minimum working distances.

The assessment presented in **Table 5-11** indicates that during works, the following buildings may be within the minimum working distances should a large rockbreaker be used at the outer extents of the work sites:

- Up to 22 buildings for The Crescent overpass, green link and shared path user bridge works
- One building for The Crescent Civil site (C6) works
- Up to 15 buildings for The Crescent, Chapman Road and Johnston Street intersection works.

In practice, it is unlikely that a rockbreaker would be required in all areas and therefore the vibration impacts in this assessment should be considered worst-case. The required locations for vibration intensive equipment should be reviewed during detailed design when more specific information is available regarding the construction methodologies.

5.5.2 Human comfort assessment summary

The assessment presented in **Table 5-11** indicates the proposed surface works using a large rockbreaker may result in the following buildings within the nominated minimum working distance for human comfort vibration:

- Up to 55 buildings for The Crescent overpass, green link and shared path user bridge works
- Two buildings for The Crescent Civil site (C6) works

- Up to 43 buildings for The Crescent, Chapman Road and Johnston Street intersection works.

In relation to human comfort (response), the minimum working distances relate to continuous vibration and apply to residential receivers. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels occurring over shorter periods are permitted, as discussed in BS 6472-1.

Receivers adjacent to the construction areas have been identified as likely to perceive vibration impacts at times during construction works. This is expected to be primarily due to works associated with rockbreakers and other vibration intensive plant items. In practice vibration impacts from most construction activities would be intermittent. The required locations for vibration intensive equipment should be reviewed during detailed design when more specific information is available.

5.6 Construction mitigation

Particular effort should be directed towards the implementation of all feasible and reasonable noise mitigation and management strategies as per the standard mitigation measures detailed in the ICNG and CNVG. Where feasible and reasonable, mitigating impacts via means of source and or path control are preferred.

Based on the noise impact assessment of the proposed works, the following mitigation measures summarised in **Table 5-13** should be further investigated in addition to the standard suite of measures in the ICNG and CNVG.

The measures below are recommended to be used in addition to the requirements of the various CoA detailed in **Section 3.2.2**.

Table 5-13 Project specific mitigation measures

Mitigation measure	Details
Construction Environmental Management Plan (CEMP) – Noise and vibration sub-plan	The potential construction impacts from the proposed modification should be reviewed during detailed design when detailed construction planning information is available. The review should form part of the CEMP Noise and vibration sub-plan, as required by CoA C4.
Use and siting of noise intrusive plant	When assigning works locations, the offset distance between noisy plant and adjacent sensitive receivers should be maximised where practicable. Only plant necessary to the works should be on site, and noise intrusive plant should be directed away from sensitive receivers where possible.
Equipment selection	Use quieter and less vibration emitting methods where feasible and reasonable. Ensure plant, including the silencer, is well maintained.
Non-tonal and ambient sensitive reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used onsite and for any out of hours work. Consider the use of ambient sensitive alarms that adjust output relative to the ambient noise level.
Minimise disturbance arising from delivery of goods to construction ancillary facilities	Loading and unloading of materials/deliveries is to occur as far as possible away from sensitive receivers where practicable. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Avoid or minimise out of hours movements where possible.

Mitigation measure	Details
Equipment selection (including rented equipment)	Use quieter construction methods where feasible and reasonable. Ensure all equipment is well maintained. Noise emissions from rented plant and equipment should be considered prior to use.
Site inductions / behavioural practices	Information regarding all noise intrusive plant and equipment planned for or currently at site which has the potential to impact nearby sensitive receivers should be included in mandatory site inductions given to all employees, contractors and subcontractors. The inductions should include: • Permissible hours of work and site opening/closing times • Locations of nearest sensitive receivers • Any limitations on high noise producing equipment, plant and activities • Clear instructions regarding the mobility and parking of vehicles on site • Permissible delivery periods • No swearing or unnecessary shouting or loud stereos/radios onsite No dropping of materials from height, throwing of metal items and slamming of doors.
Mobile acoustic enclosure or use of localised hoarding around noise generating plant items	Where feasible, reasonable and practicable, portable acoustic enclosures should be erected around noise intrusive plant, particularly that which does not require constant mobility.
Construction respite period during normal and out of hours work	The CNVG recommends that high noise generating activities near receivers should be carried out in continuous blocks that do not exceed three hours each, with a minimum respite period of one hour between each block. The duration of each block of work and respite should be flexible to accommodate the usage and amenity at nearby receivers.
Scheduling of construction hours and activities	Where feasible and reasonable, construction should be carried out during standard daytime working hours. Work generating high noise levels should be scheduled less sensitive time periods. For works outside standard daytime construction hours, the use of equipment with potential to generate high noise impacts (such as concrete saws and rock-breakers) should be scheduled and carried out as early as possible in the work shift, wherever practicable.
Vibration works within minimum working distance	Where works are within the minimum working distances and considered likely to exceed the cosmetic damage criteria: • Different construction methods with lower source vibration levels should be investigated and implemented, where feasible • Attended vibration measurements should be undertaken at the start of the works to determine actual vibration levels at the item. Works should be ceased if the monitoring indicates vibration levels are likely to, or do, exceed the relevant criteria.
	Certain receivers in the study area are within the human comfort minimum working distance and occupants of affected buildings may be able to perceive vibration impacts when vibration intensive equipment is in use. The potential human comfort impacts and requirement for vibration intensive works should be reviewed as the project progresses.

Mitigation measure	Details
Building condition surveys	Building condition surveys should be completed before and after the works where buildings or structures are within the minimum working distances and considered likely to exceed the cosmetic damage criteria during the use of vibration intensive equipment.

6 Operational noise assessment

6.1 Overview of traffic changes due to the proposed modification

The proposed modification introduces The Crescent overpass (a new elevated vehicular overpass at the intersection of the Crescent and City West Link) and changes to the layout of the approach roads leading to the Anzac Bridge from Victoria Road, The Crescent and the Rozelle Interchange.

These changes reduce delay for vehicles traveling from City West Link and The Crescent towards Balmain and the city. The reduction in delay makes the use of The Crescent more attractive and results in a small increase in traffic on Johnston Street, including heavy vehicles, in certain scenarios.

6.2 Operational road traffic noise

Operational road traffic noise impacts 'without mitigation' have been predicted for all sensitive receivers in the assessment area for the project (see **Section 4.3.4**). The traffic scenarios which have been investigated are:

- **No Build Vs Do Something (2023 and 2033)** (ie with the project): The traffic data includes the M4-M5 Link and the approved WestConnex stages and is assessed against a no build scenario, i.e. the wider WestConnex programme including M4 East and New M5 did not go ahead.
- **No Build Vs Do Something Plus 2023** (ie with the project and other projects that interface, overlap or have potentially concurrent impacts). The traffic data includes the M4-M5 Link and the approved WestConnex stages, together with Western Harbour Tunnel project and Sydney Gateway and is assessed against a no build scenario, i.e. the wider WestConnex programme including M4 East and New M5 did not go ahead. The 2033 assessment scenario includes the operation of Beaches Link and F6 Extensions.

The predicted operational road noise levels at residential receivers and 'other sensitive' receivers are summarised in the following tables for the 2023 at-opening and 2033 future design scenarios for each traffic scenario. The table shows the worst-case impacts in each NCA, which are typically receivers nearest to the alignment.

The for all traffic scenarios, impacts from the project are predicted to be greatest in the 2033 future design scenario due to this timeframe generally having higher traffic volumes than in 2023 at project opening. Receivers are generally most affected by the project in the daytime period in 2033 and this scenario is considered to control the assessment in terms of determining the worst-case impacts and requirements for mitigation.

6.2.1 Predicted road traffic noise impacts Do Something traffic scenario

The predicted road traffic noise levels and number of NMG triggered receivers by floor is summarised in **Table 6-1** for residential receivers and **Table 6-2** for 'other sensitive' receivers.

The predicted noise levels for the controlling 2033 daytime scenario are shown in **Figure 6-1** and the location of triggered buildings is shown in **Figure 6-2**.

Table 6-1 Predicted road traffic noise levels at most affected residential receivers in each NCA 'Do Something' traffic scenario

NCA	Predicted noise level (dBA)[1]								NMG Triggers Buildings (Floors)			
	At-Opening (2023)				Future design (2033)							
	No Build (without project)		Build (with project)		No Build (without project)		Build (with project)					
	Day	Night	Day	Night	Day	Night	Day	Night	Trigger 1 >2.0 dB	Trigger 2 Cumulative	Trigger 3 Acute	Total[3]
NCA15	68	62	66	60	68	63	66	61	-	5	-	5
NCA16	71	64	70	63	72	64	71	63	-	-	-	-
NCA17	-	-	-	-	-	-	-	-	-	-	-	-
NCA18	-	-	-	-	-	-	-	-	-	-	-	-
NCA19	70	63	68	60	71	63	69	61	-	11	-	11
NCA20	65	59	63	56	66	60	63	57	-	-	-	-
NCA21	68	63	70	65	69	63	71	65	75	24	22	83
NCA22	48	43	49	43	49	43	49	44	-	-	-	-
NCA23	68	63	70	65	69	63	71	65	97	-	-	97
NCA24	77	72	73	67	78	72	73	68	-	-	-	-
NCA25	73	67	71	66	73	67	72	66	27	135	102	141
NCA26	-	-	-	-	-	-	-	-	-	-	-	-
NCA27	61	57	62	58	61	57	62	58	-	-	-	-
NCA28	-	-	-	-	-	-	-	-	-	-	-	-
NCA29	76	70	74	67	76	70	75	67	-	-	-	-
NCA30	77	71	72	67	77	72	73	67	-	-	-	-
NCA31	78	72	74	69	79	73	75	69	-	-	-	-
NCA32	78	72	74	68	78	72	74	69	-	1	4	4
NCA33	77	71	72	67	77	71	73	67	19	16	8	23
NCA34	71	65	67	61	71	66	67	62	-	9	1	9
NCA35	75	69	73	68	75	70	73	68	-	127	95	127
NCA36	64	59	72	67	65	59	72	67	24	26	9	30
NCA37	-	-	-	-	-	-	-	-	-	-	-	-
Total Residential Triggers – Do Something												**530**

Note

1. Daytime and night-time are $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ noise levels, respectively.
2. The NMG triggers are discussed in **Section 4.3**.
3. Receivers can trigger multiple criteria, i.e. a 2dB increase and cumulative exceedance criteria and as such the individual trigger exceedance count may not sum the total count.

Table 6-2 Predicted road traffic noise levels at most affected other sensitive receivers in each NCA 'Do Something' traffic scenario

NCA	Predicted noise level (dBA)[1]								NMG Triggers Buildings (Floors)[2]			
	At-Opening (2023)				Future design (2033)							
	No Build (without project)		Build (with project)		No Build (without project)		Build (with project)					
	Day	Night	Day	Night	Day	Night	Day	Night	Trigger 1 >2.0 dB	Trigger 2 Cumulative	Trigger 3 Acute	Total[3]
NCA15	-	-	-	-	-	-	-	-	-	-	-	-
NCA16	-	-	-	-	-	-	-	-	-	-	-	-
NCA17	-	-	-	-	-	-	-	-	-	-	-	-
NCA18	57	52	-	-	57	52	-	-	-	-	-	-
NCA19	66	63	66	63	66	63	66	63	-	-	-	-
NCA20	44	39	43	38	44	39	44	38	-	-	-	-
NCA21	69	68	71	70	70	68	72	70	-	-	-	-
NCA22	-	-	-	-	-	-	-	-	-	-	-	-
NCA23	70	67	73	71	71	68	74	71	5	7	5	9
NCA24	54	53	52	50	55	53	52	51	-	2	-	2
NCA25	68	66	65	64	68	66	66	64	-	6	-	6
NCA26	-	-	-	-	-	-	-	-	-	-	-	-
NCA27	58	56	59	57	58	56	60	58	-	16	-	16
NCA28	-	-	-	-	-	-	-	-	-	-	-	-
NCA29	58	56	57	56	58	57	57	56	-	3	-	3
NCA30	76	75	72	70	77	75	72	71	-	-	-	-
NCA31	63	61	60	57	64	62	61	58	-	8	-	8
NCA32	74	69	73	68	74	69	73	68	-	-	-	-
NCA33	-	-	-	-	-	-	-	-	-	-	-	-
NCA34	-	-	-	-	-	-	-	-	-	-	-	-
NCA35	51	49	51	49	52	50	52	50	-	-	-	-
NCA36	63	57	65	59	64	58	65	59	-	1	-	1
NCA37	56	54	56	54	56	55	56	55	-	14	-	14
Total Other Sensitive Triggers – Do Something												**59**

Note

1. Daytime and night-time are $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ noise levels, respectively.
2. The NMG triggers are discussed in **Section 4.3**.
3. Receivers can trigger multiple criteria, i.e. a 2dB increase and cumulative exceedance criteria and as such the individual trigger exceedance count may not sum the total count.

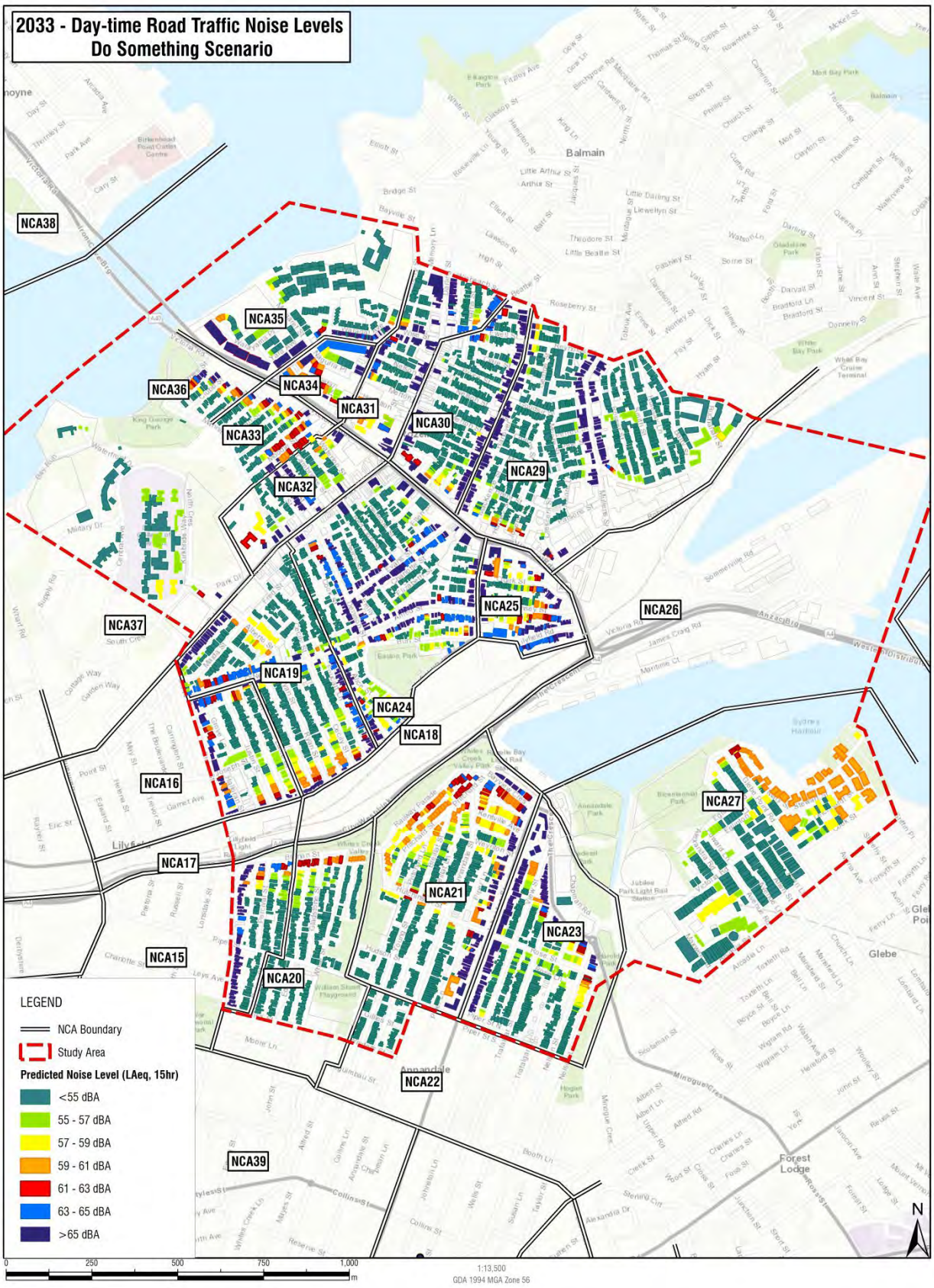


Figure 6-1 Predicted operational noise levels (2033 Daytime) – Do Something scenario

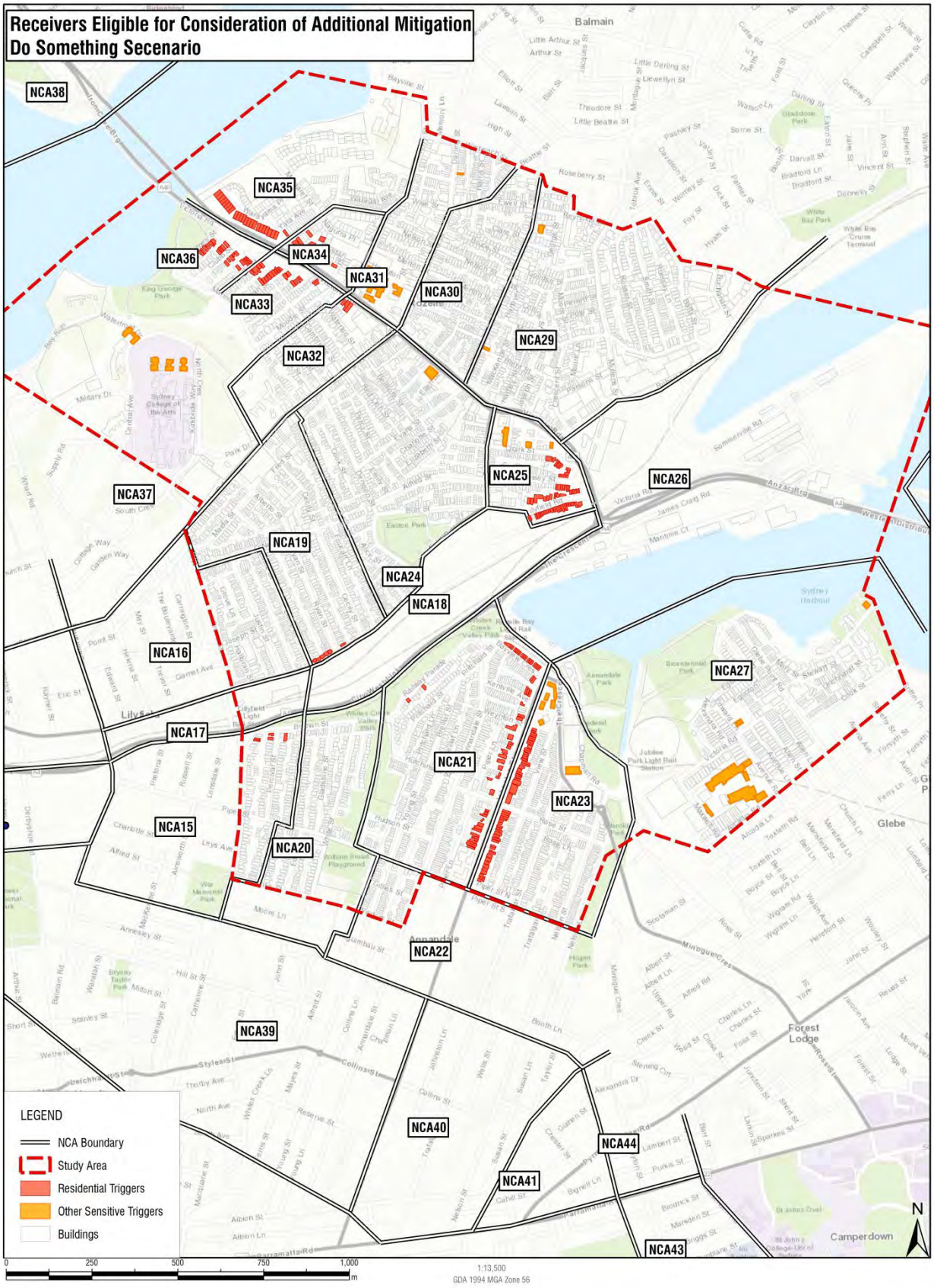


Figure 6-2 Receivers considered for additional noise mitigation – Do Something scenario

6.2.2 Predicted road traffic noise impacts Do Something Plus traffic scenario

The predicted road traffic noise levels and number of NMG triggered receivers by floor is detailed in **Table 6-3** for residential receivers and **Table 6-4** for 'other sensitive' receivers.

The predicted noise levels for the controlling 2033 daytime scenario are shown in **Figure 6-3** and the location of triggered buildings is shown in **Figure 6-4**.

Table 6-3 Predicted road traffic noise levels at most affected residential receivers in each NCA Do Something Plus traffic scenario

NCA	Predicted noise level (dBA)[1]								NMG Triggers Buildings (Floors)[2]			
	At-Opening (2023)				Future design (2033)							
	No Build (without project)		Build (with project)		No Build (without project)		Build (with project)					
	Day	Night	Day	Night	Day	Night	Day	Night	Trigger 1 >2.0 dB	Trigger 2 Cumulative	Trigger 3 Acute	Total[3]
NCA15	68	62	66	60	68	63	66	60	-	3	-	3
NCA16	71	64	70	63	72	64	71	63	-	-	-	-
NCA17	-	-	-	-	-	-	-	-	-	-	-	-
NCA18	-	-	-	-	-	-	-	-	-	-	-	-
NCA19	70	63	68	60	71	63	69	61	-	7	-	7
NCA20	65	59	62	56	66	60	63	57	-	-	-	-
NCA21	67	61	69	62	68	61	70	63	20	26	22	35
NCA22	48	43	48	43	49	43	49	44	-	-	-	-
NCA23	69	64	71	65	70	64	72	66	-	-	-	-
NCA24	77	72	73	67	78	72	73	68	-	-	-	-
NCA25	73	67	71	66	73	67	71	66	23	123	91	129
NCA26	-	-	-	-	-	-	-	-	-	-	-	-
NCA27	61	57	61	57	61	57	62	58	-	-	-	-
NCA28	-	-	-	-	-	-	-	-	-	-	-	-
NCA29	76	70	74	67	76	70	75	67	-	-	-	-
NCA30	77	71	72	67	77	72	73	67	-	-	-	-
NCA31	78	72	75	69	79	73	75	69	-	-	-	-
NCA32	78	72	74	68	78	72	74	69	-	1	4	4
NCA33	77	71	72	67	77	71	73	67	19	16	8	23
NCA34	71	65	67	61	71	66	67	62	-	8	1	8
NCA35	75	69	73	68	75	70	73	68	-	127	96	127
NCA36	66	60	72	68	66	60	72	68	24	27	11	31
NCA37	-	-	-	-	-	-	-	-	-	-	-	-
Total Residential Triggers – Do Something Plus												**367**

Note

1. Daytime and night-time are $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ noise levels, respectively.
2. The NMG triggers are discussed in **Section 4.3.**
3. Receivers can trigger multiple criteria, i.e. a 2dB increase and cumulative exceedance criteria and as such the individual trigger exceedance count may not sum the total count.

Table 6-4 Predicted road traffic noise levels at most affected other sensitive receivers in each NCA Do Something Plus traffic scenario

NCA	Predicted noise level (dBA)[1]								NMG Triggers Buildings (Floors)[2]			
	At-Opening (2023)				Future design (2033)							
	No Build (without project)		Build (with project)		No Build (without project)		Build (with project)					
	Day	Night	Day	Night	Day	Night	Day	Night	Trigger 1 >2.0 dB	Trigger 2 Cumulative	Trigger 3 Acute	Total[3]
NCA15	-	-	-	-	-	-	-	-	-	-	-	-
NCA16	-	-	-	-	-	-	-	-	-	-	-	-
NCA17	-	-	-	-	-	-	-	-	-	-	-	-
NCA18	57	52	-	-	57	52	-	-	-	-	-	-
NCA19	66	63	66	63	66	63	66	63	-	-	-	-
NCA20	44	39	43	38	44	39	44	39	-	-	-	-
NCA21	69	68	71	69	70	68	71	70	-	-	-	-
NCA22	-	-	-	-	-	-	-	-	-	-	-	-
NCA23	70	67	73	71	71	68	74	71	1	7	6	7
NCA24	54	53	52	50	55	53	52	50	-	2	-	2
NCA25	68	66	65	64	68	66	66	64	-	6	-	6
NCA26	-	-	-	-	-	-	-	-	-	-	-	-
NCA27	57	56	57	57	57	56	57	57	-	14	-	14
NCA28	-	-	-	-	-	-	-	-	-	-	-	-
NCA29	55	53	52	51	55	54	53	51	-	2	-	2
NCA30	76	75	72	70	77	75	72	71	-	-	-	-
NCA31	63	61	60	57	64	62	61	58	-	8	-	8
NCA32	74	69	73	68	74	69	73	69	-	-	-	-
NCA33	-	-	-	-	-	-	-	-	-	-	-	-
NCA34	-	-	-	-	-	-	-	-	-	-	-	-
NCA35	51	49	52	50	52	50	52	50	-	-	-	-
NCA36	63	57	65	60	64	58	65	60	-	1	-	1
NCA37	56	54	56	54	56	55	56	55	-	14	-	14
Total Other Sensitive Triggers – Do Something Plus												**54**

Note

1. Daytime and night-time are $L_{Aeq(15hour)}$ and $L_{Aeq(9hour)}$ noise levels, respectively.
2. The NMG triggers are discussed in Section **4.3**
3. Receivers can trigger multiple criteria, i.e. a 2dB increase and cumulative exceedance criteria and as such the individual trigger exceedance count may not sum the total count.

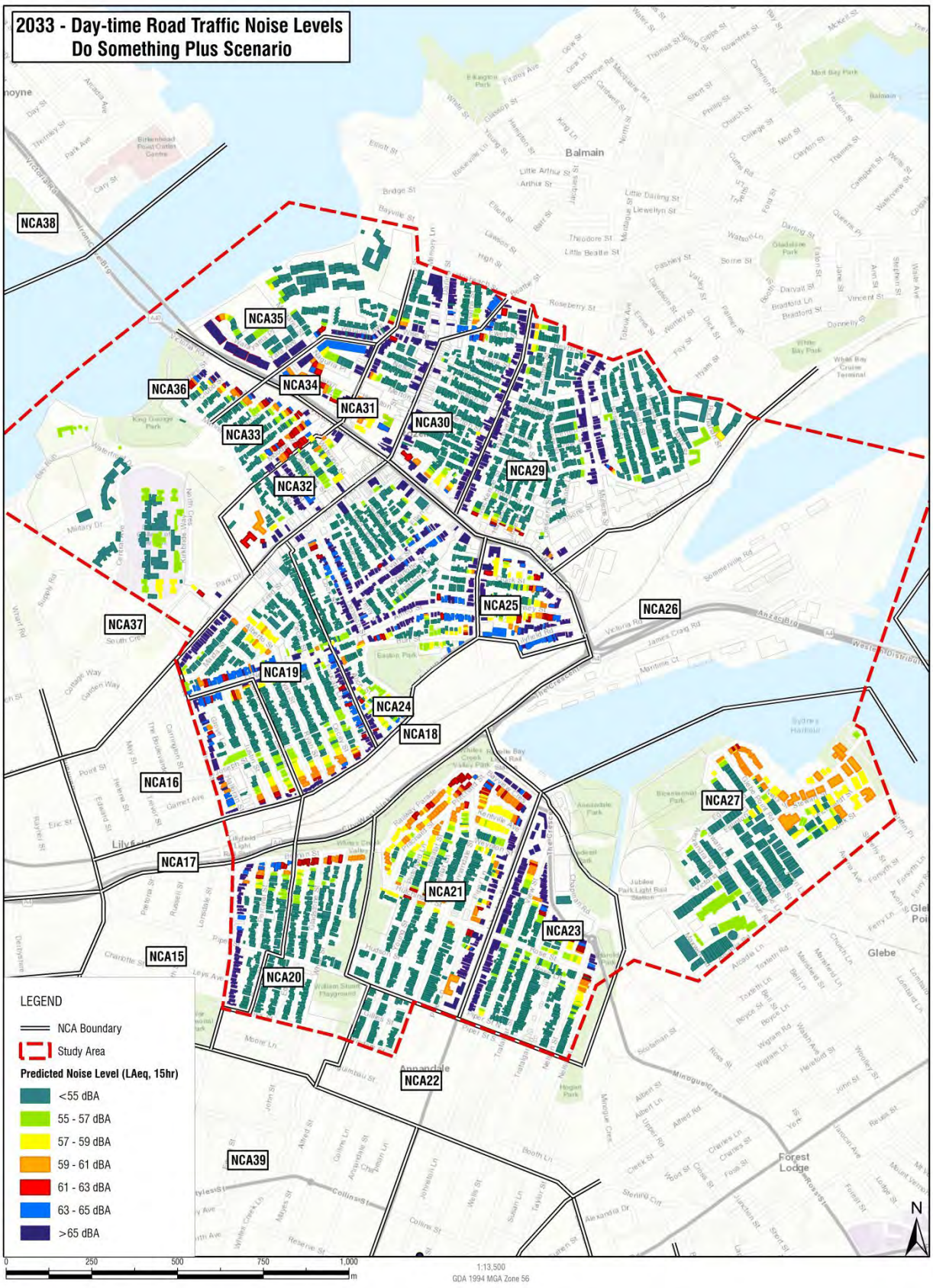


Figure 6-3 Predicted operational noise levels (2033 Daytime) – Do Something Plus scenario

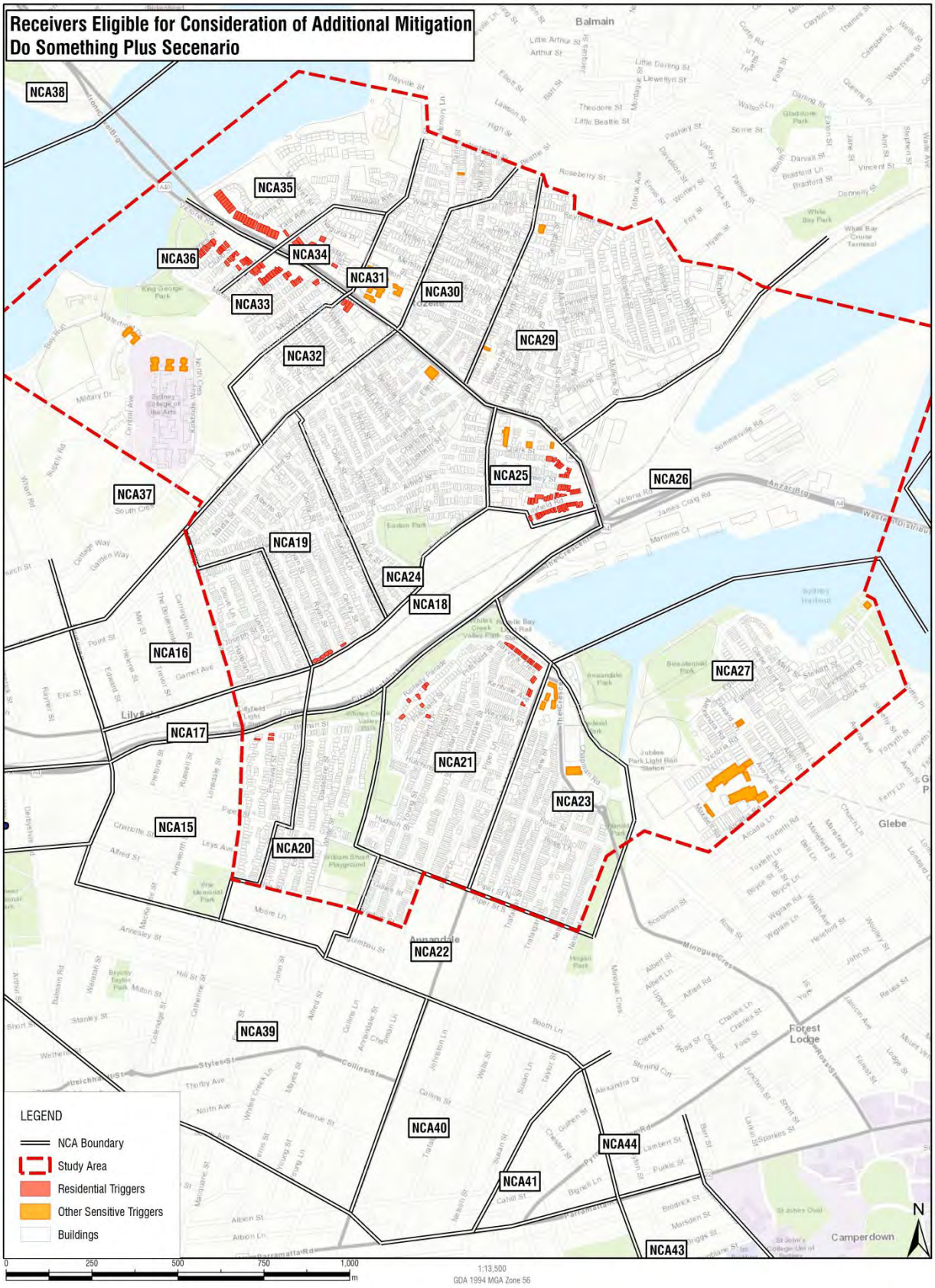


Figure 6-4 Receivers considered for additional noise mitigation – Do Something Plus scenario

6.2.3 Discussion

The above results show the following:

- Many residential receivers in the study area are subject to relatively high existing road traffic noise impacts which already exceed the NCG criteria in many cases.
- The project would result in increases in road traffic noise levels that are predicted above the eligibility threshold of 2.0 dB in certain areas.

Do Something

- The *Do Something* scenario is predicted to result in 530 triggered residential receiver floors and 59 'other sensitive' triggered floors.
- Increases of greater than 2.0 dB are predicted in:
  - NCA21 and NCA 23, which is due to the widening and additional roads within the City West Link road corridor as part of the approved project. The proposed modification also results in altered traffic volumes on Johnston Street and The Crescent, as previously discussed in **Section 6.1**.
  - NCA25, NCA33 and NCA36, where large increases in noise (up to +15 dBA) are identified in NCA33 and NCA36 (on the southern side of Victoria Road at Iron Cove near the Iron Cove Link tunnel portals) and in NCA25 (near the new Victoria Road bridge), where the approved project results in traffic lanes being closer to receivers, in combination with removing existing screening due to property acquisitions. These increases are generally limited to receivers which have partial or direct line of sight to Victoria Road once the acquired buildings are demolished. The proposed modification does not alter the physical works in this area and the increases are generally consistent with the EIS. This location would be assessed further during detailed design to identify appropriate noise mitigation measures to address the large predicted increases.

Do Something Plus

- The *Do Something Plus* scenario is predicted to result in 367 triggered residential receiver floors and 54 'other sensitive' triggered floors.
- Increases of greater than 2.0 dB are predicted in:
  - NCA21 and NCA 23, which is due to the widening and additional roads within the City West Link road corridor as part of the approved project. The proposed modification also results in altered traffic volumes on Johnston Street and The Crescent. The increase in noise on Johnston Street is however slightly lower than for the *Do Something* scenario which is due to slightly less heavy vehicles using this route in the *Do Something Plus* scenario.
  - NCA25, NCA33 and NCA36, as for the *Do Something* scenario, these increases are generally consistent with the EIS and this location would be assessed further in detailed design.

The key difference between the two traffic scenarios is the increase in triggered receivers along Johnston Street in the *Do Something* scenario. Whilst the *Do Something Plus* scenario has a higher volume of light vehicles on Johnston Street, the *Do Something* scenario has more heavy vehicles which results in the *Do Something* noise levels being around 0.2 dB higher than for *Do Something Plus*. Most sensitive receivers on Johnston Street are marginally compliant in the *Do Something Plus* scenario and only marginally in exceedance in the *Do Something* scenario. This marginal level of compliance in the *Do Something Plus* scenario is generally consistent with the EIS assessment.

Whilst the inclusion of The Crescent overpass results in changes to the wider traffic network, the elevated structure does not significantly change the number of triggers near the overpass. This is due to road traffic noise levels at nearby receivers generally being controlled by the high volume of traffic on the City West Link and The Crescent, as opposed to the overpass which has lower relative volumes.

6.2.4 Changes in road traffic noise levels compared to the EIS

Figure 6-5 and **Figure 6-6** show the change in noise level at residential receivers as a result of the proposed modification when compared with the appropriate EIS traffic scenario. This aims to highlight the key difference in noise levels due to the proposed modification, when compared to the approved project.

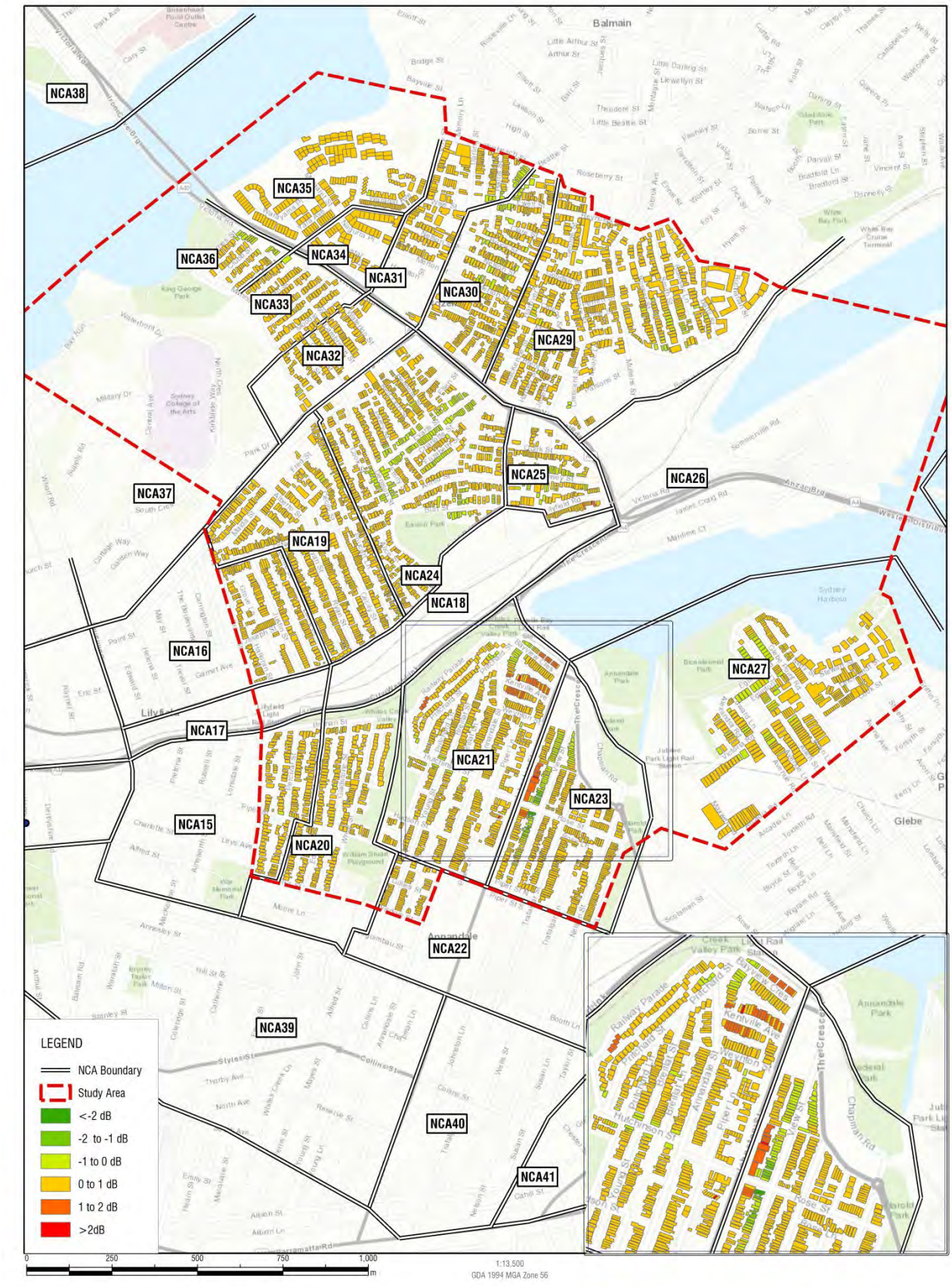


Figure 6-5 Predicted change in noise level between modification and EIS – Do Something

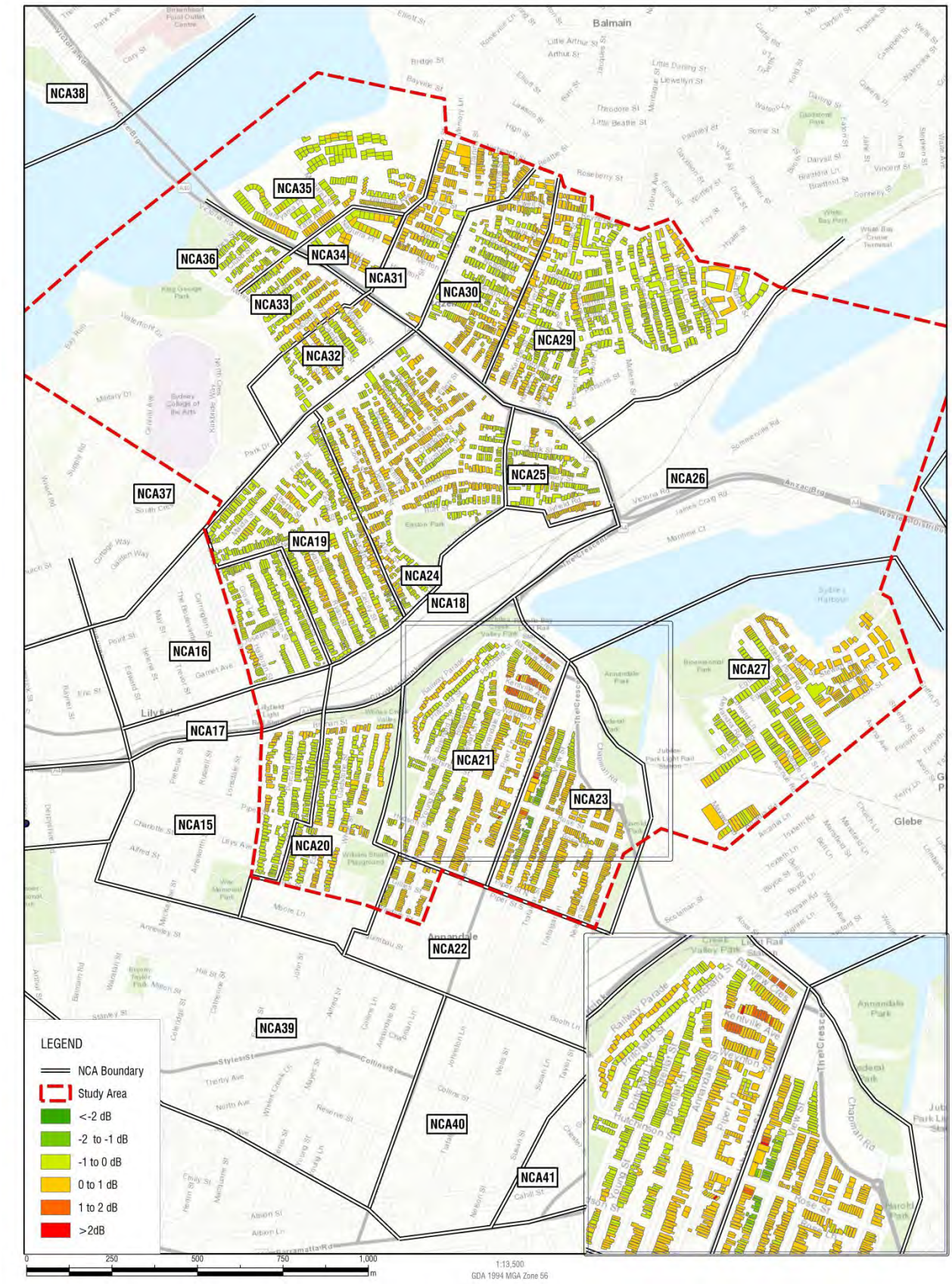


Figure 6-6 Predicted change in noise level between modification and EIS – Do Something Plus

The above results show the following:

- Changes in noise levels as a result of the proposed modification are generally between -0.5 and +0.5 dBA for the majority of receivers in the operational study area, which is considered a marginal change in noise. The increases are generally higher in the *Do Something* scenario due to traffic redistribution effects, particularly on Johnston Street.
- The inclusion of The Crescent overpass increases noise levels at receivers near to Bayview Crescent, with the increase generally being between +0.5 dBA and +1.5 dBA.
- The difference between the EIS *Do Something* and the Modification *Do Something* traffic scenario results in the greatest change in noise levels at receivers, with a general change of around +0.5 dB apparent across the study area.
- Increases of between +0.5 dBA and +1.0 dBA are predicted along Johnston Street in the *Do Something* scenario which is due to increased heavy vehicles on this route. The increase on this route in the *Do Something Plus* scenario is marginally lower due to less heavy vehicles.

A comparison of the differences in the number of triggered receivers between the EIS and proposed modification is provided in **Table 6-5**.

Table 6-5 Comparison of EIS triggers with proposed modification

NCA	Receiver type	EIS Triggered receivers (Floors)		Modification Triggered receivers (Floors)		Difference	
		Do Something	Do Something Plus (cumulative scenario)	Do Something	Do Something Plus	Do Something	Do Something Plus
NCA15	Residential	7	4	5	3	-2	-1
	Other	-	-	-	-	-	-
NCA16	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA17	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA18	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA19	Residential	13	11	11	7	-2	-4
	Other	-	-	-	-	-	-
NCA20	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA21	Residential	17	23	83	35	66	12
	Other	1	1	-	-	-	-
NCA22	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA23	Residential	1	-	97	-	96	-
	Other	-	-	9	7	-	-
NCA24	Residential	-	-	-	-	-	-
	Other	1	1	2	2	1	1
NCA25	Residential	151	127	141	129	-10	2
	Other	6	6	6	6	-	-
NCA26	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA27	Residential	-	-	-	-	-	-
	Other	15	15	16	14	1	-1
NCA28	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-

NCA	Receiver type	EIS Triggered receivers (Floors)		Modification Triggered receivers (Floors)		Difference	
		Do Something	Do Something Plus (cumulative scenario)	Do Something	Do Something Plus	Do Something	Do Something Plus
NCA29	Residential	-	-	-	-	-	-
	Other	3	2	3	2	-	-
NCA30	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA31	Residential	-	-	-	-	-	-
	Other	8	8	8	8	-	-
NCA32	Residential	3	4	4	4	1	-
	Other	-	-	-	-	-	-
NCA33	Residential	23	23	23	23	-	-
	Other	-	-	-	-	-	-
NCA34	Residential	8	8	9	8	1	-
	Other	-	-	-	-	-	-
NCA35	Residential	127	127	127	127	-	-
	Other	1	1	-	-	-	-
NCA36	Residential	33	33	30	31	-3	-2
	Other	1	1	1	1	-	-
NCA37	Residential	-	-	-	-	-	-
	Other	12	14	14	14	2	-
NCA38	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA39	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
NCA40	Residential	-	-	-	-	-	-
	Other	-	-	-	-	-	-
ALL	**Residential**	**383**	**360**	**530**	**367**	**147**	**7**
	Other	**48**	**49**	**59**	**54**	**11**	**5**
	TOTAL	**431**	**409**	**589**	**421**	**158**	**12**

The above results show the following:

- The greatest change in triggered receivers is in NCA21 and NCA23 in the *Do Something* scenario. As discussed previously, the increased heavy vehicle movements on Johnston Street in this scenario results in an additional 162 triggered floors at residential receivers within these two NCAs when compared to the EIS assessment.
  - Overall, 158 additional floors are eligible for consideration of mitigation in the *Do Something* scenario for the proposed modification compared to the EIS assessment.
- In the *Do Something Plus* scenario the heavy vehicle volumes on Johnston Street are slightly reduced from the *Do Something* scenario and the total number of triggered receivers is approximately consistent with the findings of the EIS.
  - An additional 12 floors are identified for consideration of mitigation in total in this scenario.

The location of the additional triggered receivers is shown in **Section 6.3**.

6.2.5 Sensitivity analysis

A sensitivity analysis of the operational road traffic noise assessment and noise modelling methodology has been undertaken. The likely change in the predicted number of receivers that would be eligible for consideration of property treatment has been determined by applying a correction factor to the Build noise model predictions in 1 dBA increments. The sensitivity of the total number of at-property treatments to the modelling predictions is shown in **Figure 6-7**

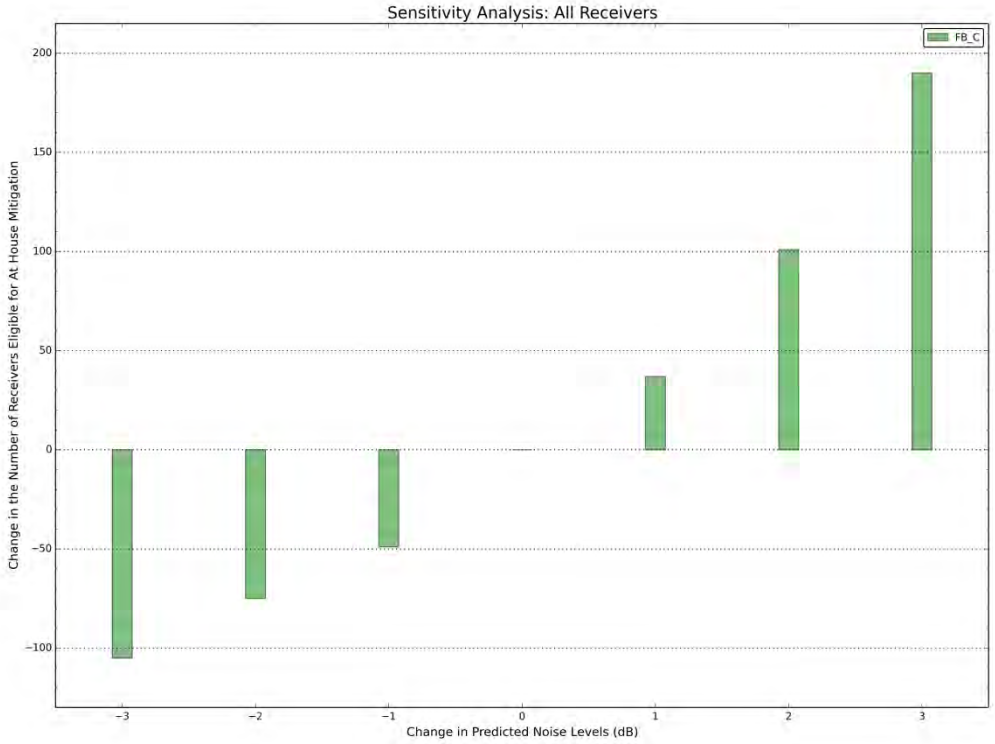


Figure 6-7 Noise model sensitivity analysis

The above indicates that an additional 37 receivers would be eligible for consideration of property treatment if a +1 dBA correction were to be added to the noise model predictions. A reduction of 49 receivers would be apparent if 1 dBA was subtracted from the noise model predictions.

6.2.6 Maximum road traffic noise levels

Existing maximum noise events

The representative results of the 2016 maximum noise level monitoring is provided in the EIS which included the maximum noise level range for the passby events in the existing situation. A summary of the existing maximum noise level assessment is shown in **Table 6-6**.

Table 6-6 Measured maximum noise level events

Monitoring location	Monitoring dates	Total night time events within the monitoring period	Measured maximum noise level (dBA LAFmax)	
			Range	Average
R.01	18/07/16 – 2/08/16	563	65-87	72
R.02	21/07/16 – 2/08/16	72	65-84	72
R.03	18/07/16 – 2/08/16	218	76-93	83
R.04	26/07/16 – 2/08/16	116	75-90	82
R.05	18/07/16 – 2/08/16	201	77-97	83
R.06	18/07/16 – 2/08/16	178	70-84	75
R.07	18/07/16 – 2/08/16	458	66-92	74
R.08	18/07/16 – 2/08/16	779	65-88	70
R.09	18/07/16 – 2/08/16	491	65-80	70
R.10	21/07/16 – 2/08/16	633	65-87	71
I.01	26/09/16 – 4/10/16	136	77-93	82
I.02	13/09/16 – 4/10/16	422	77-96	84

The above shows that existing maximum noise level events typically range from 65 dBA to 90 dBA L_{AFmax} at the monitoring locations within the study area. Locations immediately adjacent to Victoria Road, City West Link and The Crescent were observed to have higher existing maximum noise levels as a result of the relatively short setback distances and no intervening screening.

Maximum noise level events towards the upper end of the range are likely to be from heavy vehicle passbys, with light vehicles tending towards the lower end of the range.

Future maximum noise events

Indicative changes to maximum noise levels from the proposed modification have been predicted using a source height corresponding to the approximate height of a truck exhaust. Changes in the number of maximum noise events at most locations would be in line with general changes in traffic volumes forecast for the project. Altered bus stop locations and signalised intersections also has the potential to change maximum noise levels.

The noise predictions indicate that maximum noise levels may increase at residential receivers in the following locations:

- **NCA21** – receivers on Bayview Crescent. In this location, widening of The Crescent increases line of sight to the widened road, whereas the existing road is screened by the edge of the embankment. Indicatively, typical increases of between 1 dBA and 3 dBA are predicted in this location. Typical increases of up to 1 dBA are predicted at receivers adjacent to the flyover from The Crescent to City West Link as these receivers generally have similar impacts from the existing roads.
- **NCA33** and **NCA36** – receivers south of Victoria Road adjacent to the Iron Cove Link tunnel portals. In this location, demolition of acquired buildings results in residences having line of sight to the widened Victoria Road where they were previously screened by existing buildings. Indicatively, typical increases of between 5 dBA and 10 dBA are predicted. A small number of receivers experience an increase of up to 18 dBA due to the removal of adjacent buildings.
- **NCA24** – receivers west of Victoria Road at Rozelle. In this location, demolition of acquired buildings results in some residences having line of sight to Victoria Road where they were previously screened by existing buildings. Indicatively, typical increases of between 2 dBA and 10 dBA are predicted. A small number of receivers experience a higher increase due to the removal of adjacent buildings.
- The change in maximum operational noise levels at receivers in other catchment areas is predicted to be negligible.

- Where changes to the location of bus stops are proposed, the character of noise may also change and should be considered further during detailed design.

The predicted change in maximum noise levels is generally consistent with what was predicted for the approved project in the EIS. Maximum noise levels at receivers in NCA21 are however predicted to be up to 2 dBA higher than predicted in the EIS due to the widened section of The Crescent and up to 1 dBA higher than predicted in the EIS due to the overpass from The Crescent to City West Link.

6.3 Operational noise mitigation

Road traffic noise levels from infrastructure projects should be reduced to meet the NCG noise criteria through the use of feasible and reasonable mitigation. An Operation Noise and Vibration Review (ONVR) will be prepared as part of the construction of the project which will detail the specific mitigation measures for eligible receivers. CoA E92 details the specific requirements of the ONVR (refer to **Section 3.2.2)**. In addition to E92, the proponent is required to implement the operational noise mitigation measures within six months of commencement of construction (CoA E93). The findings and recommendations presented in this modification report will be used to inform the ONVR for the project.

For receivers that qualify for consideration of additional noise mitigation (refer to **Section 6.2.1** and **6.2.2**), potential noise mitigation measures include (in order of preference outlined in the RNP):

- Quieter road pavement surfaces
- Noise mounds
- Noise barriers
- At-property treatments.

The selection and specification of noise mitigation also requires the consideration of a range of safety, engineering, cost, social, and environmental factors. These factors are considered in determining whether a mitigation option is feasible and reasonable to implement.

The terms ‘feasible’ and ‘reasonable’, with respect to noise mitigation, are outlined in the NMG as follows.

Feasibility – Relates to engineering considerations (what can practically be built). These engineering considerations include:

- The inherent limitations of different techniques to reduce noise emissions from road traffic noise sources
- Safety issues such as restrictions on road vision
- Road corridor site constraints such as space limitations
- Floodway and stormwater flow obstruction
- Access requirements
- Maintenance requirements
- The suitability of building conditions for at receiver treatments.

Reasonable – Selecting reasonable measures from those that are feasible involves judging whether the overall noise benefits provide significant social, economic or environmental benefits. The factors to be considered are:

- The noise reduction provided and the overall number of people that benefit from the mitigation
- Existing and future noise levels, including changes in noise levels, and the extent of any exceedance of the noise criteria
- Potential for a mitigation measure to reduce noise during construction as well as from road traffic after the project is complete

- The cost of mitigation, including the cost of noise mitigation measures as a percentage of the total project cost and the ongoing maintenance and operational costs
- Community views and preferences (typically gathered during the community consultation process following the noise assessment)
- Visual impacts for the community surrounding the road project and for road users (identified in Appendix G of the EIS)
- The wider community benefits arising from noise mitigation of the road
- Relative weighting of treatments with respect to protection of outdoor areas or only internal living spaces.

The following assessment of operational mitigation measures forms a preliminary feasible and reasonable assessment to inform the detailed design stage of the project.

6.3.1 Additional noise mitigation – low noise pavement

The choice of road pavement surfaces and textures must meet a number of criteria including structural integrity, skid resistance, water shedding and design life as well as potential noise generating characteristics. The long-term noise performance of the road pavement and the need to maintain performance through regular cleaning and/or replacement are also important considerations.

The noise assessment considers the use of quieter noise pavement in the form of dense graded asphalt across the extent of the project.

Low noise pavements are generally most effective where vehicle speeds are high, such as on motorways, and less effective where traffic speeds are slower or where traffic is required to slow down or stop, such as near intersections. The use of low noise pavement to further reduce road traffic noise at the source will be investigated during detailed design taking into account the specific features of the project, together with whole-of-life engineering considerations and the overall social, economic and environmental effects.

It is currently proposed that Crumb Rubber Asphalt (CRA), which is a quieter noise surface, would be used on roads in local areas to reduce the potential road traffic noise impacts at adjacent receivers.

6.3.2 Additional noise mitigation – noise barriers

The purpose of this modification report is to address the noise impacts associated with the construction and operation of The Crescent overpass along with upgrades to Johnston Street and The Crescent Intersection. The noise barriers investigated as part of the EIS, along with any barriers being further investigated as part of detailed design, do not change as a result of the findings of this modification. This includes barrier NW05 situated along the light rail line at The Crescent which was investigated as part of the EIS design but found to have potential issues around obstruction of views to nearby receivers.

In relation to a possible noise barrier along The Crescent overpass, road traffic noise levels at receivers near to the overpass along Bayview Crescent and Railway Parade are controlled by traffic on City West Link and The Crescent. Traffic on these roads are around 45,000 and 27,000 vehicles during the 2033 daytime, respectively, whereas The Crescent overpass has around 16,000 vehicles during the same period.

The noise levels from the overpass alone are around 4 dB below the noise levels from the other surrounding roads, meaning the overpass does not control noise levels at the nearby receivers. Whilst a noise barrier would potentially reduce road traffic noise levels from vehicles on the overpass, it would likely be ineffective in reducing the overall road traffic noise levels at nearby receivers given the relatively low contribution of the overpass.

As shown in **Figure 6-8**, there are no additional receivers other than those identified in the EIS which trigger consideration of mitigation and are also situated near the proposed overpass. Additional exceedances are largely due to the re-classification of Johnston Street as a project road and marginal changes to the mix of traffic. As such noise barriers are deemed to not be a reasonable or effective mitigation of noise associated with the operation of the overpass.

In addition, other non-acoustic issues should be considered as the project progresses in determining whether a noise barrier would be a feasible and reasonable option:

- Wind loading forces on the structure
- Access and maintenance requirements
- Potential visual and urban design impacts
- Potential community safety/crime prevention considerations such as isolated walkways on the shared user path
- Potential overshadowing impacts
- Preferences of the local community as gauged during the community consultation phase.

The alternative to a noise barrier would be to install architectural treatments as discussed below.

6.3.3 Discussion of at-property treatments

Architectural treatment of individual properties is typically used to mitigate residual impacts at residential properties. The preferred noise mitigation option (low noise pavement, noise barrier, architectural treatments, a combination, or other) would be determined during detailed design taking into account whole-of-life engineering considerations and the overall social economic and environment benefits.

If detailed design investigation confirms the findings in this report, then at-property treatments for the triggered receivers summarised in **Table 6-7** would likely be the preferred noise mitigation measure. The summary below is the combined number of triggers from both the *Do Something* scenario and the *Do Something Plus* scenarios. The locations of the receivers eligible for consideration of at-property treatment are shown in **Figure 6-8**.

Table 6-7 Number of potential at-property noise treatments predicted for proposed modification

NCA	Receiver floors	Receiver buildings
NCA15	5	5
NCA16	-	-
NCA17	-	-
NCA18	-	-
NCA19	11	6
NCA20	-	-
NCA21	88	64
NCA22	-	-
NCA23	106	60
NCA24	2	1
NCA25	147	69
NCA26	-	-
NCA27	16	11
NCA28	-	-
NCA29	3	2
NCA30	-	-
NCA31	8	7
NCA32	4	3
NCA33	23	21
NCA34	9	7
NCA35	127	24
NCA36	32	24
NCA37	14	4
TOTAL	**595**	**308**

A small number of receivers along the City West Link are predicted to only be triggered in the *Do Something Plus* scenario, which is due to marginally increased traffic volumes from the operation of the M4-M5 Link ramps which tie into City West Link at this location. These receivers are included in the table above and are considered eligible for mitigation given traffic volumes on roads in this area are marginally higher in the *Do Something Plus* scenario.

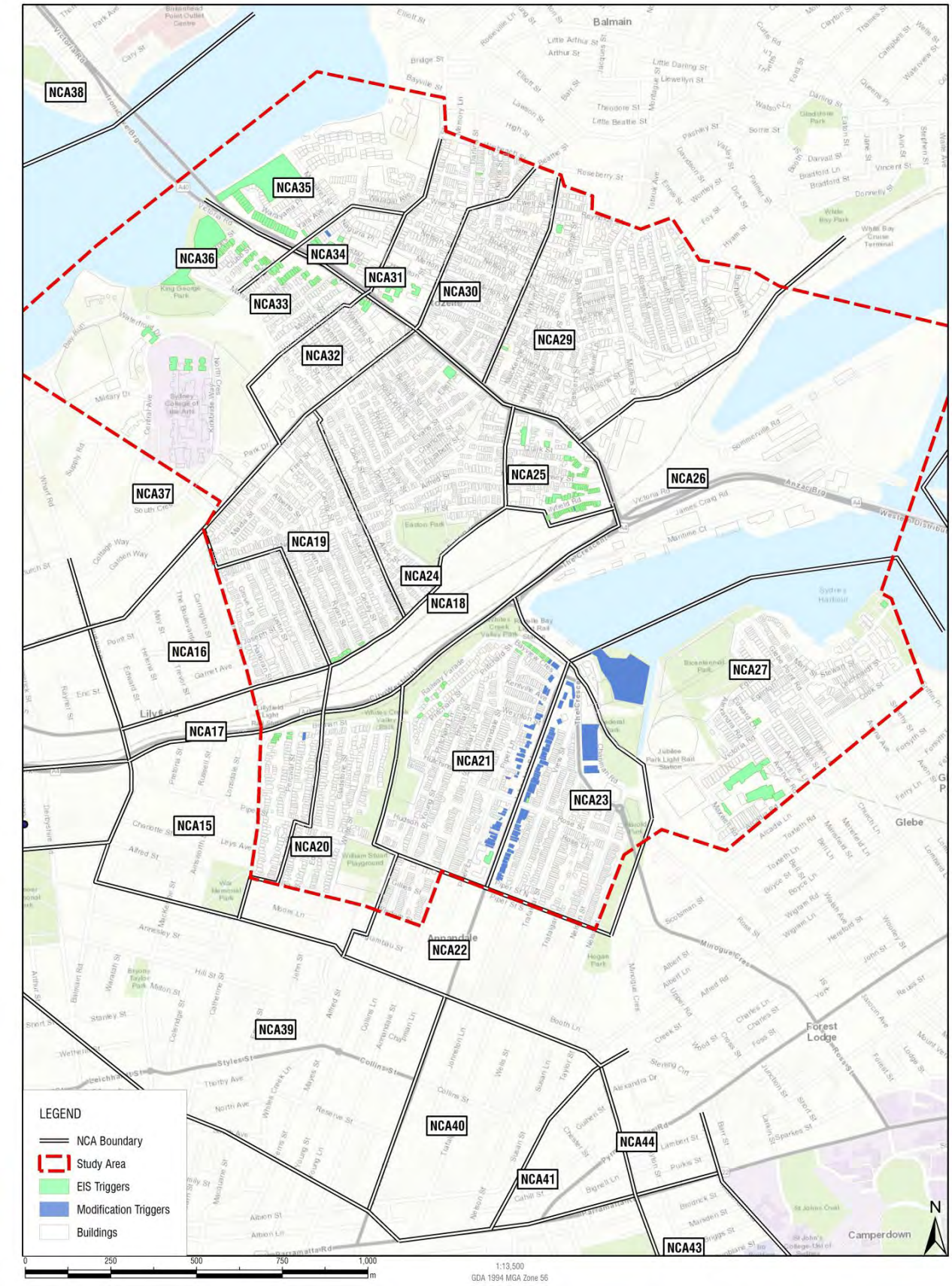


Figure 6-8 Receivers considered eligible for at-property treatment

At this stage in the assessment, the identification of at-property treatments is indicative. Further consideration is required to be given to Roads and Maritime's *At-receiver Noise Treatment Guideline* as well as to the following points at detailed design stage in order to confirm the final extent of treatments:

- The build date of the property and the related conditions of consent which may require that the property has been built to account for existing high levels of road traffic noise
- Caution should be exercised before providing treatments for buildings in a poor state of repair, as they will be less effective and may not provide any appreciable noise reduction benefit
- Heritage advice should be sought if the treatments have the potential to impact the heritage significance of a property. In extreme cases this could result in a decision not to proceed with a treatment on the grounds that it was not considered to be a reasonable or feasible mitigation option.

Treatments are generally limited to acoustic treatment of the building elements (doors, windows, vents, etc) or courtyard fences where they reduce noise to habitable rooms. The installation of courtyard fences close to the dwelling may also provide some mitigation for outdoor living spaces.

The overall goal of the architectural treatment is to provide similar acoustic amenity and internal noise levels to those experienced within a receiver where the external noise criteria have been met.

In most instances, assuming brick construction and standard glazing, this goal equates to internal noise levels that are around 20 dBA less than the external noise criteria with windows closed. In practice there will be some variation in reduction due to the design of the existing building and other limitations such as building condition. A 20 dBA goal results in internal noise levels that are consistent with other guidelines. These guidelines include the State Environmental Planning Policy (Infrastructure) 2007 (NSW) and Australian Standard 2107. The 20 dBA goal also provides protection against a large increase in internal noise level in accordance with the NCG and RNP relative increase criterion.

Building element treatments are more effective when they are applied to masonry structures than lightly clad timber frame structures. The architectural treatments provided by Roads and Maritime typically include:

- Fresh air ventilation systems that meet the National Construction Code of Australia requirements with the windows and doors closed
- Upgraded windows and glazing and solid core doors on the exposed facades of the substantial structures only (eg masonry or insulated weather board cladding with sealed underfloor). These techniques would be unlikely to produce any noticeable benefit for light frame structures with no acoustic insulation in the walls
- Upgrading window or door seals and appropriately treating sub-floor ventilation
- The sealing of wall vents
- The sealing of the underfloor below the bearers
- The sealing of eaves.

Alternative at-receiver treatments are:

- The installation of courtyard fences that break line of site between the affected facade window and the road where they are feasible and reasonable and are preferred by the owner.

Inspections should be completed before treatment packages are installed. Treatment packages should only be recommended and considered feasible and reasonable where they are predicted to provide a noticeable improvement in noise reduction (ie 3 dBA or greater) than the existing window, door and facade system. In some instances partial treatment packages may be considered feasible and reasonable where the existing system forms part of the recommended package.

During the installation phase of the acoustic treatments, ownership details would be obtained for all receivers identified as eligible for consideration of at-property treatment. This phase also identifies the location of internal habitable areas for each receiver and subsequently the most appropriate form of at-property treatment to be installed.

During detailed design, ownership details would be obtained for all receivers identified as eligible for consideration of at-property treatment. Once an internal inspection of the property is undertaken, consideration of the internal layout of habitable spaces and subsequently the most appropriate form of at-property treatment can be confirmed.

This would also include confirmation of external criteria for other sensitive receivers on a case by case basis. External criteria for other sensitive receivers have been derived assuming a 10 dBA reduction of external noise levels to internal (see **Table 3-7)**. For some non-residential receivers this assumption may be overly conservative as the facade area to window ratios are often larger when compared to residential receivers, or windows may not be openable and the internal criteria may be achievable without additional at-property treatment.

Where at-receiver treatments are found to be the preferred option, the design of treatments should take into account the potential for change in noise characteristics as a result of relocating the signalised intersection on Johnston Street and noise associated with stop start traffic at the intersection.

7 Conclusion

NSW Roads and Maritime Services is seeking to modify the existing approval for the construction and operation of the WestConnex M4-M5 Link project, which is part of the WestConnex program of works.

The proposed modification to the project includes the following key components:

- The Crescent overpass, which would allow eastbound traffic heading north on The Crescent from Annandale to bypass the signalised intersection at The Crescent / City West Link junction and continue east on The Crescent towards Victoria Road and the Anzac Bridge
- Modifications to the eastbound lanes of the City West Link and The Crescent on either side of the intersection and northbound lanes on The Crescent at Annandale to provide space for the tie-in of The Crescent overpass
- Upgrades to the intersection of The Crescent/Johnston Street/Chapman Road (including lane reconfiguration and marking, signal phasing, adjusting positions of traffic signals kerb works etc.)
- Realignment of the green link to the west of The Crescent, providing a connection between the Rozelle Rail Yards and the Rozelle Bay light rail stop
- A new shared user path bridge spanning The Crescent to the east of The Crescent / City West Link intersection. The shared user path bridge provides a connection between Rozelle Rail Yards and the shared user path to Bicentennial Park along the east side of The Crescent and adjacent to Rozelle Bay. The shared user path bridge and shared user path would provide the pedestrian and cyclist connectivity required by Conditions E120 and E121, albeit in a different arrangement to that shown in the EIS.
- Minor changes to the layout of the approach roads leading to the Anzac Bridge from Victoria Road, The Crescent and the Rozelle Interchange to improve traffic merging arrangements
- Use of a minor construction ancillary facility, established in accordance with Condition C24, as a construction ancillary facility. The proposed construction ancillary facility (C6a) is located on the south side of The Crescent to the west of James Craig Road and adjacent to Rozelle Bay. The proposed modification would allow use of the site for a limited number of additional purposes which are not permitted by Condition C24 including:
  - Light vehicle parking for workers (around 9 spaces) and
  - Material laydown areas and a limited number of associated vehicle movements (small delivery vans and rigid trucks).

  These additional purposes would support the various construction activities at the C6 civil site.

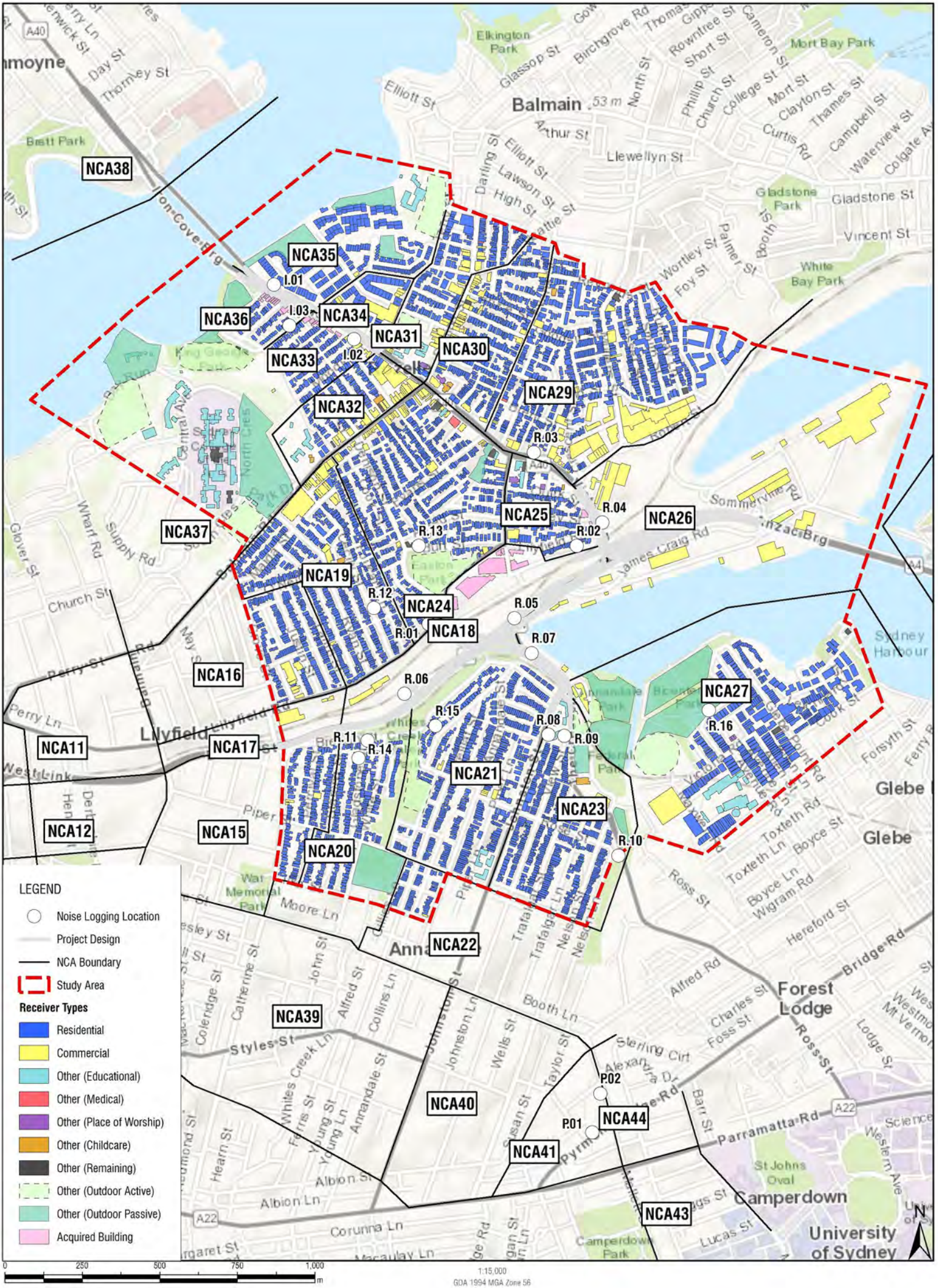
The construction of the proposed modification would generally be in similar locations to what was assessed for the approved project, meaning the impacts during construction are generally expected to be consistent with the EIS. The works around The Crescent, Chapman Road and Johnston Street may however impact a relatively small number of additional receivers given the need to complete construction work for The Crescent overpass further to the east than was assessed for the approved project.

Operational road traffic noise levels are expected to generally be comparable to the approved project, with noise levels for the proposed modification being within -0.5 dBA to +0.5 dBA of the EIS noise levels for the majority of receivers in the study area. This relatively small increase is however sufficient to result in additional exceedances on Johnston Street in the *Do Something* scenario. In total, 158 additional floors are identified as eligible for consideration of mitigation in the *Do Something* scenario due to the proposed modification. In the *Do Something Plus* scenario, the heavy vehicle traffic volumes on Johnston Street are reduced and an additional 12 floors are identified for treatment in this scenario in total.

The Crescent overpass is predicted to increase noise levels at a small number of receivers near to Bayview Crescent by between 0.5 dBA and 1.5 dBA. Noise levels in this area are however controlled by high volumes of traffic on City West Link and The Crescent, in comparison to the relatively lower traffic volumes on the overpass. Whilst a noise barrier would potentially reduce road traffic noise levels of vehicles on the overpass, it would likely be ineffective in significantly reducing the overall road traffic noise levels at nearby receivers given the relatively low contribution from the overpass.

If detailed design investigation confirms the findings in this report, then at-property treatments for the triggered receivers would be considered as the preferred noise mitigation measure.

Annexure A – Site plan


NCA38
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R.07
R.08
R.09
R.10
R.11
R.12
R.13
R.14
R.15
R.16
P.01
P.02
Balmain
Lilyfield
Glebe
Forest Lodge
Camperdown
University of Sydney
LEGEND
Noise Logging Location
Project Design
NCA Boundary
Study Area
Receiver Types
Residential
Commercial
Other (Educational)
Other (Medical)
Other (Place of Worship)
Other (Childcare)
Other (Remaining)
Other (Outdoor Active)
Other (Outdoor Passive)
Acquired Building
0
250
500
750
1,000
m
1:15,000
GDA 1994 MGA Zone 56
N

Annexure B – Operational noise inputs

Traffic Data - 2023 Timeframe 1

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Victoria Rd - Southbound												
Btwn Park Ave & Iron Cove Link	41033	2051	6139	228	43322	2441	6481	271	43665	2807	6533	312
Btwn Iron Cove Link & Terry St	41033	2051	6139	228	17088	795	2717	105	16567	870	2634	115
Btwn Terry St & Wellington St	35556	2005	5320	223	12675	779	1896	87	12248	838	1833	93
Btwn Wellington St & Darling St	37549	2034	5618	226	15525	898	2323	100	15221	955	2277	106
Btwn Darling St & Evans St	29896	1434	4473	159	9222	519	1380	58	9007	483	1348	54
Btwn Evans St & Gordon St	30512	1465	4565	163	10931	554	1635	61	10644	532	1593	59
Btwn Gordon St & Robert St	34105	1547	4993	181	15848	661	2320	77	15558	620	2278	73
Btwn Robert St & City West Link	43774	1637	6891	157	27827	861	3855	92	27557	788	3818	85
Victoria Rd - Northbound												
Btwn City West Link & Lilyfield Rd	41790	1504	5789	161	24124	608	3835	80	24515	515	3897	68
Btwn Lilyfield Rd & Robert St	39169	1164	5427	125	20994	545	3305	52	21302	440	3354	42
Btwn Robert St & Gordon St	29603	1138	4987	114	10533	428	1775	43	10790	355	1818	35
Btwn Gordon St & Evans St	29580	1136	5041	120	10539	426	1796	45	10795	353	1840	37
Btwn Evans St & Darling St	30514	1143	4851	151	11872	453	1887	60	12150	390	1932	51
Btwn Darling St & Wellington St	31250	1391	5326	147	12554	553	2140	58	13133	537	2238	57
Btwn Wellington St & Moodie St	38761	1481	6162	195	18640	609	2963	80	19203	603	3053	79
Btwn Moodie St & Terry St	38422	1516	6549	160	18191	621	3101	65	18713	614	3190	65
Btwn Terry St & Iron Cove Link	36404	1484	6205	157	15730	562	2501	74	16163	558	2570	73
Btwn Iron Cove Link & Park Ave	36404	1484	6205	157	37960	2136	6470	226	42516	2251	7246	238
City West Link - Eastbound												
Btwn Norton St & Balmain Rd	25476	2259	6351	280	18134	1053	3182	227	16581	787	2910	170
Btwn Balmain Rd & Catherine St	25521	2166	4057	285	16795	1079	2670	142	15568	798	2475	105
Btwn Catherine St & M4M5 Link Intersection	26017	2217	6486	275	18124	1132	2881	149	16951	870	2695	115
Btwn M4M5 Link Intersection & The Crescent	26017	2217	6486	275	21196	1616	3370	213	21485	1031	3415	136
Btwn The Crescent & James Craig Rd	39202	2500	6315	472	18328	1315	2952	249	17840	754	2873	143
Btwn James Craig Rd & Victoria Rd	7078	154	1140	29	8071	271	1283	36	8684	264	1381	35
Btwn James Craig Rd & Underpass to Anzac Bridge	32751	2267	7490	519	24194	1655	5533	379	23222	921	5311	211
City West Link - Westbound												
Btwn Victoria Rd & James Craig Rd	30031	1546	6679	185	27873	1629	6199	194	29728	1392	6611	166
Btwn James Craig Rd & The Crescent	28162	1554	6263	186	27258	1631	6062	195	29135	1395	6480	166
Btwn The Crescent & M4M5 Link Intersection	21913	1306	3846	282	20593	1323	3274	174	23968	1199	3810	158

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn M4M5 Link Intersection & Catherine St	21913	1306	3846	282	18349	1170	2917	154	18904	947	3005	125
Btwn Catherine St & Balmain Rd	23926	1761	4199	380	18320	1320	4568	164	18880	1105	4707	137
Btwn Balmain Rd & Norton St	23708	1841	4160	397	17327	1357	4320	168	17700	1144	4413	142
Anzac Bridge - Eastbound												
Btwn Victoria Rd & ON Ramp from M4M5 Link	35687	1456	5673	192	15912	360	2530	47	15345	246	2439	32
Btwn ON Ramp from M4M5 Link & east end of Anzac Bridge	66412	3608	15189	825	79222	4980	18118	1139	74952	3554	17141	813
Anzac Bridge - Westbound												
Btwn east end of Anzac Bridge & OFF Ramp to M4M5 Link	54342	2495	12428	570	68035	4182	15560	957	68971	3249	15774	743
Btwn OFF Ramp to M4M5 Link & Victoria Rd	57611	2710	9159	357	32263	1481	7175	177	33619	1113	7477	133
The Crescent - Southbound												
Btwn City West Link & Johnston St	9926	185	1051	14	14695	825	1556	63	15561	795	1648	61
Btwn Johnston St & Chapman Rd	4079	83	377	9	5247	315	485	32	5763	307	533	31
Btwn Chapman St & Scotsman St	3689	141	586	19	4610	310	733	41	4995	301	794	40
The Crescent - Northbound												
Btwn Scotsman St & Chapman Rd	5691	232	905	31	5627	335	895	44	6770	365	1076	48
Btwn Chapman Rd & Johnston St	6154	206	808	51	6401	308	841	76	7826	338	1028	84
Btwn Johnston St & City West Link Intersection	13955	491	1370	38	3200	273	314	21	4722	355	463	27
Flyover to City West Link EB	-	-	-	-	14612	689	2323	91	14705	473	2338	62
James Craig Rd - Eastbound												
Btwn City West Link & Sommerville Rd	6951	36	1120	7	7284	36	1173	7	7371	36	1187	7
James Craig Rd - Westbound												
Btwn Sommerville Rd & City West Link	7137	41	1587	5	7222	41	1606	5	7278	41	1619	5
Bowman St - Southbound												
Btwn Tambula St & Bank St	3487	163	363	14	3481	168	362	14	3483	163	362	14
Bowman St - Northbound												
Btwn Bank St & Tambula St	3859	129	401	11	3785	110	393	9	3798	102	395	9
Terry St - Southbound												
Btwn Wellington St & Wulumay Cl	900	30	94	2	791	23	82	2	826	16	86	1
Btwn Wulumay Cl & Victoria Rd	951	31	43	1	835	24	38	1	872	16	40	1
Terry St - Northbound												
Btwn Victoria Rd & Wulumay Cl	9033	113	619	7	8582	102	588	7	8614	112	590	7
Btwn Wulumay Cl & Wellington St	8741	111	909	9	8305	100	863	8	8335	110	866	9

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Wise St - Eastbound												
Btwn Terry St & Darling St	5906	55	405	4	5298	43	363	3	5220	54	358	3
Wise St - Westbound												
Btwn Darling St & Terry St	5779	49	264	2	5354	63	244	3	5249	59	239	3
Beattie St - Westbound												
Btwn Wisbeach St & Darling St	3374	23	351	2	3209	23	334	2	3285	22	341	2
Beattie St - Eastbound												
Btwn Darling St & Wisbeach St	3967	12	412	1	3920	20	407	2	3942	23	410	2
Wellington St - Southbound												
Btwn Terry St & Merton St	7908	73	822	6	7905	96	822	8	7883	96	819	8
Btwn Merton St & Victoria Rd	10171	162	464	8	9741	204	444	10	9851	207	449	10
Darling St - Southbound												
Btwn Wisbeach St & Beattie St	6916	193	673	8	6746	197	657	8	6789	190	661	8
Btwn Beattie St & Merton St	5265	165	513	7	5103	152	497	6	5229	150	509	6
Btwn Merton St & National St	3512	77	365	6	3754	46	390	4	3751	41	390	3
Btwn National St & Victoria Rd	3532	80	344	3	3775	48	368	2	3772	42	367	2
Darling St - Northbound												
Btwn Victoria Rd & National St	6862	173	670	15	6775	209	662	18	6771	219	661	19
Btwn National St & Merton St	6823	172	709	14	6737	208	700	17	6732	217	700	18
Btwn Merton St & Beattie St	6862	173	670	15	6775	209	662	18	6771	219	661	19
Btwn Beattie St & Wisbeach St	8160	217	797	19	7761	237	758	20	7748	253	757	22
Evans St - Southbound												
Btwn Beattie St & Victoria Rd	5015	184	521	15	5076	116	528	10	5008	144	521	12
Evans St - Northbound												
Btwn Victoria Rd & Beattie St	3767	200	392	17	3700	163	385	14	3707	165	385	14
Robert St - Eastbound												
Btwn Victoria Rd & Mullens St	19026	250	1304	16	17181	255	1178	17	17206	233	1179	15
Btwn Mullens St & Buchanan St	302	5	21	0	303	3	21	0	306	3	21	0
Robert St - Westbound												
Btwn Buchanan St & Mullens St	1381	22	63	1	1429	19	65	1	1436	19	66	1
Btwn Mullens St & Victoria Rd	20930	283	955	14	19012	345	867	17	19004	324	867	16
Mullens St - Northbound												
Btwn Robert St & Reynolds St	14026	212	1458	18	13888	220	1444	18	13905	198	1445	17

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Mullens St - Southbound												
Btwn Reynolds St & Robert St	14712	250	1529	21	14660	313	1524	26	14648	293	1523	25
Lilyfield Rd - Eastbound												
Btwn Norton St & Balmain Rd	1250	81	57	4	1404	30	64	1	1452	30	66	1
Btwn Balmain Rd & Helena St	6165	183	281	9	5245	116	239	6	5175	116	236	6
Btwn Helena St & Catherine St	6165	183	281	9	5245	116	239	6	5175	116	236	6
Btwn Catherine St & Foucart St	3856	99	176	5	3501	84	160	4	3501	86	160	4
Btwn Foucart St & Gordon St	2501	66	114	3	2169	62	99	3	2151	64	98	3
Btwn Gordon St & Victoria Rd	1805	4	176	0	1215	0	119	0	1178	0	115	0
Lilyfield Rd - Westbound												
Btwn Victoria Rd & Gordon St	4524	365	441	15	4548	87	443	4	4600	97	448	4
Btwn Gordon St & Foucart St	1470	418	101	27	941	14	64	1	914	25	63	2
Btwn Foucart St & Catherine St	4677	477	321	31	3179	91	218	6	3174	111	218	7
Btwn Catherine St & Helena St	1809	109	124	7	1105	8	76	0	1033	7	71	0
Btwn Helena St & Balmain Rd	1809	109	124	7	1105	8	76	0	1033	7	71	0
Btwn Balmain Rd & Norton St	499	122	34	8	300	1	21	0	319	0	22	0
O'Neill St - Eastbound												
Btwn Grove St & Alberto St	2766	113	288	9	2570	63	267	5	2598	63	270	5
Btwn Alberto St & Foucart St	2338	44	243	4	2599	48	270	4	2615	42	272	3
O'Neill St - Westbound												
Btwn Foucart St & Alberto St	2143	22	223	2	1915	17	199	1	1936	14	201	1
Btwn Alberto St & Grove St	3187	79	331	7	2420	37	252	3	2456	42	255	4
Alfred St - Eastbound												
Btwn Denison St & Gordon St	4030	180	419	15	4604	65	479	5	4581	42	476	4
Alfred St - Westbound												
Btwn Gordon St & Denison St	3370	69	350	6	3313	66	344	5	3389	65	352	5
Evans St - Eastbound												
Btwn Denison St & Victoria Rd	2568	137	267	11	3006	128	312	11	3001	125	312	10
Evans St - Westbound												
Btwn Victoria Rd & Denison St	2501	53	260	4	1313	8	136	1	1289	8	134	1
Perry St - Eastbound												
Btwn Mary St & Balmain Rd	8704	215	397	10	10339	228	472	11	10554	232	482	11
Perry St - Westbound												

Traffic Data - 2023 Timeframe 1

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn Balmain Rd & Mary St	9670	250	663	16	9267	227	635	15	9203	241	631	16
Balmain Rd - Eastbound												
Btwn Perry St & Grove St	13436	587	613	28	13489	523	615	25	13818	577	630	28
Btwn Grove St & Alberto St	11033	525	503	25	10960	458	500	22	11262	511	514	25
Btwn Alberto St & Denison St	10685	536	1699	71	10573	429	1681	56	10850	481	1725	63
Balmain Rd - Westbound												
Btwn Denison St & Alberto St	12581	643	2000	85	11283	453	1794	60	11280	538	1793	71
Btwn Alberto St & Grove St	12851	644	881	42	11615	470	796	31	11612	560	796	36
Btwn Grove St & Perry St	10151	535	696	35	8964	291	614	19	8815	312	604	20
Darling St - Eastbound												
Btwn Denison St & Victoria Rd	10172	467	993	40	9417	353	919	30	9776	416	955	36
Darling St - Westbound												
Btwn Victoria Rd & Denison St	13749	789	1339	33	12163	509	1184	22	12109	603	1179	25
Moodie St - Eastbound												
Btwn Oxford St & Victoria Rd	1259	13	131	1	993	6	103	1	973	8	101	1
Moodie St - Westbound												
Btwn Victoria Rd & Oxford St	1214	11	126	1	1275	11	133	1	1293	9	134	1
Grove St - Southbound												
Btwn O'Neill St & Lilyfield Rd	6589	207	685	17	5858	236	609	20	6039	305	628	26
Grove St - Northbound												
Btwn Lilyfield Rd & O'Neill St	1078	71	112	6	844	20	88	2	855	20	89	2
Alberto St - Southbound												
Btwn Balmain Rd & O'Neill St	774	41	81	3	604	12	63	1	603	14	63	1
Alberto St - Northbound												
Btwn O'Neill St & Balmain Rd	771	54	80	5	719	9	75	1	724	10	75	1
Foucart St - Southbound												
Btwn O'Neill St & Lilyfield Rd	3388	63	352	5	2493	78	259	6	2491	89	259	7
Foucart St - Northbound												
Btwn Lilyfield Rd & O'Neill St	1089	27	113	2	1105	20	115	2	1094	19	114	2
Oxford St - Southbound												
Btwn Moodie St & Balmain Rd	2140	25	222	2	2162	30	225	2	2183	29	227	2
Oxford St - Northbound												
Btwn Balmain St & Moodie St	1987	29	207	2	1637	27	170	2	1623	28	169	2

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Denison St - Southbound												
Btwn Balmain Rd & Evans St	2850	196	296	16	3412	134	355	11	3337	127	347	11
Btwn Evans St & Alfred St	4193	154	436	13	3102	46	322	4	3052	44	317	4
Denison St - Northbound												
Btwn Alfred St & Evans St	2542	57	264	5	2286	49	238	4	2333	54	243	4
Btwn Evans St & Balmain St	1130	17	118	1	902	16	94	1	907	18	94	2
Gordon St - Northbound												
Btwn Lilyfield Rd & Victoria Rd	3690	97	360	8	5127	113	501	10	5126	94	501	8
Brenan St - Eastbound												
Btwn Catherine St & Railway Pde	1610	79	167	7	1749	16	182	1	1710	10	178	1
Brenan St - Westbound												
Btwn Railway Pde & Catherine St	1539	82	160	7	659	19	69	2	670	19	70	2
Railway Pde - Eastbound												
Btwn Brenan St & Bayview Cres	534	12	33	0	893	14	55	1	874	9	54	0
Railway Pde - Westbound												
Btwn Bayview Cres & Brenan St	700	6	32	0	0	0	0	0	0	0	0	0
Bayview Cres - Eastbound												
Btwn Railway Pde & Annandale St	514	11	53	1	859	14	89	1	841	8	87	1
Bayview Cres - Westbound												
Btwn Annandale St & Railway Pde	663	6	69	0	0	0	0	0	0	0	0	0
Annandale St - Southbound												
Btwn Bayview Cres & Kentville Ave	514	11	53	1	859	14	89	1	841	8	87	1
Annandale St - Northbound												
Btwn Kentville Ave & Bayview Cres	663	6	69	0	0	0	0	0	0	0	0	0
Johnston St - Southbound												
Btwn The Crescent & Kentville Ave	7523	180	911	19	9966	495	1206	53	10318	474	1249	50
Btwn Kentville Ave & Rose St	6646	172	1056	23	9640	484	1532	64	9980	463	1587	61
Btwn Rose St & Piper St	5706	164	907	22	8285	455	1317	60	8585	435	1365	57
Johnston St - Northbound												
Btwn Piper St & Rose St	7981	319	1269	42	10372	595	1649	78	10519	431	1672	57
Btwn Rose St & Kentville Ave	8376	313	1332	41	11140	602	1771	79	11302	437	1797	58
Btwn Kentville Ave & The Crescent	9379	342	896	22	12649	655	1209	41	12805	472	1223	30
Kentville Ave - Eastbound												

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn Annandale St & Johnston St	514	11	53	1	859	14	89	1	841	8	87	1
Kentville Ave - Westbound												
Btwn Johnston St & Annandale St	663	6	69	0	0	0	0	0	0	0	0	0
Hutchinson St - Eastbound												
Btwn Railway Pde & Annandale St	1096	68	114	6	891	1	93	0	871	2	90	0
Hutchinson St - Westbound												
Btwn Annandale St & Railway Pde	877	77	91	6	659	19	69	2	670	19	70	2
Rose St - Eastbound												
Btwn Annandale St & Johnston St	1096	68	114	6	891	1	93	0	871	2	90	0
Rose St - Westbound												
Btwn Johnston St & Annandale St	877	77	91	6	659	19	69	2	670	19	70	2
Catherine St - Southbound												
Btwn Lilyfield Rd & City West Link	9991	570	1573	55	8410	319	1165	34	8572	407	1187	44
Btwn City West Link & Brenan St	7492	265	793	20	6520	215	690	17	6579	272	697	21
Btwn Brenan St & Piper St	6437	191	779	20	5664	209	686	22	5744	265	695	28
Btwn Piper St & Ilka St	7356	263	891	28	6133	215	742	23	6195	269	750	29
Btwn Ilka St & Moore St	7470	269	777	22	6228	220	647	18	6291	275	654	23
Catherine St - Northbound												
Btwn Moore St & Ilka St	4941	192	514	16	3960	87	412	7	3971	90	413	7
Btwn Ilka St & Piper St	4979	196	476	12	3991	88	381	6	4002	91	382	6
Btwn Piper St & Brenan St	935	168	89	11	1043	87	100	6	1012	80	97	5
Btwn Brenan St & City West Link	1835	237	180	18	728	91	71	7	726	87	71	7
Balmain Rd - Southbound												
Btwn Perry St & Lilyfield Rd	2538	295	372	35	2144	86	314	10	2114	92	309	11
Btwn Lilyfield Rd & City West Link	3882	349	611	33	3522	106	488	11	3524	111	488	12
Btwn City West Link & Piper St	5079	141	615	15	5002	40	605	4	5011	42	607	4
Btwn Piper St & Alfred St	3455	63	418	7	3452	10	418	1	3416	11	414	1
Btwn Alfred St & Moore St	3508	65	365	5	3506	10	364	1	3469	11	361	1
Balmain Rd - Northbound												
Btwn Moore St & Alfred St	5672	308	590	26	9315	399	1467	38	9474	448	1491	43
Btwn Alfred St & Piper St	5716	314	546	20	5197	305	876	31	5347	353	901	35
Btwn Piper St & City West Link	10367	348	991	22	4531	295	471	25	4750	332	494	28
Btwn City West Link & Lilyfield Rd	11126	531	1541	57	4566	300	436	19	4787	339	457	21

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn Lilyfield Rd & Perry St	6288	379	1059	38	8477	327	810	21	8807	376	842	24
Piper St - Eastbound												
Btwn Balmain Rd & Catherine St	1686	79	175	7	1611	30	167	3	1656	31	172	3
Piper St - Westbound												
Btwn Catherine St & Balmain Rd	4653	34	484	3	3921	27	408	2	4028	38	419	3
M4M5 Link ON Ramp from City West Link												
Btwn City West Link & M4M5 Link EB	-	-	-	-	4658	231	1065	53	7983	371	1826	85
M4M5 Link OFF Ramp to City West Link												
Btwn M4M5 Link WB & City West Link	-	-	-	-	5439	536	1244	123	7481	288	1711	66
M4M5 Link OFF Ramp to Anzac Bridge EB												
Btwn Rozelle Interchange & Anzac Bridge	-	-	-	-	40018	2993	9152	685	37255	2407	8520	551
M4M5 Link ON Ramp from Anzac Bridge WB												
Btwn Anzac Bridge & Rozelle Interchange	-	-	-	-	35937	2831	8219	648	35526	2234	8125	511
Iron Cove Link - Northbound												
Btwn Rozelle Interchange & Victoria Rd	-	-	-	-	21323	1406	4876	321	25257	1512	5776	346
Iron Cove Link - Southbound												
Btwn Victoria Rd & Rozelle Interchange	-	-	-	-	24413	1475	5583	337	25228	1737	5770	397
Western Harbour Tunnel NB ON Ramp from City West Link												
Btwn City West Link & WHT NB	-	-	-	-	-	-	-	-	-	-	-	-
Western Harbour Tunnel SB OFF Ramp to City West Link												
Btwn WHT SB & City West Link	-	-	-	-	-	-	-	-	-	-	-	-

Traffic Data - 2033 Timeframe 2

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Victoria Rd - Southbound												
Btwn Park Ave & Iron Cove Link	42331	2526	6333	281	43067	2913	6443	323	43988	3048	6581	338
Btwn Iron Cove Link & Terry St	42331	2526	6333	281	18166	955	2888	126	17736	965	2820	127
Btwn Terry St & Wellington St	37378	2466	5592	274	13993	971	2093	108	13645	968	2041	107
Btwn Wellington St & Darling St	39688	2495	5938	277	17571	1095	2629	122	17568	1092	2628	121
Btwn Darling St & Evans St	31473	1776	4709	197	10992	640	1644	71	10802	536	1616	59
Btwn Evans St & Gordon St	31834	1790	4763	199	12306	734	1841	81	12134	557	1815	62
Btwn Gordon St & Robert St	35956	1866	5264	218	18017	843	2638	99	17821	648	2609	76
Btwn Robert St & City West Link	46105	1938	7258	186	30999	973	4295	104	30869	821	4277	88
Victoria Rd - Northbound												
Btwn City West Link & Lilyfield Rd	46120	1692	6390	181	27201	640	4324	84	27785	553	4417	73
Btwn Lilyfield Rd & Robert St	42522	1194	5891	128	23228	542	3657	52	23612	403	3717	39
Btwn Robert St & Gordon St	32278	1205	5438	120	12153	426	2048	43	12394	315	2088	31
Btwn Gordon St & Evans St	32466	1195	5534	126	12355	424	2106	45	12599	313	2147	33
Btwn Evans St & Darling St	33191	1185	5277	156	13617	452	2165	59	13977	355	2222	47
Btwn Darling St & Wellington St	33231	1543	5664	163	14076	584	2399	62	14473	537	2467	57
Btwn Wellington St & Moodie St	41600	1637	6613	216	20882	644	3320	85	21158	601	3364	79
Btwn Moodie St & Terry St	41499	1686	7073	178	20338	653	3466	69	20597	611	3510	64
Btwn Terry St & Iron Cove Link	38873	1656	6626	175	17086	596	2716	78	17358	558	2760	73
Btwn Iron Cove Link & Park Ave	38873	1656	6626	175	39454	2266	6725	239	42849	2356	7303	249
City West Link - Eastbound												
Btwn Norton St & Balmain Rd	26346	2269	6568	281	20250	1145	3553	247	18666	851	3276	183
Btwn Balmain Rd & Catherine St	25931	2073	4122	273	18673	1175	2969	155	17370	871	2761	115
Btwn Catherine St & M4M5 Link Intersection	27124	2159	6762	268	20038	1225	3185	161	18979	935	3017	123
Btwn M4M5 Link Intersection & The Crescent	27124	2159	6762	268	23580	1838	3749	242	23995	1099	3815	145
Btwn The Crescent & James Craig Rd	41722	2570	6720	486	19861	1517	3199	287	19509	813	3142	153
Btwn James Craig Rd & Victoria Rd	9525	129	1534	24	9852	289	1566	38	10252	289	1630	38
Btwn James Craig Rd & Underpass to Anzac Bridge	35818	2355	8191	539	26218	1883	5996	431	25593	985	5853	225
City West Link - Westbound												
Btwn Victoria Rd & James Craig Rd	33455	1339	7440	160	31983	1817	7113	217	34680	1450	7713	173
Btwn James Craig Rd & The Crescent	29507	1350	6562	161	30652	1820	6817	217	33415	1455	7432	174
Btwn The Crescent & M4M5 Link Intersection	22073	1134	3874	245	22691	1442	3607	190	27477	1278	4368	168
Btwn M4M5 Link Intersection & Catherine St	22073	1134	3874	245	20027	1240	3184	163	20530	956	3264	126

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn Catherine St & Balmain Rd	25384	1658	4455	358	20213	1419	5040	176	20679	1165	5156	145
Btwn Balmain Rd & Norton St	24815	1793	4355	387	19303	1475	4813	183	19768	1294	4929	161
Anzac Bridge - Eastbound												
Btwn Victoria Rd & ON Ramp from M4M5 Link	36579	1759	5815	232	17182	361	2732	48	17002	234	2703	31
Btwn ON Ramp from M4M5 Link & east end of Anzac Bridge	70321	3975	16082	909	83150	5685	19016	1300	80125	3780	18325	864
Anzac Bridge - Westbound												
Btwn east end of Anzac Bridge & OFF Ramp to M4M5 Link	58096	2512	13286	575	72914	4309	16676	986	73285	3376	16760	772
Btwn OFF Ramp to M4M5 Link & Victoria Rd	61591	2729	9791	359	35851	1573	7973	188	38671	1139	8600	136
The Crescent - Southbound												
Btwn City West Link & Johnston St	11023	170	1167	13	17524	945	1856	72	18475	834	1957	64
Btwn Johnston St & Chapman Rd	4845	88	448	9	6471	366	598	37	6928	326	640	33
Btwn Chapman St & Scotsman St	4426	181	704	24	5764	362	916	48	6109	325	971	43
The Crescent - Northbound												
Btwn Scotsman St & Chapman Rd	7045	231	1120	30	6797	368	1080	48	8162	416	1298	55
Btwn Chapman Rd & Johnston St	7583	205	996	51	7571	341	994	84	9111	390	1197	96
Btwn Johnston St & City West Link Intersection	15140	626	1486	49	3588	312	352	24	5710	407	560	32
Flyover to City West Link EB	-	-	-	-	16081	743	2556	98	16220	507	2578	67
James Craig Rd - Eastbound												
Btwn City West Link & Sommerville Rd	13742	38	2214	7	14659	38	2361	7	14685	38	2365	7
James Craig Rd - Westbound												
Btwn Sommerville Rd & City West Link	14526	42	3231	5	14936	42	3322	5	14749	42	3280	5
Bowman St - Southbound												
Btwn Tambula St & Bank St	4014	202	417	17	3964	210	412	18	4029	202	419	17
Bowman St - Northbound												
Btwn Bank St & Tambula St	4552	159	473	13	4631	122	481	10	4606	123	479	10
Terry St - Southbound												
Btwn Wellington St & Wulumay Cl	1523	35	158	3	1069	50	111	4	1113	36	116	3
Btwn Wulumay Cl & Victoria Rd	1608	36	73	2	1129	52	51	3	1175	37	54	2
Terry St - Northbound												
Btwn Victoria Rd & Wulumay Cl	9784	131	671	9	9497	97	651	6	9437	98	647	6
Btwn Wulumay Cl & Wellington St	9468	128	984	11	9191	95	955	8	9133	96	949	8
Wise St - Eastbound												
Btwn Terry St & Darling St	5886	73	403	5	5273	41	361	3	5314	41	364	3

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Wise St - Westbound												
Btwn Darling St & Terry St	6446	64	294	3	5838	42	266	2	6010	95	274	5
Beattie St - Westbound												
Btwn Wisbeach St & Darling St	3522	19	366	2	3485	25	362	2	3624	28	377	2
Beattie St - Eastbound												
Btwn Darling St & Wisbeach St	3506	27	364	2	3644	10	379	1	3387	16	352	1
Wellington St - Southbound												
Btwn Terry St & Merton St	8950	81	930	7	9320	50	969	4	9345	115	971	10
Btwn Merton St & Victoria Rd	11453	169	523	8	11325	211	517	10	11564	213	528	10
Darling St - Southbound												
Btwn Wisbeach St & Beattie St	7840	210	763	9	7383	208	719	9	7404	204	721	9
Btwn Beattie St & Merton St	5736	165	559	7	5431	188	529	8	5558	134	541	6
Btwn Merton St & National St	3804	79	395	7	3997	28	415	2	3921	38	408	3
Btwn National St & Victoria Rd	3825	83	372	3	4019	29	391	1	3944	39	384	2
Darling St - Northbound												
Btwn Victoria Rd & National St	7327	168	716	14	7184	213	701	18	7119	187	695	16
Btwn National St & Merton St	7286	167	757	14	7142	212	742	18	7078	186	736	16
Btwn Merton St & Beattie St	7327	168	716	14	7184	213	701	18	7119	187	695	16
Btwn Beattie St & Wisbeach St	9033	218	882	19	8543	244	834	21	8651	215	845	18
Evans St - Southbound												
Btwn Beattie St & Victoria Rd	5925	170	616	14	5306	188	552	16	5306	139	552	12
Evans St - Northbound												
Btwn Victoria Rd & Beattie St	4962	202	516	17	4507	180	468	15	4753	230	494	19
Robert St - Eastbound												
Btwn Victoria Rd & Mullens St	21178	256	1452	17	18299	256	1254	17	18380	234	1260	15
Btwn Mullens St & Buchanan St	319	5	22	0	325	3	22	0	326	3	22	0
Robert St - Westbound												
Btwn Buchanan St & Mullens St	1455	22	66	1	1521	19	69	1	1502	19	69	1
Btwn Mullens St & Victoria Rd	23018	300	1050	15	20566	268	938	13	20566	323	938	16
Mullens St - Northbound												
Btwn Robert St & Reynolds St	15332	215	1594	18	14705	219	1529	18	14760	198	1534	17
Mullens St - Southbound												
Btwn Reynolds St & Robert St	15634	267	1625	22	15729	239	1635	20	15698	293	1632	25

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Lilyfield Rd - Eastbound												
Btwn Norton St & Balmain Rd	1667	94	76	5	1549	35	71	2	1595	47	73	2
Btwn Balmain Rd & Helena St	7575	217	346	11	6107	126	279	6	6129	115	280	6
Btwn Helena St & Catherine St	7575	217	346	11	6107	126	279	6	6129	115	280	6
Btwn Catherine St & Foucart St	4804	87	219	4	4310	93	197	5	4325	95	197	5
Btwn Foucart St & Gordon St	3023	53	138	3	2728	68	124	3	2764	69	126	3
Btwn Gordon St & Victoria Rd	1863	0	182	0	1293	0	126	0	1285	0	125	0
Lilyfield Rd - Westbound												
Btwn Victoria Rd & Gordon St	5593	532	545	22	5520	125	538	5	5721	178	557	8
Btwn Gordon St & Foucart St	2208	612	151	40	1735	53	119	3	1874	66	128	4
Btwn Foucart St & Catherine St	5847	672	401	44	4102	116	281	8	4220	157	289	10
Btwn Catherine St & Helena St	2040	135	140	9	1587	6	109	0	1680	5	115	0
Btwn Helena St & Balmain Rd	2040	135	140	9	1587	6	109	0	1680	5	115	0
Btwn Balmain Rd & Norton St	751	178	51	12	410	14	28	1	373	6	26	0
O'Neill St - Eastbound												
Btwn Grove St & Alberto St	3327	131	346	11	2914	66	303	6	2940	67	306	6
Btwn Alberto St & Foucart St	2494	42	259	4	2936	51	305	4	2933	41	305	3
O'Neill St - Westbound												
Btwn Foucart St & Alberto St	2204	20	229	2	2111	16	219	1	2106	11	219	1
Btwn Alberto St & Grove St	3938	59	409	5	2750	42	286	3	2782	46	289	4
Alfred St - Eastbound												
Btwn Denison St & Gordon St	4355	227	453	19	5220	79	543	7	5156	41	536	3
Alfred St - Westbound												
Btwn Gordon St & Denison St	3670	91	381	8	3524	79	366	7	3581	100	372	8
Evans St - Eastbound												
Btwn Denison St & Victoria Rd	3231	150	336	13	3434	133	357	11	3714	174	386	15
Evans St - Westbound												
Btwn Victoria Rd & Denison St	3388	84	352	7	1668	12	173	1	1566	11	163	1
Perry St - Eastbound												
Btwn Mary St & Balmain Rd	8938	265	408	13	10897	236	497	11	11110	243	507	12
Perry St - Westbound												
Btwn Balmain Rd & Mary St	10804	289	741	19	9756	223	669	14	9630	220	660	14
Balmain Rd - Eastbound												

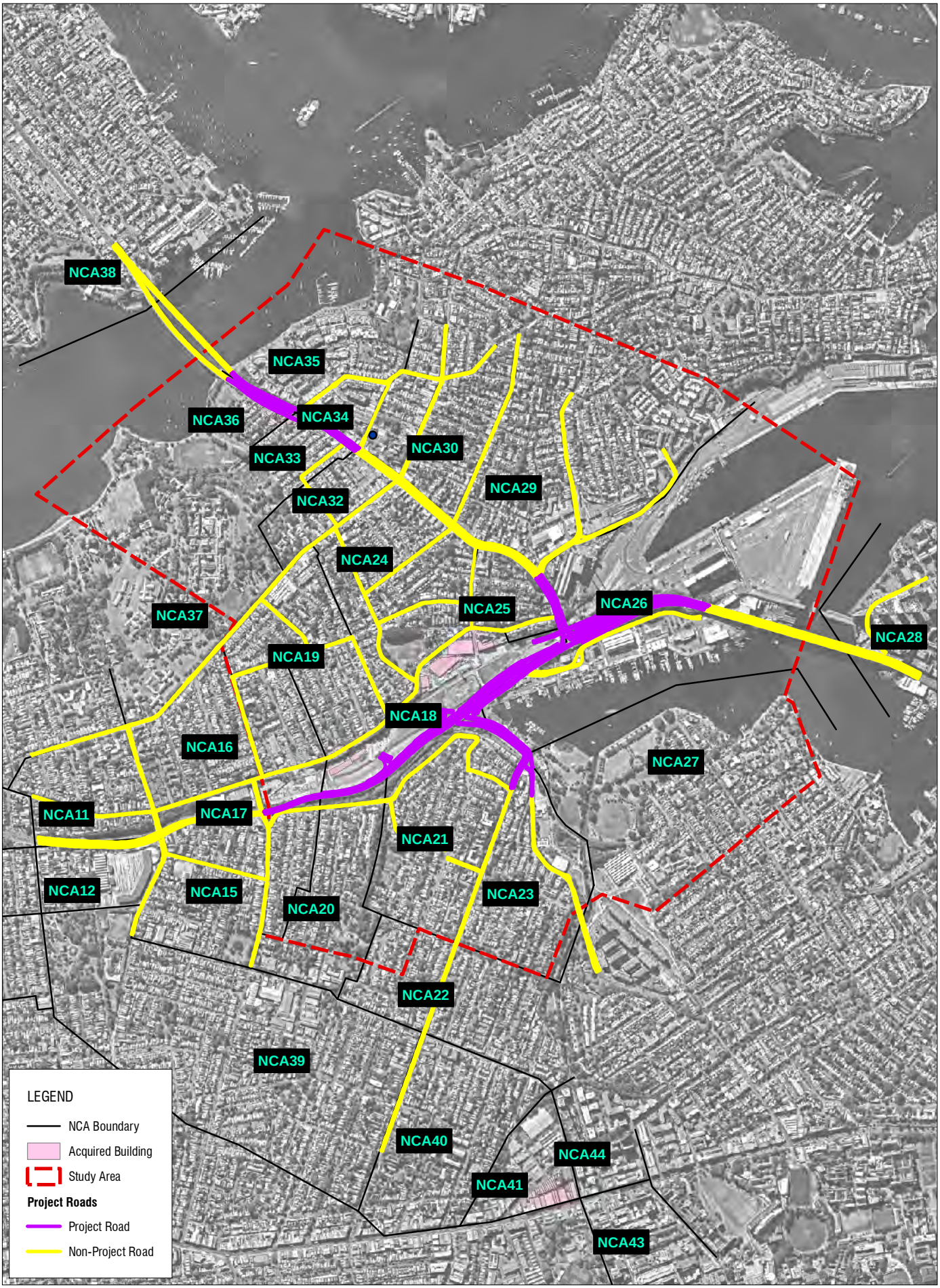
	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn Perry St & Grove St	13906	678	634	33	14165	552	646	27	14358	597	655	29
Btwn Grove St & Alberto St	11334	599	517	29	11524	482	526	23	11680	523	533	25
Btwn Alberto St & Denison St	10991	619	1747	82	11112	454	1767	60	11274	493	1792	65
Balmain Rd - Westbound												
Btwn Denison St & Alberto St	13706	721	2179	95	11736	501	1866	66	11837	613	1882	81
Btwn Alberto St & Grove St	13915	750	954	49	12106	520	830	34	12215	636	837	41
Btwn Grove St & Perry St	11457	633	785	41	9695	325	665	21	9579	393	657	26
Darling St - Eastbound												
Btwn Denison St & Victoria Rd	10088	561	985	48	9701	386	947	33	9591	413	937	36
Darling St - Westbound												
Btwn Victoria Rd & Denison St	14801	902	1441	38	12794	562	1246	24	12824	681	1249	29
Moodie St - Eastbound												
Btwn Oxford St & Victoria Rd	1497	20	156	2	1053	7	109	1	1074	8	112	1
Moodie St - Westbound												
Btwn Victoria Rd & Oxford St	1173	9	122	1	1415	11	147	1	1452	10	151	1
Grove St - Southbound												
Btwn O'Neill St & Lilyfield Rd	7293	193	758	16	6140	254	638	21	6396	304	665	25
Grove St - Northbound												
Btwn Lilyfield Rd & O'Neill St	1551	74	161	6	1146	22	119	2	1146	18	119	2
Alberto St - Southbound												
Btwn Balmain Rd & O'Neill St	920	21	96	2	606	14	63	1	607	15	63	1
Alberto St - Northbound												
Btwn O'Neill St & Balmain Rd	801	69	83	6	755	9	79	1	772	11	80	1
Foucart St - Southbound												
Btwn O'Neill St & Lilyfield Rd	4059	64	422	5	3013	64	313	5	2979	90	310	7
Foucart St - Northbound												
Btwn Lilyfield Rd & O'Neill St	1160	29	121	2	1132	20	118	2	1101	20	114	2
Oxford St - Southbound												
Btwn Moodie St & Balmain Rd	2245	26	233	2	2414	30	251	3	2442	30	254	3
Oxford St - Northbound												
Btwn Balmain St & Moodie St	2262	40	235	3	1713	29	178	2	1707	29	177	2
Denison St - Southbound												
Btwn Balmain Rd & Evans St	3217	203	334	17	4099	125	426	10	4355	139	453	12

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn Evans St & Alfred St	5047	209	525	17	3819	50	397	4	3700	47	385	4
Denison St - Northbound												
Btwn Alfred St & Evans St	3073	86	319	7	2463	61	256	5	2491	89	259	7
Btwn Evans St & Balmain St	1397	14	145	1	980	15	102	1	998	17	104	1
Gordon St - Northbound												
Btwn Lilyfield Rd & Victoria Rd	4472	85	437	7	6165	121	602	10	6145	99	600	8
Brenan St - Eastbound												
Btwn Catherine St & Railway Pde	2230	91	232	8	1823	18	189	1	1809	10	188	1
Brenan St - Westbound												
Btwn Railway Pde & Catherine St	2602	85	270	7	780	19	81	2	803	19	84	2
Railway Pde - Eastbound												
Btwn Brenan St & Bayview Cres	734	28	45	1	945	14	58	1	928	11	57	0
Railway Pde - Westbound												
Btwn Bayview Cres & Brenan St	1608	0	74	0	0	0	0	0	0	0	0	0
Bayview Cres - Eastbound												
Btwn Railway Pde & Annandale St	706	27	73	2	909	14	94	1	892	10	93	1
Bayview Cres - Westbound												
Btwn Annandale St & Railway Pde	1524	0	158	0	0	0	0	0	0	0	0	0
Annandale St - Southbound												
Btwn Bayview Cres & Kentville Ave	706	27	73	2	909	14	94	1	892	10	93	1
Annandale St - Northbound												
Btwn Kentville Ave & Bayview Cres	1524	0	158	0	0	0	0	0	0	0	0	0
Johnston St - Southbound												
Btwn The Crescent & Kentville Ave	8926	165	1081	17	11640	563	1409	60	12138	494	1469	52
Btwn Kentville Ave & Rose St	7183	175	1142	23	11259	551	1790	73	11741	483	1866	64
Btwn Rose St & Piper St	6500	151	1033	20	9891	521	1572	69	10320	454	1641	60
Johnston St - Northbound												
Btwn Piper St & Rose St	8662	451	1377	59	11245	653	1788	86	11869	459	1887	60
Btwn Rose St & Kentville Ave	8952	445	1423	59	11864	656	1886	86	12532	463	1992	61
Btwn Kentville Ave & The Crescent	10182	488	973	31	13468	714	1287	45	14156	502	1352	32
Kentville Ave - Eastbound												
Btwn Annandale St & Johnston St	706	27	73	2	909	14	94	1	892	10	93	1
Kentville Ave - Westbound												

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn Johnston St & Annandale St	1524	0	158	0	0	0	0	0	0	0	0	0
Hutchinson St - Eastbound												
Btwn Railway Pde & Annandale St	1524	63	158	5	910	3	95	0	919	2	95	0
Hutchinson St - Westbound												
Btwn Annandale St & Railway Pde	1080	90	112	7	780	19	81	2	803	19	84	2
Rose St - Eastbound												
Btwn Annandale St & Johnston St	1524	63	158	5	910	3	95	0	919	2	95	0
Rose St - Westbound												
Btwn Johnston St & Annandale St	1080	90	112	7	780	19	81	2	803	19	84	2
Catherine St - Southbound												
Btwn Lilyfield Rd & City West Link	11496	758	1810	73	8846	364	1225	39	9130	444	1265	48
Btwn City West Link & Brenan St	8046	280	852	21	6768	243	717	19	6866	270	727	21
Btwn Brenan St & Piper St	6714	202	813	22	5892	235	713	25	5981	264	724	28
Btwn Piper St & Ilka St	7990	314	967	33	6497	239	787	25	6633	274	803	29
Btwn Ilka St & Moore St	8114	320	843	27	6598	244	686	20	6736	280	700	23
Catherine St - Northbound												
Btwn Moore St & Ilka St	5720	165	595	14	4441	95	462	8	4539	98	472	8
Btwn Ilka St & Piper St	5764	168	551	11	4475	97	428	6	4574	100	437	6
Btwn Piper St & Brenan St	1399	115	134	7	1187	94	113	6	1214	84	116	5
Btwn Brenan St & City West Link	3019	180	296	14	941	99	92	8	1010	94	99	7
Balmain Rd - Southbound												
Btwn Perry St & Lilyfield Rd	3055	403	447	47	2557	122	374	14	2654	189	389	22
Btwn Lilyfield Rd & City West Link	4536	414	714	40	4667	131	647	14	4890	226	678	24
Btwn City West Link & Piper St	5977	203	724	22	5668	44	686	5	5692	58	689	6
Btwn Piper St & Alfred St	3872	83	469	9	3960	14	479	2	3938	20	477	2
Btwn Alfred St & Moore St	3932	85	409	7	4021	15	418	1	3999	20	416	2
Balmain Rd - Northbound												
Btwn Moore St & Alfred St	6289	335	654	28	10633	432	1674	41	10685	464	1682	44
Btwn Alfred St & Piper St	6337	342	606	21	5491	326	925	33	5561	359	937	36
Btwn Piper St & City West Link	11387	401	1088	25	4929	320	512	27	5003	344	520	29
Btwn City West Link & Lilyfield Rd	12784	630	1771	67	4966	326	475	21	5041	350	482	22
Btwn Lilyfield Rd & Perry St	6846	473	1153	47	9175	355	877	22	9336	395	892	25
Piper St - Eastbound												

	No Build				Do Something				Do Something Plus			
	15 Hour		9 Hour		15 Hour		9 Hour		15 Hour		9 Hour	
	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV	Light Volume	HGV
Btwn Balmain Rd & Catherine St	2243	127	233	11	1776	35	185	3	1821	42	189	3
Piper St - Westbound												
Btwn Catherine St & Balmain Rd	5114	61	532	5	4218	29	438	2	4303	44	447	4
M4M5 Link ON Ramp from City West Link												
Btwn City West Link & M4M5 Link EB	-	-	-	-	5299	282	1212	65	10277	441	2350	101
M4M5 Link OFF Ramp to City West Link												
Btwn M4M5 Link WB & City West Link	-	-	-	-	6128	660	1402	151	8457	299	1934	68
M4M5 Link OFF Ramp to Anzac Bridge EB												
Btwn Rozelle Interchange & Anzac Bridge	-	-	-	-	40723	3470	9314	794	38495	2580	8804	590
M4M5 Link ON Ramp from Anzac Bridge WB												
Btwn Anzac Bridge & Rozelle Interchange	-	-	-	-	37247	2876	8518	658	34812	2334	7962	534
Iron Cove Link - Northbound												
Btwn Rozelle Interchange & Victoria Rd	-	-	-	-	21467	1491	4910	341	24443	1608	5590	368
Iron Cove Link - Southbound												
Btwn Victoria Rd & Rozelle Interchange	-	-	-	-	23159	1754	5296	401	24427	1865	5586	427
Western Harbour Tunnel NB ON Ramp from City West Link												
Btwn City West Link & WHT NB	-	-	-	-	-	-	-	-	-	-	-	-
Western Harbour Tunnel SB OFF Ramp to City West Link												
Btwn WHT SB & City West Link	-	-	-	-	-	-	-	-	-	-	-	-

Noise criteria guideline requirements



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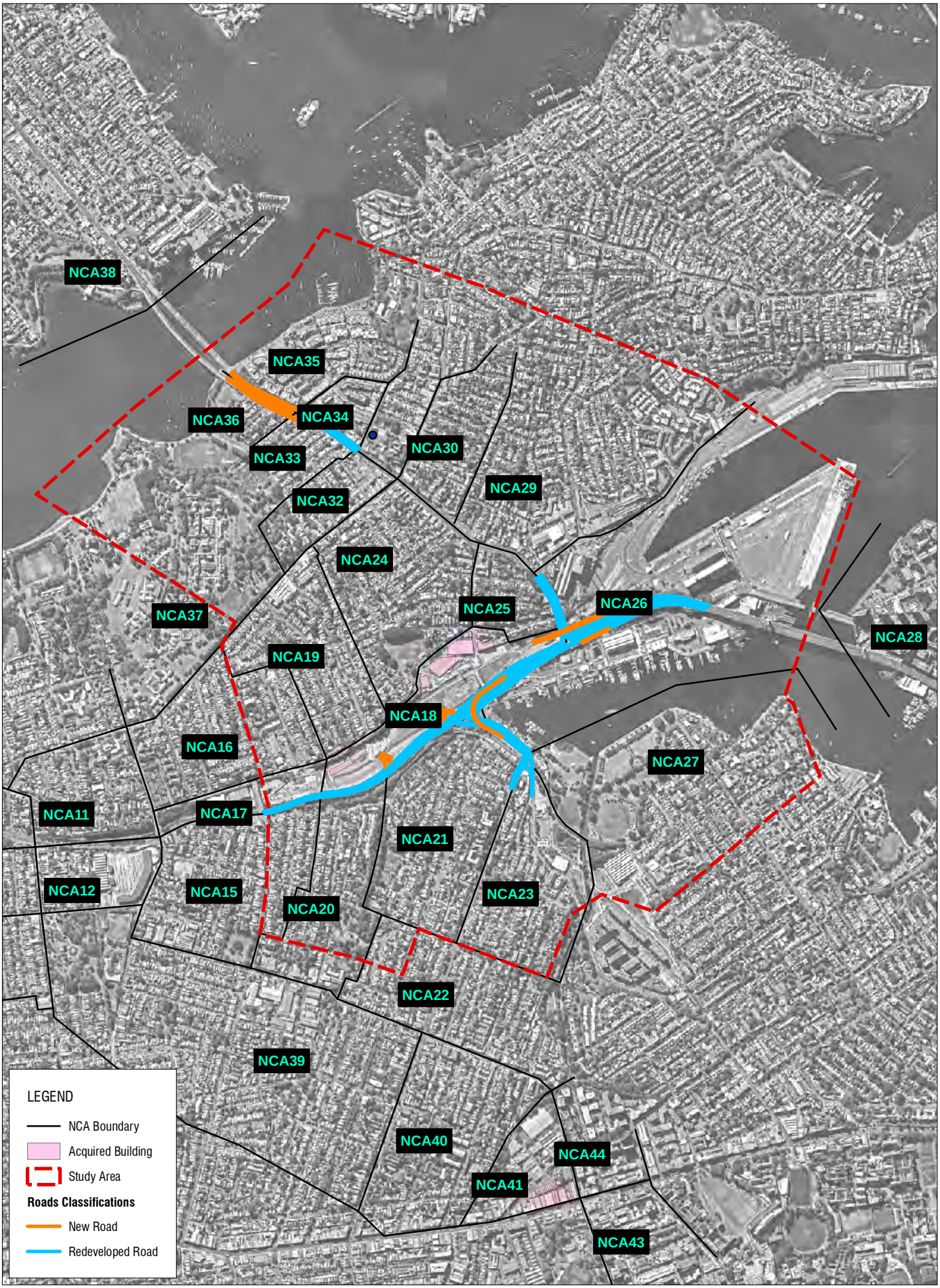
Sydney Motorway Corporation

WestConnex M4-M5 Link

Project and Non-Project Road Classifications



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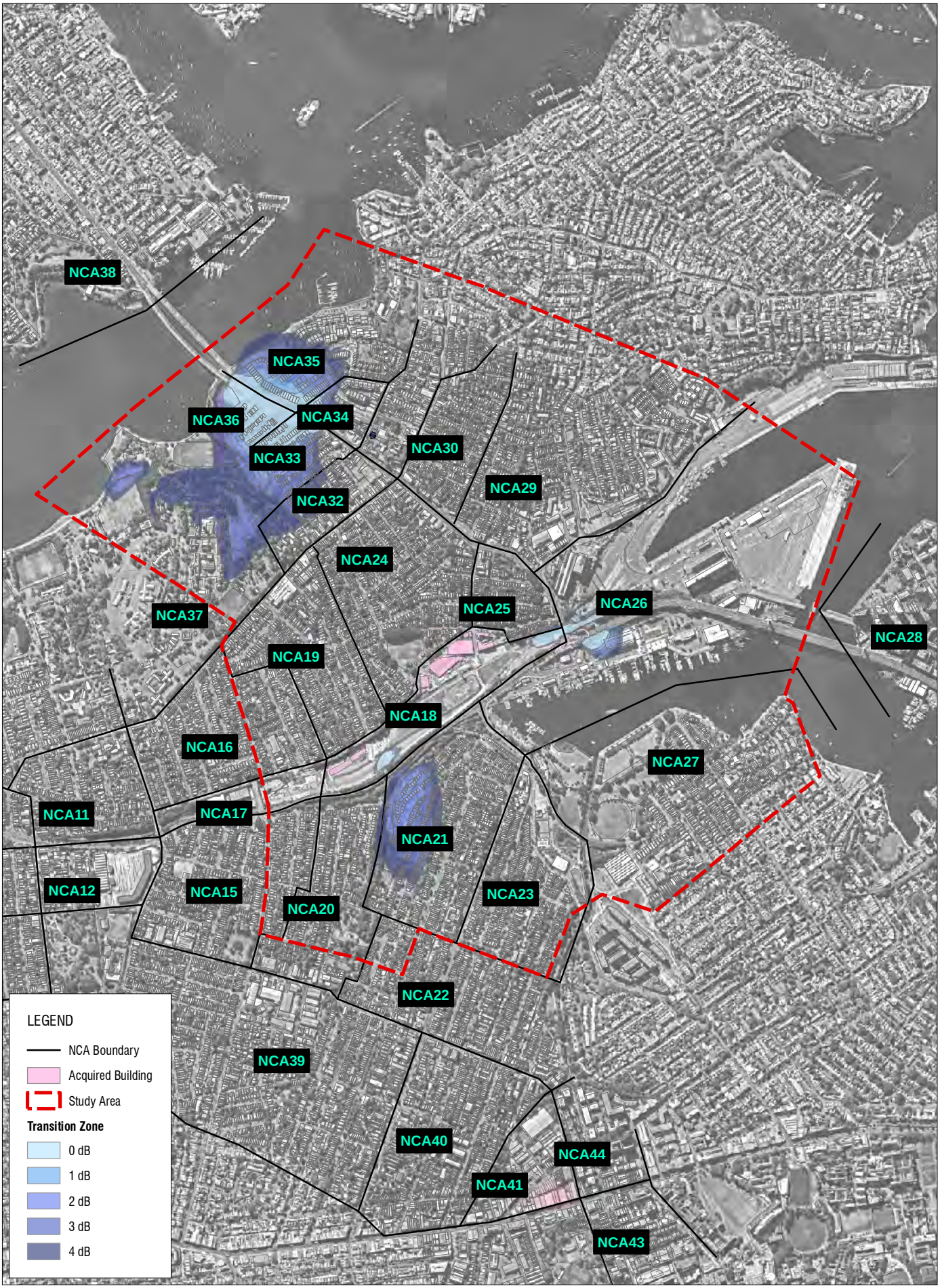
Sydney Motorway Corporation

WestConnex M4-M5 Link

New and Redeveloped Road Classifications



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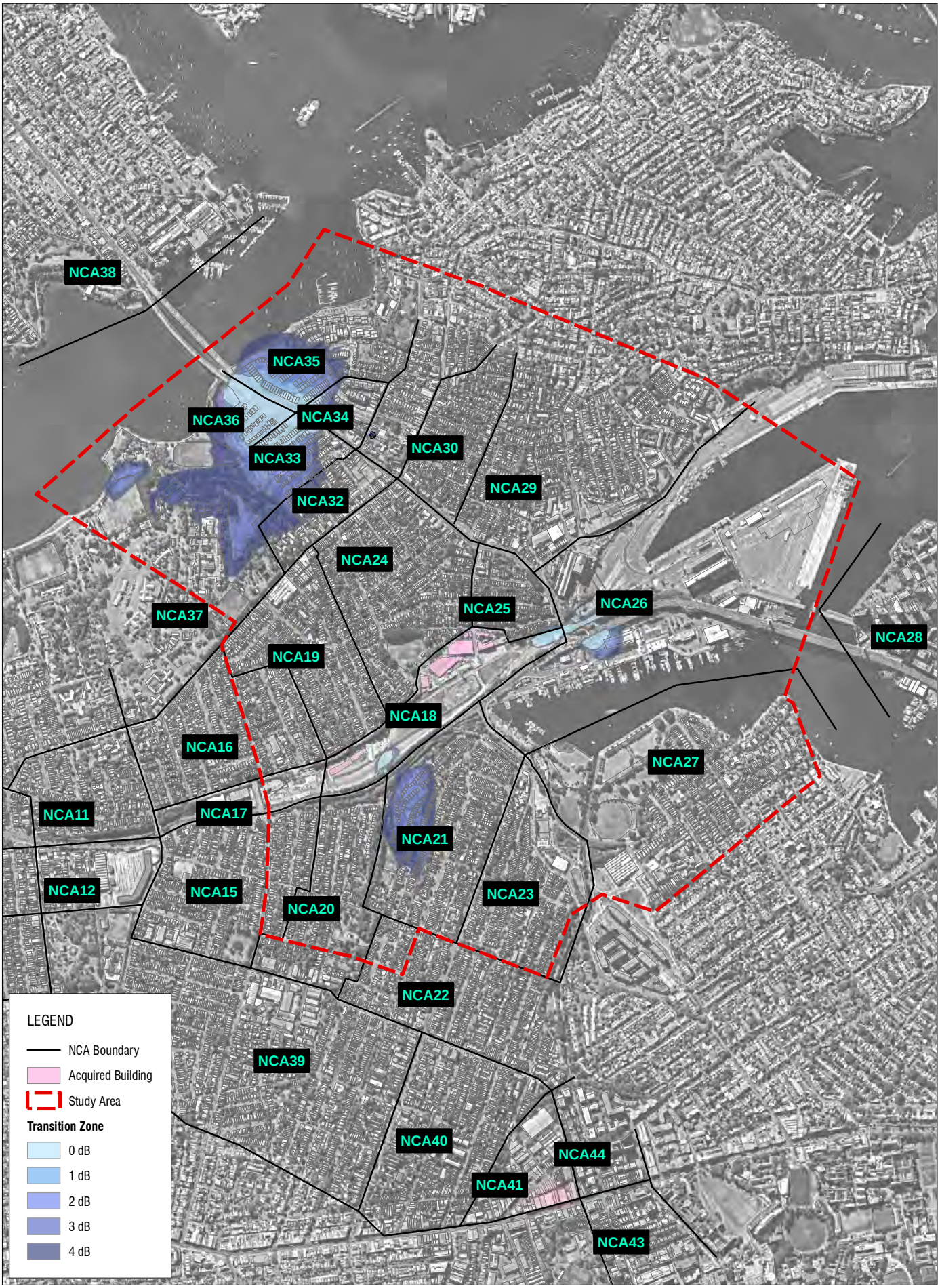
Sydney Motorway Corporation

WestConnex M4-M5 Link

Transition Zone Do Something Plus



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Sydney Motorway Corporation

WestConnex M4-M5 Link

Transition Zone Do Something

Operational Road Traffic Noise Levels – Do Something

Note.

Only receivers which qualify for the consideration of mitigation that were not triggered in the approved EIS (triggers as a result of the modification) are included.

The results in this table are based on the highest noise level of the triggered facades, per floor. If no facades are triggered, then the highest noise level of all facades is presented for each floor. It is noted that a single receiver may be triggered on multiple facades by different criteria and for some receivers where a >2 dB increase is shown, the increase may be on a different facade from where the highest noise level is predicted.

Address information has been taken from third party data. Reference should be made to the exceedance maps for the location of all triggered buildings.

Name	NCA	Flr	Easting	Northing	RecType	Address	NCG Criteria		Period	Predicted Noise Level (dBA)								> 2 dB(A) Increase		Cumulative Limit		Project Acute		Eligible for Consideration of Mitigatio
										At Opening (2026)				Future Design (2036)										
										No Build		Build		No Build		Build								
							D	N		D	N	D	N	D	N	D	N	D	N	D	N	D	N	
NCA15.RES.0147.01	NCA15	2	330404	6250245	Residential	46 BRENAN STREET LILYFIELD	60	55	P	67	61	64	59	67	61	65	59	-	-	Y	-	-	-	Y
NCA21.RES.0017.01	NCA21	1	331122	6250462	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	61	56	64	58	61	56	64	59	Y	Y	-	-	-	-	Y
NCA21.RES.0018.01	NCA21	1	331130	6250457	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	60	55	62	57	60	55	63	57	Y	Y	-	-	-	-	Y
NCA21.RES.0019.01	NCA21	1	331133	6250454	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	60	54	62	56	60	55	62	57	Y	Y	-	-	-	-	Y
NCA21.RES.0020.01	NCA21	1	331137	6250452	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	59	54	62	56	60	54	62	56	Y	Y	-	-	-	-	Y
NCA21.RES.0021.01	NCA21	1	331140	6250449	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	60	54	62	56	60	54	63	57	Y	Y	-	-	-	-	Y
NCA21.RES.0022.01	NCA21	1	331144	6250446	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	65	58	67	60	66	59	67	61	Y	Y	Y	Y	Y	Y	Y
NCA21.RES.0594.01	NCA21	1	331105	6250382	Residential	6 KENTVILLE AVENUE ANNANDALE	60	55	P	61	54	63	56	61	54	63	56	Y	-	-	-	-	-	Y
NCA21.RES.0596.01	NCA21	1	331116	6250373	Residential	2 KENTVILLE AVENUE, ANNANDALE 2038	60	55	P	67	61	69	63	68	61	70	63	Y	-	Y	Y	Y	Y	Y
NCA21.RES.0600.01	NCA21	1	331126	6250411	Residential	1 BAYVIEW CRESCENT, ANNANDALE 2038	60	55	P	66	59	68	61	67	60	69	62	Y	-	Y	Y	Y	Y	Y
NCA21.RES.0608.01	NCA21	1	331110	6250378	Residential	4 KENTVILLE AVENUE, ANNANDALE 2038	60	55	P	62	56	65	58	63	56	65	58	Y	-	Y	-	Y	-	Y
NCA21.RES.0615.01	NCA21	1	331085	6250300	Residential	274 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA21.RES.0616.01	NCA21	1	331093	6250342	Residential	284A JOHNSTON STREET, ANNANDALE 2038	60	55	P	64	58	65	59	65	59	66	60	-	-	Y	Y	-	-	Y
NCA21.RES.0617.01	NCA21	1	331059	6250246	Residential	270 JOHNSTON STREET, ANNANDALE 2038	60	55	P	59	54	61	56	59	54	61	56	Y	-	-	-	-	-	Y
NCA21.RES.0620.01	NCA21	1	331123	6250417	Residential	3 BAYVIEW CRESCENT ANNANDALE	60	55	P	63	56	65	58	63	57	65	59	Y	-	Y	-	Y	-	Y
NCA21.RES.0620.01	NCA21	2	331123	6250417	Residential	3 BAYVIEW CRESCENT ANNANDALE	60	55	P	64	58	66	59	64	58	66	60	-	-	Y	Y	Y	-	Y
NCA21.RES.0622.01	NCA21	1	331064	6250273	Residential	272 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	67	62	66	60	68	62	Y	-	-	-	-	-	Y
NCA21.RES.0622.01	NCA21	2	331064	6250273	Residential	272 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0628.01	NCA21	2	331091	6250307	Residential	276 JOHNSTON STREET ANNANDALE	60	55	P	68	63	70	65	69	63	71	65	Y	-	-	-	-	-	Y
NCA21.RES.0630.01	NCA21	1	330999	6250124	Residential	252 JOHNSTON STREET ANNANDALE	60	55	P	59	54	61	56	60	54	62	56	Y	-	-	-	-	-	Y
NCA21.RES.0635.01	NCA21	1	331042	6250204	Residential	266 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	59	67	62	65	60	67	62	Y	-	-	-	-	-	Y
NCA21.RES.0635.01	NCA21	2	331042	6250204	Residential	266 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	67	62	66	60	68	62	Y	-	-	-	-	-	Y
NCA21.RES.0635.01	NCA21	3	331042	6250204	Residential	266 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	67	62	65	60	67	62	Y	-	-	-	-	-	Y
NCA21.RES.0642.01	NCA21	1	331028	6250138	Residential	258 JOHNSTON STREET ANNANDALE	60	55	P	62	56	64	58	62	57	64	59	Y	-	-	-	-	-	Y
NCA21.RES.0642.01	NCA21	2	331028	6250138	Residential	258 JOHNSTON STREET ANNANDALE	60	55	P	62	57	64	59	63	57	65	59	Y	-	-	-	-	-	Y
NCA21.RES.0643.01	NCA21	1	331022	6250129	Residential	258 JOHNSTON STREET ANNANDALE	60	55	P	61	56	63	58	62	56	64	58	Y	-	-	-	-	-	Y
NCA21.RES.0647.01	NCA21	1	331005	6250085	Residential	252 JOHNSTON STREET ANNANDALE	60	55	P	61	56	63	58	62	57	64	58	Y	-	-	-	-	-	Y
NCA21.RES.0647.01	NCA21	2	331005	6250085	Residential	252 JOHNSTON STREET ANNANDALE	60	55	P	62	57	64	59	63	57	65	59	Y	-	-	-	-	-	Y
NCA21.RES.0649.01	NCA21	1	331032	6250176	Residential	262 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	67	62	66	60	68	62	Y	-	-	-	-	-	Y
NCA21.RES.0659.01	NCA21	1	331037	6250190	Residential	264 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0659.01	NCA21	2	331037	6250190	Residential	264 JOHNSTON STREET, ANNANDALE 2038	60	55	P	64	59	66	61	65	59	67	61	Y	-	-	-	-	-	Y
NCA21.RES.0659.01	NCA21	3	331037	6250190	Residential	264 JOHNSTON STREET, ANNANDALE 2038	60	55	P	64	59	66	61	64	59	66	61	Y	-	-	-	-	-	Y
NCA21.RES.0660.01	NCA21	1	331057	6250222	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	65	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0660.01	NCA21	2	331057	6250222	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0660.01	NCA21	3	331057	6250222	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	65	60	67	62	66	60	68	62	Y	-	-	-	-	-	Y
NCA21.RES.0660.01	NCA21	4	331057	6250222	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	65	60	67	62	66	60	68	62	Y	-	-	-	-	-	Y
NCA21.RES.0661.01	NCA21	1	331054	6250216	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0661.01	NCA21	2	331054	6250216	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	66	61	68	63	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0661.01	NCA21	3	331054	6250216	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0661.01	NCA21	4	331054	6250216	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0662.01	NCA21	1	331060	6250228	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA21.RES.0662.01	NCA21	2	331060	6250228	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA21.RES.0662.01	NCA21	3	331060	6250228	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA21.RES.0662.01	NCA21	4	331060	6250228	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA21.RES.0662.01	NCA21	5	331060	6250228	Residential	268 JOHNSTON STREET ANNANDALE	60	55	P	63	58	65	60	64	58	66	60	Y	-	-	-	-	-	Y
NCA21.RES.0663.01	NCA21	2	331030	6250157	Residential	260 JOHNSTON STREET, ANNANDALE 2038	60	55	P	59	54	61	56	60	54	62	56	Y	-	-	-	-	-	Y
NCA21.RES.0664.01	NCA21	1	330966	6249983	Residential	232 JOHNSTON STREET ANNANDALE	60	55	P	66	61	68	63	67	61	69	63	Y	-	-	-	-	-	Y
NCA21.RES.0666.01	NCA21	1	330944	6249925	Residential	214 JOHNSTON STREET ANNANDALE	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0667.01	NCA21	1	330962	6249976	Residential	230 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	61	68	63	67	61	69	63	Y	-	-	-	-	-	Y
NCA21.RES.0668.01	NCA21	1	330972	6249991	Residential	234 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	61	68	63	67	61	69	63	Y	-	-	-	-	-	Y
NCA21.RES.0668.01	NCA21	2	330972	6249991	Residential	234 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA21.RES.0669.01	NCA21	1	330951	6249943	Residential	220 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0672.01	NCA21	1	330945	6249932	Residential	216 JOHNSTON STREET ANNANDALE	60	55	P	66	61	68	63	67	61	69	63	Y	-	-	-	-	-	Y
NCA21.RES.0675.01	NCA21	1	330956	6249962	Residential	226 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	61	68	63	67	61	69	63	Y	-	-	-	-	-	Y
NCA21.RES.0677.01	NCA21	1	330982	6250019	Residential	242 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0677.01	NCA21	2	330982	6250019	Residential	242 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA21.RES.0680.01	NCA21	1	330947	6249937	Residential	218 JOHNSTON STREET ANNANDALE	60	55	P	66	61	68	63	67	61	69	63	Y	-	-	-	-	-	Y
NCA21.RES.0681.01	NCA21	1	330957	6249948	Residential	222 JOHNSTON STREET ANNANDALE	60	55	P	66	61	68	63	67	61	69	63	Y	-	-	-	-	-	Y
NCA21.RES.0682.01	NCA21	1	330958	6249953	Residential	224 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	61	68	63	67	61	69	63	Y	-	-	-	-	-	Y
NCA21.RES.0684.01	NCA21	1	330988	6250025	Residential	244 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	67	62	66	60	68	62	Y	Y	-	-	-	-	Y
NCA21.RES.0684.01	NCA21	2	330988	6250025	Residential	244 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA21.RES.0685.01	NCA21	1	330991	6250032	Residential	246 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	59	67	61	65	60	67	62	Y	-	-	-	-	-	Y
NCA21.RES.0685.01	NCA21	2	330991	6250032	Residential	246 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA21.RES.0692.01	NCA21	1	330977	6250004	Residential	236 JOHNSTON STREET ANNANDALE	60	55	P	63	58	65	60	64	58	66	60	Y	-	-	-	-	-	Y
NCA21.RES.0692.01	NCA21	2	330977	6250004	Residential	236 JOHNSTON STREET ANNANDALE	60	55	P	64	59	66	61	64	59	66	61	Y	-	-	-	-	-	Y
NCA21.RES.0692.01	NCA21	3	330977	6250004	Residential	236 JOHNSTON STREET ANNANDALE	60	55	P	65	59	67	61	65	60	67	62	Y	-	-	-	-	-	Y
NCA23.OCC.0425.01	NCA23	1	331241	6250149	Other (Childcare)	7 CHAPMAN ROAD, ANNANDALE 2038	45	-	H	54	53	54	54	54	54	55	54	-	-	Y	-	-	-	Y
NCA23.OED.0426.01	NCA23	1	331183	6250341	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	69	67	70	68	70	68	71	69	-	-	Y	-	Y	-	Y
NCA23.OED.0427.01	NCA23	1	331184	6250385	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	70	67	73	71	71	68	74	71	Y	-	Y	-	Y	-	Y
NCA23.OED.0428.01	NCA23	1	331149	6250289	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	63	61	65	63	63	62	65	64	Y	-	-	-	-	-	Y
NCA23.OED.0428.01	NCA23	2	331149	6250289	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	64	62	66	64	64	63	66	65	Y	-	-	-	-	-	Y
NCA23.OED.0430.01	NCA23	1	331165	6250363	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	67	64	69	66	67	64	69	66	Y	-	Y	-	Y	-	Y
NCA23.OED.0430.01	NCA23	2	331165	6250363	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	68	65	70	67	68	65	70	67	-	-	Y	-	Y	-	Y

Name	NCA	Flr	Easting	Northing	RecType	Address	NCG Criteria		Period	Predicted Noise Level (dBA)								> 2 dB(A) Increase		Cumulative Limit		Project Acute		Eligible for Consideration of Mitigatio
										At Opening (2026)				Future Design (2036)										
										No Build		Build		No Build		Build								
							D	N		D	N	D	N	D	N	D	N	D	N	D	N	D	N	
NCA23.OED.0431.01	NCA23	1	331152	6250338	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	68	66	70	68	69	67	71	68	Y	-	Y	-	Y	-	Y
NCA23.OOP.0433.01	NCA23	1	331238	6250228	Other (Outdoor Passive)	7 THE CRESCENT , ANNANDALE 2038	55	-	P	63	57	64	58	63	57	65	59	-	-	Y	-	-	-	Y
NCA23.RES.0447.01	NCA23	1	331055	6250068	Residential	233A JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0447.01	NCA23	2	331055	6250068	Residential	233A JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0465.01	NCA23	1	331092	6250159	Residential	245 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	60	68	62	66	61	68	63	Y	-	-	-	-	-	Y
NCA23.RES.0468.01	NCA23	1	331083	6250135	Residential	239 JOHNSTON STREET ANNANDALE	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0469.01	NCA23	1	331085	6250141	Residential	241 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0473.01	NCA23	1	331085	6250150	Residential	243 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0475.01	NCA23	1	331082	6250129	Residential	237 JOHNSTON STREET ANNANDALE	60	55	P	66	60	68	63	66	61	69	63	Y	-	-	-	-	-	Y
NCA23.RES.0477.01	NCA23	1	331080	6250123	Residential	235 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	67	62	66	60	68	62	Y	-	-	-	-	-	Y
NCA23.RES.0482.01	NCA23	1	331102	6250187	Residential	251B JOHNSTON STREET ANNANDALE	60	55	P	66	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0482.01	NCA23	2	331102	6250187	Residential	251B JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0486.01	NCA23	1	331116	6250227	Residential	263 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0486.01	NCA23	2	331116	6250227	Residential	263 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0487.01	NCA23	1	331100	6250181	Residential	251A JOHNSTON STREET ANNANDALE	60	55	P	67	61	69	64	67	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0487.01	NCA23	2	331100	6250181	Residential	251A JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0490.01	NCA23	1	331126	6250250	Residential	271 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	69	64	Y	Y	-	-	-	-	Y
NCA23.RES.0490.01	NCA23	2	331126	6250250	Residential	271 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0492.01	NCA23	1	331068	6250095	Residential	233A JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	62	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0492.01	NCA23	2	331068	6250095	Residential	233A JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0494.01	NCA23	1	331127	6250255	Residential	273 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	69	64	Y	Y	-	-	-	-	Y
NCA23.RES.0494.01	NCA23	2	331127	6250255	Residential	273 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	70	64	68	62	70	64	Y	Y	-	-	-	-	Y
NCA23.RES.0495.01	NCA23	1	331108	6250204	Residential	255 JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	62	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0495.01	NCA23	2	331108	6250204	Residential	255 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0496.01	NCA23	1	331121	6250239	Residential	267 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0496.01	NCA23	2	331121	6250239	Residential	267 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0497.01	NCA23	1	331118	6250232	Residential	265 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	70	64	68	62	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0497.01	NCA23	2	331118	6250232	Residential	265 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0498.01	NCA23	1	331110	6250209	Residential	257 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0498.01	NCA23	2	331110	6250209	Residential	257 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0502.01	NCA23	1	331123	6250244	Residential	269 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0502.01	NCA23	2	331123	6250244	Residential	269 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	62	70	64	68	63	71	65	Y	Y	-	-	-	-	Y
NCA23.RES.0503.01	NCA23	1	331115	6250217	Residential	259 JOHNSTON STREET ANNANDALE	60	55	P	64	58	66	60	64	59	66	61	Y	Y	-	-	-	-	Y
NCA23.RES.0503.01	NCA23	2	331115	6250217	Residential	259 JOHNSTON STREET ANNANDALE	60	55	P	64	59	67	61	65	60	67	62	Y	Y	-	-	-	-	Y
NCA23.RES.0504.01	NCA23	1	331127	6250262	Residential	275 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	68	62	70	64	Y	Y	-	-	-	-	Y
NCA23.RES.0504.01	NCA23	2	331127	6250262	Residential	275 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0504.01	NCA23	3	331127	6250262	Residential	275 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0505.01	NCA23	1	331105	6250198	Residential	253 JOHNSTON STREET ANNANDALE	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0505.01	NCA23	2	331105	6250198	Residential	253 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0505.01	NCA23	3	331105	6250198	Residential	253 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0506.01	NCA23	1	331103	6250193	Residential	251 JOHNSTON STREET ANNANDALE	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0506.01	NCA23	2	331103	6250193	Residential	251 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0506.01	NCA23	3	331103	6250193	Residential	251 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0507.01	NCA23	1	331129	6250268	Residential	277 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	Y	-	-	-	-	Y
NCA23.RES.0507.01	NCA23	2	331129	6250268	Residential	277 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0507.01	NCA23	3	331129	6250268	Residential	277 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0508.01	NCA23	1	331104	6250171	Residential	249 JOHNSTON STREET ANNANDALE	60	55	P	64	59	66	61	65	59	67	61	Y	-	-	-	-	-	Y
NCA23.RES.0508.01	NCA23	2	331104	6250171	Residential	249 JOHNSTON STREET ANNANDALE	60	55	P	65	59	67	61	65	60	67	62	Y	-	-	-	-	-	Y
NCA23.RES.0508.01	NCA23	3	331104	6250171	Residential	249 JOHNSTON STREET ANNANDALE	60	55	P	65	60	67	62	66	60	68	62	Y	-	-	-	-	-	Y
NCA23.RES.0509.01	NCA23	1	331103	6250165	Residential	247 JOHNSTON STREET, ANNANDALE 2038	60	55	P	64	59	66	61	65	59	67	61	Y	-	-	-	-	-	Y
NCA23.RES.0509.01	NCA23	2	331103	6250165	Residential	247 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	67	62	65	60	68	62	Y	-	-	-	-	-	Y
NCA23.RES.0509.01	NCA23	3	331103	6250165	Residential	247 JOHNSTON STREET, ANNANDALE 2038	60	55	P	65	60	67	62	66	60	68	62	Y	-	-	-	-	-	Y
NCA23.RES.0510.01	NCA23	1	331077	6250114	Residential	233A JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0510.01	NCA23	2	331077	6250114	Residential	233A JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0510.01	NCA23	3	331077	6250114	Residential	233A JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	63	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0511.01	NCA23	1	331045	6250023	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0512.01	NCA23	1	331043	6250017	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0513.01	NCA23	1	331041	6250012	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0514.01	NCA23	1	331023	6249965	Residential	225 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0515.01	NCA23	1	331019	6249949	Residential	217 JOHNSTON STREET, ANNANDALE 2038	60	55	P	68	63	70	65	69	63	71	65	Y	Y	-	-	-	-	Y
NCA23.RES.0517.01	NCA23	1	331026	6249973	Residential	227 JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0519.01	NCA23	1	331005	6249908	Residential	209 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0521.01	NCA23	1	331038	6250007	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	62	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0531.01	NCA23	1	331006	6249913	Residential	211 JOHNSTON STREET, ANNANDALE 2038	60	55	P	66	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0534.01	NCA23	1	330990	6249880	Residential	203 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0535.01	NCA23	1	331019	6249958	Residential	223 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0536.01	NCA23	1	331015	6249943	Residential	219 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0537.01	NCA23	1	331032	6250002	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0540.01	NCA23	1	330995	6249890	Residential	205 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0540.01	NCA23	2	330995	6249890	Residential	205 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0543.01	NCA23	1	331029	6249995	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	Y	-	-	-	-	Y
NCA23.RES.0543.01	NCA23	2	331029	6249995	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0545.01	NCA23	1	330998	6249900	Residential	207 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y

Name	NCA	Flr	Easting	Northing	RecType	Address	NCG Criteria		Period	Predicted Noise Level (dBA)								> 2 dB(A) Increase		Cumulative Limit		Project Acute		Eligible for Consideration of Mitigatio
										At Opening (2026)				Future Design (2036)										
										No Build		Build		No Build		Build								
							D	N		D	N	D	N	D	N	D	N	D	N	D	N	D	N	
NCA23.RES.0545.01	NCA23	2	330998	6249900	Residential	207 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0547.01	NCA23	1	331025	6249980	Residential	229 JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0547.01	NCA23	2	331025	6249980	Residential	229 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0549.01	NCA23	1	330982	6249852	Residential	197 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0549.01	NCA23	2	330982	6249852	Residential	197 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0550.01	NCA23	1	331007	6249923	Residential	213 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	69	64	Y	Y	-	-	-	-	Y
NCA23.RES.0550.01	NCA23	2	331007	6249923	Residential	213 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	67	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0553.01	NCA23	1	331048	6250028	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0553.01	NCA23	2	331048	6250028	Residential	233 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0554.01	NCA23	1	331028	6249986	Residential	231 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0554.01	NCA23	2	331028	6249986	Residential	231 JOHNSTON STREET ANNANDALE	60	55	P	68	62	70	64	68	63	70	65	Y	Y	-	-	-	-	Y
NCA23.RES.0555.01	NCA23	1	331009	6249928	Residential	215 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	69	64	Y	Y	-	-	-	-	Y
NCA23.RES.0555.01	NCA23	2	331009	6249928	Residential	215 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	63	67	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0556.01	NCA23	1	330984	6249861	Residential	199 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0556.01	NCA23	2	330984	6249861	Residential	199 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0557.01	NCA23	1	330988	6249869	Residential	201 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0557.01	NCA23	2	330988	6249869	Residential	201 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0566.01	NCA23	1	330972	6249829	Residential	191 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0566.01	NCA23	2	330972	6249829	Residential	191 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0566.01	NCA23	3	330972	6249829	Residential	191 JOHNSTON STREET, ANNANDALE 2038	60	55	P	67	61	69	63	67	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0567.01	NCA23	1	330974	6249835	Residential	193 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0567.01	NCA23	2	330974	6249835	Residential	193 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0567.01	NCA23	3	330974	6249835	Residential	193 JOHNSTON STREET ANNANDALE	60	55	P	67	61	69	63	67	62	69	64	Y	-	-	-	-	-	Y
NCA23.RES.0568.01	NCA23	1	330976	6249842	Residential	195 JOHNSTON STREET ANNANDALE	60	55	P	67	62	70	64	68	63	70	65	Y	-	-	-	-	-	Y
NCA23.RES.0568.01	NCA23	2	330976	6249842	Residential	195 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA23.RES.0568.01	NCA23	3	330976	6249842	Residential	195 JOHNSTON STREET ANNANDALE	60	55	P	67	62	69	64	68	62	70	64	Y	-	-	-	-	-	Y
NCA25.RES.0054.01	NCA25	1	331192	6250910	Residential	34 LILYFIELD ROAD, ROZELLE 2039	60	55	P	65	61	63	59	66	61	64	60	-	-	-	Y	-	-	Y
NCA27.OOP.0538.01	NCA27	1	331340	6250420	Other (Outdoor Passive)	FEDERAL PARK	55	-	P	58	53	59	54	58	53	60	54	-	-	Y	-	-	-	Y
NCA34.RES.0033.01	NCA34	4	330473	6251712	Residential	2 NAGURRA PLACE, ROZELLE 2039	55	50	P	61	55	59	53	62	56	60	53	-	-	Y	-	-	-	Y

Operational Road Traffic Noise Levels – Do Something Plus

Note.

Only receivers which qualify for the consideration of mitigation that were not triggered in the approved EIS (triggers as a result of the modification) are included.

The results in this table are based on the highest noise level of the triggered facades, per floor. If no facades are triggered, then the highest noise level of all facades is presented for each floor. It is noted that a single receiver may be triggered on multiple facades by different criteria and for some receivers where a >2 dB increase is shown, the increase may be on a different facade from where the highest noise level is predicted.

Address information has been taken from third party data. Reference should be made to the exceedance maps for the location of all triggered buildings.

Name	NCA	Flr	Easting	Northing	RecType	Address	NCG Criteria		Period	Predicted Noise Level (dBA)								> 2 dB(A) Increase		Cumulative Limit		Project Acute		Eligible for Consideration of Mitigation
										At Opening (2026)				Future Design (2036)										
										No Build		Build		No Build		Build								
							D	N		D	N	D	N	D	N	D	N	D	N	D	N	D	N	
NCA21.RES.0017.01	NCA21	1	331122	6250462	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	61	56	64	58	61	56	64	58	Y	Y	-	-	-	-	Y
NCA21.RES.0018.01	NCA21	1	331130	6250457	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	60	55	62	57	60	55	63	57	Y	-	-	-	-	-	Y
NCA21.RES.0019.01	NCA21	1	331133	6250454	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	60	54	62	56	60	55	62	57	Y	-	-	-	-	-	Y
NCA21.RES.0020.01	NCA21	1	331137	6250452	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	59	54	61	56	60	54	62	56	Y	-	-	-	-	-	Y
NCA21.RES.0021.01	NCA21	1	331140	6250449	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	60	54	62	56	60	54	63	57	Y	Y	-	-	-	-	Y
NCA21.RES.0022.01	NCA21	1	331144	6250446	Residential	300 JOHNSTON STREET ANNANDALE	60	55	P	65	58	67	60	66	59	67	61	Y	Y	Y	Y	Y	Y	Y
NCA21.RES.0596.01	NCA21	1	331116	6250373	Residential	2 KENTVILLE AVENUE, ANNANDALE 2038	60	55	P	67	61	69	62	68	61	70	63	-	-	Y	Y	Y	Y	Y
NCA21.RES.0600.01	NCA21	1	331126	6250411	Residential	1 BAYVIEW CRESCENT, ANNANDALE 2038	60	55	P	67	60	68	61	67	60	69	62	-	-	Y	Y	Y	Y	Y
NCA21.RES.0608.01	NCA21	1	331110	6250378	Residential	4 KENTVILLE AVENUE, ANNANDALE 2038	60	55	P	62	56	64	58	63	56	65	58	-	-	Y	-	Y	-	Y
NCA21.RES.0616.01	NCA21	1	331093	6250342	Residential	284A JOHNSTON STREET, ANNANDALE 2038	60	55	P	64	58	65	59	65	59	66	60	-	-	Y	Y	-	-	Y
NCA21.RES.0620.01	NCA21	1	331123	6250417	Residential	3 BAYVIEW CRESCENT ANNANDALE	60	55	P	63	56	65	58	63	57	65	59	-	-	Y	-	Y	-	Y
NCA21.RES.0620.01	NCA21	2	331123	6250417	Residential	3 BAYVIEW CRESCENT ANNANDALE	60	55	P	64	58	66	59	64	58	66	60	-	-	Y	Y	Y	-	Y
NCA23.OCC.0425.01	NCA23	1	331241	6250149	Other (Childcare)	7 CHAPMAN ROAD, ANNANDALE 2038	45	-	H	54	53	54	54	54	54	55	54	-	-	Y	-	-	-	Y
NCA23.OED.0426.01	NCA23	1	331183	6250341	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	69	67	71	69	70	68	71	70	-	-	Y	-	Y	-	Y
NCA23.OED.0427.01	NCA23	1	331184	6250385	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	70	67	73	71	71	68	74	71	Y	-	Y	-	Y	-	Y
NCA23.OED.0430.01	NCA23	1	331165	6250363	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	67	64	69	66	67	64	69	66	-	-	Y	-	Y	-	Y
NCA23.OED.0430.01	NCA23	2	331165	6250363	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	68	65	70	67	68	65	70	67	-	-	Y	-	Y	-	Y
NCA23.OED.0431.01	NCA23	1	331152	6250338	Other (Educational)	279 JOHNSTON STREET, ANNANDALE 2038	50	-	H	68	66	70	68	69	67	70	68	-	-	Y	-	Y	-	Y
NCA23.OOP.0433.01	NCA23	1	331238	6250228	Other (Outdoor Passive)	7 THE CRESCENT , ANNANDALE 2038	55	-	P	63	57	64	59	63	57	65	59	-	-	Y	-	Y	-	Y

WestConnex M4-M5 Link

Rozelle Interchange – Modification: The Crescent overpass and active transport links

Modification report

Appendix D

Air quality assessment

Roads and Maritime Services

WestConnex M4-M5 Link

Rozelle Interchange – Modification: The Crescent overpass and active transport links

Modification Report

Appendix D Air quality assessment

August 2019

Prepared for

NSW Roads and Maritime Services

Prepared by

ERM Australia Pacific Pty Ltd

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1 Introduction

NSW Roads and Maritime Services (Roads and Maritime) is seeking to modify the existing project approval for the construction and operation of the WestConnex M4-M5 Link project (the project), as shown in **Figure 1-1**. Approval for the construction and operation of the project was granted on 17 April 2018 by the former NSW Minister for Planning (application number SSI 7485).

1.1 Overview of M4-M5 Link project

The EIS for the project described construction and operation of the M4-M5 Link project in two stages:

- Stage 1[1]: A new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters (Mainline Tunnels)
- Stage 2[2]: An interchange at Lilyfield and Rozelle (the Rozelle Interchange) and a tunnel connection between Anzac Bridge and Victoria Road, east of Iron Cove Bridge (Iron Cove Link).

Stage 2 works commenced in 2019 with these components of the project anticipated to open to traffic in 2023.

A more comprehensive overview of the M4-M5 Link project, as well as other aspects of the WestConnex program of works is provided within the Environmental Impact Statement (EIS) and the Submissions and Preferred Infrastructure Report (SPIR).

[1] M4-M5 Link Stage 1 (the Mainline Tunnels)
[2] M4-M5 Link Stage 2 (the Rozelle Interchange and Iron Cove Link)

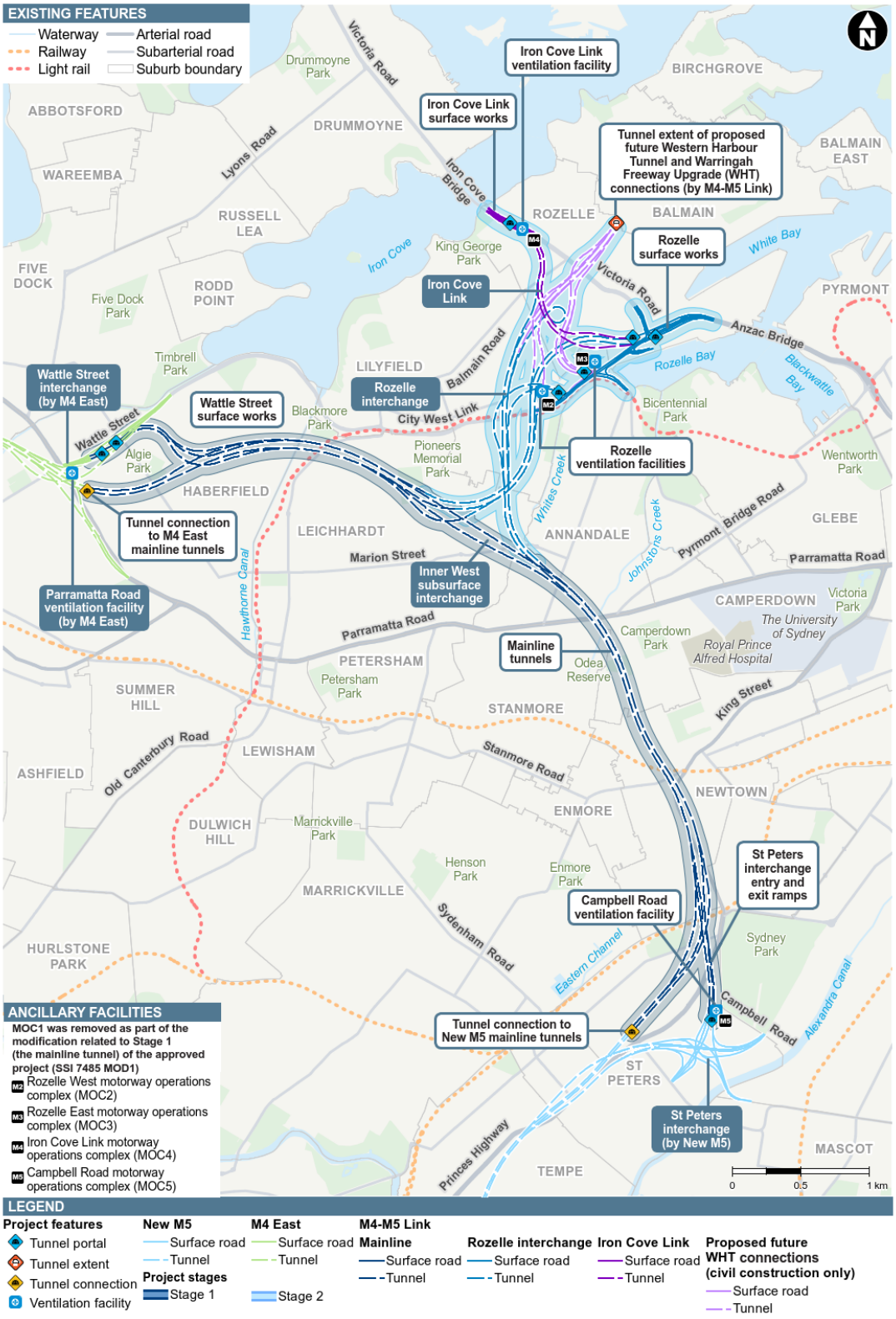

Figure 1-1 Overview of the M4-M5 Link project

1.2 Overview of proposed modification

Since Planning Approval (April 2018 Infrastructure Approval) was granted, a contractor has been appointed to construct Stage 2 of the approved project on behalf of Roads and Maritime. The contractor has reviewed the concept design for the approved project and in discussions with Roads and Maritime has identified a number of potential design and constructability improvements.

The proposed modification relates to Stage 2 of the approved project. The following key components are proposed as part of the proposed modification (refer to **Figure 1-2**):

- A new elevated vehicular overpass ('The Crescent overpass') that would allow eastbound traffic heading north on The Crescent from Annandale to bypass the signalised intersection at The Crescent / City West Link junction and continue east on The Crescent towards Victoria Road and the Anzac Bridge
- Modifications to the eastbound lanes of the City West Link and The Crescent on either side of the intersection and northbound lanes on The Crescent at Annandale to provide space for the tie-in of The Crescent overpass
- Upgrades to the intersection of The Crescent/Johnston Street/Chapman Road (including lane reconfiguration and marking, signal phasing, adjusting positions of traffic signals kerb works etc.)
- Realignment of the Pedestrian and Cycling Green Link ('green link') to the west of The Crescent, providing a connection between the Rozelle Rail Yards and the Rozelle Bay light rail stop
- A new shared user path bridge spanning The Crescent to the east of The Crescent / City West Link intersection. The shared user path bridge provides a connection between Rozelle Rail Yards and the shared user path to Bicentennial Park along the east side of The Crescent and adjacent to Rozelle Bay. The shared user path bridge and shared user path would provide the pedestrian and cyclist connectivity required by Conditions E120 and E121, albeit in a different arrangement to that shown in the EIS
- Minor changes to the layout of the approach roads leading to the Anzac Bridge from Victoria Road, The Crescent and the Rozelle Interchange to improve traffic merging arrangements
- Use of a minor construction ancillary facility, established in accordance with Condition C24, as a construction ancillary facility. The proposed construction ancillary facility (C6a) is located on the south side of The Crescent to the west of James Craig Road and adjacent to Rozelle Bay. The proposed modification would allow use of the site for a limited number of additional purposes which are not permitted by Condition C24 including:
  - Light vehicle parking for workers (around 9 spaces) and
  - Material laydown areas and a limited number of associated vehicle movements (small delivery vans and rigid trucks).

  These additional purposes would support the various construction activities at the C6 civil site.

As outlined in Chapter 1 (Introduction) of the Modification report, the proposed modification would:

- Improve intersection performance on this congested section of the road network including at the City West Link/The Crescent and The Crescent/Johnston Street/Chapman Road intersections
- Adjust the alignment of active transport links to avoid conflict with The Crescent overpass while still improving the overall connectivity proposed within the EIS and Conditions of Approval (CoA) for the project by providing a direct connection between the suburbs of Rozelle and Annandale and public transport infrastructure including the Rozelle Bay light rail stop
- Improve the efficiency of construction and minimise the duration of construction impacts on nearby residents by reducing the need for further construction activities to accommodate the proposed Western Harbour Tunnel and Warringah Freeway Upgrade project (Western Harbour Tunnel project) at City West Link and The Crescent

- Improve capacity at the intersections so that they can maintain performance with traffic generation from future development proposed in the vicinity of the project including the Western Harbour Tunnel project if that future development proceeds.

1.3 Assessment requirements

In preparing this assessment, the Secretary's Environmental Assessment Requirements (SEARs), issued for the proposed modification have been reviewed.

Environmental assessment requirements as proposed by RMS for the M4-M5 Link Rozelle Interchange Modification: The Crescent overpass and active transport links which are relevant to the Air Quality Assessment are presented below.

- Assessment of potential air quality impacts during the construction period. This would be a risk-based assessment consistent with the assessment prepared for the EIS.
- Consideration of potential changes to the predicted operational air quality impacts for the approved project as a result of the proposed modification.

These requirements are addressed in Chapter 2, 5 and 6 of this report.

1.4 Purpose of this report

The purpose of this report is to assess the potential air quality impacts related to the proposed modification. Specifically, the assessment includes the following:

- Discussion of air quality impacts and standard practice mitigation measures during construction.
- Discussion of air quality impacts ($PM_{2.5}$ and NO_2) at the nearest residents to the City West Link, as reported in the EIS Air Quality Technical Report (Pacific Environment, 2017). The area considered is that bordered by City West Link, The Crescent and Johnston Street.
- Quantitative assessment of changes in $PM_{2.5}$ and NO_2 concentrations at these receptors due to the proposed modification.

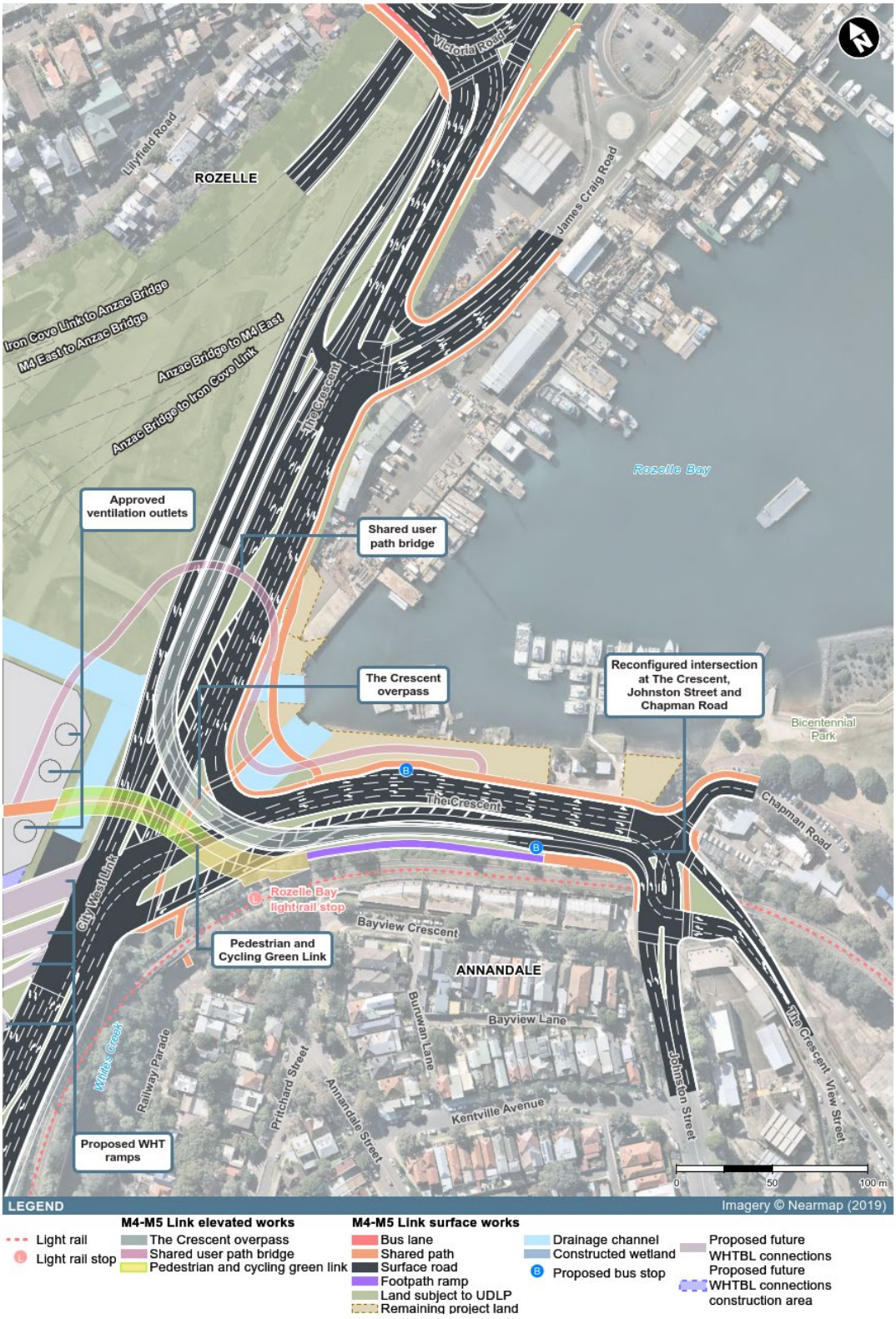

Figure 1-2 Overview of the proposed modification

2 Assessment methodology

2.1 Key assumptions

The following assumptions were made in the assessment:

- The assumptions in the WestConnex Road Traffic Model (WRTM) – the strategic traffic model used by Roads and Maritime to forecast traffic demands for future scenarios – were retained
- All vehicle emissions assumptions for 2033 used in the EIS were retained
- Emissions from ventilation outlets that were used in the EIS remained the same
- Meteorological modelling data used for the EIS was retained.

2.2 Approach

2.2.1 Construction

The changes to construction are minor and are described in Section 3. The EIS provided an assessment of risk of impacts due to construction dust based on a precinct approach which included a number of construction sites including the Rozelle civil and tunnel site (C5), The Crescent civil site (C6) and The Victoria Road civil site (C7). The construction activities proposed at these sites included building demolition, significant earthworks, tunnelling and civil works.

Based on this the EIS assessment concluded that the risks without mitigation were in the range of medium to high and so a number of mitigation measures were recommended. It is not anticipated that any additional measures will be required given that the proposed modification does not substantially alter the scope, nature and footprint of the construction works and the comprehensive mitigation measures to be implemented under the CoA.

2.2.2 Operation

The operational impacts of the proposed modification were assessed using existing the GRAL[3] dispersion model. The GRAL model was previously used to assess operational impacts for the Rozelle Interchange in the EIS. Predicted impacts were assessed at the nearest 400 RWR[4] receptors surrounding the Rozelle Interchange.

Four future year project scenarios were modelled in the EIS and these are listed below:

- **Do Something – 2023 (DS-2023)**: With the M4 Widening, M4 East, New M5 and the King Georges Road Interchange Upgrade projects completed and the M4-M5 Link complete and open to traffic.
- **Do Something Cumulative – 2023 (DSC-2023)**: As for DS-2023, the M4-M5 Link complete and open to traffic, and in addition, the proposed future Sydney Gateway and the Western Harbour Tunnel project complete and operational.
- **Do Something – 2033 (DS-2033)**: With the M4 Widening, M4 East, New M5 and the King Georges Road Interchange Upgrade projects completed and the M4-M5 Link complete and open to traffic.
- **Do Something Cumulative – 2033 (DSC-2033)**: As for DS-2033, the M4-M5 Link complete and open to traffic, and in addition, the proposed future Sydney Gateway, Western Harbour Tunnel project and Beaches Link and F6 Extension complete and operational.

The DSC-2033 scenario is the focus of this assessment as this was the worst-case scenario for operational impacts in the EIS. This scenario has been remodelled using the updated traffic inputs,

[3] The Graz Lagrangian Model air quality dispersion modelling package used in the EIS and for this assessment
[4] Residential, workplace and recreational receptors. This term refers to all discrete receptor locations along the project corridor, and mainly covers residential and commercial land uses

provided by AECOM, following changes to the road network (new overpass) resulting from the proposed modification.

No changes to the locations or design of the ventilation outlets are proposed as part of the proposed modification and emissions from these outlets remain as per the EIS. The only changes resulting from the proposed modification are those related to the surface roads which reflect the altered road layout.

Results from the EIS have focused on the nearest RWR receptors (predominantly along Bayview Crescent and nearby streets in Annandale). These RWR receptors are a subset of those reported in the EIS and are shown in **Figure 2-1**. Contour plots across the domain are provided.

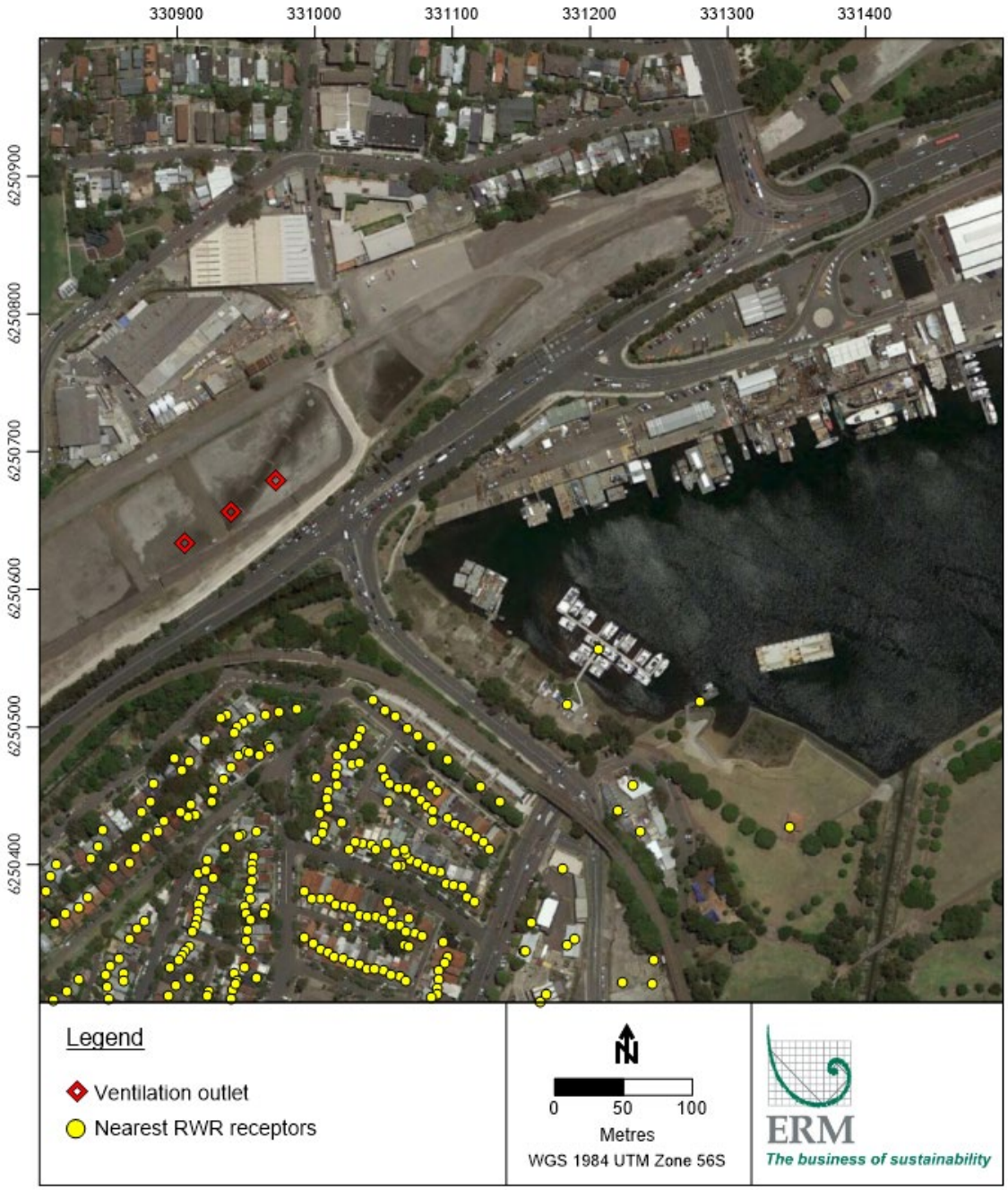

Figure 2-1 RWR receptors assessed

The EIS presented plots showing the changes due to the project for a number of pollutants. These changes were calculated by subtracting the Do Minimum (DM) scenarios from the Do Something

Cumulative (DSC) scenarios. The difference represented the change due to the project. A negative value represented a decrease in concentration (improvement in air quality), while a positive value indicated an increase in concentrations.

This assessment will present the original changes due to the project shown in the EIS, and compare them to the predicted changes due to the proposed modification.

3 Construction

A detailed assessment of potential construction impacts for the project was carried out in the EIS. This was a qualitative risk assessment based on a precinct wide approach, with the precinct including a number of construction sites including the Rozelle civil and tunnel site (C5), The Crescent civil site (C6) and The Victoria Road civil site (C7).

The EIS assessment identified areas at risk of potential impacts based on their proximity to works and sensitivity to dust and the potential magnitude of dust generating construction activities proposed at these sites. Due to the high dust generating potential of the construction activities which included building demolition, significant earthworks, tunneling and civil works, risks were categorized in the EIS as in the range of medium to high within the Rozelle precinct.

The key elements of the proposed modification includes the construction of a new overpass, realignment of active transport links, upgrade of The Crescent/Johnston Street intersection and use of a minor construction ancillary facility, established in accordance with Condition C24, as a construction ancillary facility. The proposed construction ancillary facility (C6a) would support the approved construction activities at The Crescent civil site (C6). Both construction sites are shown on **Figure 3-1.**

As the proposed modification is generally within the same footprint as the approved project, with minor extensions of footprint limited to areas within existing road reservations on The Crescent and Johnston Street, it is not anticipated that the construction dust risk profile would be different to that assessed in the EIS. Activities occurring in the limited extended footprint areas would include such things such as re-sheeting, kerb adjustments and line marking, which are not significant generators of dust. As such, the mitigation measures proposed in the EIS would remain unchanged for the proposed modification.

These measures are standard practice for construction dust and are listed in significant detail in the EIS. Relevant Revised Environmental Mitigation Measures (REMMs) from the Submissions and Preferred Infrastructure Report (SPIR) include:

Impact	Ref #	Environmental Management Measure	Timing
Impacts on ambient air quality and human health from dust generation and plant emissions during construction	AQ1	A Construction Air Quality Management Plan will be developed and implemented to monitor and manage potential air quality impacts associated with the construction for the project. The management plan will include controls required to reduce the emission of dust out of the door openings of acoustic sheds. The Plan will be implemented for the duration of construction.	Construction
	AQ2	Regular communication to be carried out with other WestConnex projects under construction in close proximity to ensure that measures are in place to manage cumulative dust impacts.	Construction
	AQ3	Regular site inspections will be conducted to monitor potential dust issues. The site inspections, required actions and ongoing issues, will be recorded and actioned appropriately within agreed timeframes by relevant project personnel.	Construction
	AQ4	Construction activities with the potential to generate dust will be modified or ceased during unfavourable weather conditions to reduce the potential for dust generation.	Construction
	AQ5	Measures to reduce potential dust generation, such as the use of water carts, sprinklers, dust screens and surface treatments, will be implemented within project sites as required.	Construction
	AQ6	Access roads within project sites will be maintained and managed to reduce dust generation.	Construction

Impact	Ref #	Environmental Management Measure	Timing
	AQ7	Where reasonable and feasible, appropriate control methods will be implemented to minimise dust emissions from the project site.	Construction
	AQ8	Storage of materials that have the potential to result in dust generation will be minimised within project sites at all times.	Construction
	AQ9	All construction vehicles and plant will be inspected regularly and maintained to ensure that they comply with relevant emission standards.	Construction
	AQ10	Engine idling will be minimised when plant is stationary, and plant will be switched off when not in use to reduce emissions.	Construction
	AQ11	The use of mains electricity will be favoured over diesel or petrol-powered generators where practicable to reduce site emissions.	Construction
	AQ12	Haul roads will be treated with water carts and monitored during earthworks operations, ceasing works if necessary during high winds where dust controls are not effective.	Construction
	AQ13	Suitable dust suppression and/or collection techniques will be used during cutting, grinding or sawing activities likely to generate dust in close proximity to sensitive receivers.	Construction
	AQ14	The potential for dust generation will be considered during the handling of loose materials. Equipment will be selected and handling protocols developed to minimise the potential for dust generation.	Construction
	AQ15	All loaded spoil haulage trucks and other project-related heavy vehicles carrying materials with the potential to result in dust generation will be covered to prevent dust emissions during transport in accordance with relevant road regulations.	Construction
	AQ19	Areas of soil exposed during construction will be minimised at all times to reduce the potential for dust generation.	Construction
	AQ20	Exposed soils will be temporarily stabilised during weather conditions conducive to dust generation and prior to extended periods of inactivity to minimise dust generation.	Construction
	AQ21	Exposed soils will be permanently stabilised as soon as practicable following disturbance to minimise the potential for ongoing dust generation.	Construction
	AQ22	Ensure that stockpiles of materials with the potential to result in dust emissions are adequately protected and managed to reduce potential dust generation.	Construction
	AQ23	Ensure fine materials are stored and handled to minimise dust.	Construction
	AQ24	All sealed surfaces within sites and site accesses will be managed to reduce dust generation and sediment tracking onto roads	Construction
	AQ25	At the commencement of establishment of project ancillary facilities, controls such as wheel washing systems and rumble grids will be installed at all site exits to prevent deposition of loose material on sealed surfaces outside project sites to reduce potential dust generation.	Construction

Relevant Infrastructure Approval Conditions include:

Ref #	Condition
C4 (d)	An Air Quality CEMP Sub-plan must be prepared in consultation with the EPA and relevant councils and be consistent with the CEMP referred to in the EIS.
C5	The CEMP Sub-plans must state how: (a) the environmental performance outcomes identified in the EIS and SPIR as modified by these conditions will be achieved; (b) the mitigation measures identified in the EIS and SPIR as modified by these conditions will be implemented; (c) the relevant terms of this approval will be complied with; and (d) issues requiring management during construction (including cumulative impacts), as identified through ongoing environmental risk analysis, will be managed.
C6	The CEMP Sub-plans must be endorsed by the ER and then submitted to the Secretary for approval no later than one (1) month prior to the commencement of the construction activities to which they apply.
C7	Any of the CEMP Sub-plans may be submitted to the Secretary along with, or subsequent to, the submission of the CEMP.
C8	Construction must not commence until the CEMP and all CEMP Sub-plans have been approved by the Secretary. The CEMP and CEMP Sub-plans, as approved by the Secretary, including any minor amendments approved by the ER, must be implemented for the duration of construction. Where the CSSI is being staged, construction of that stage is not to commence until the relevant CEMP and CEMP sub-plans have been endorsed by the ER and approved by the Secretary.
C9 (e)	A Dust Deposition Monitoring Program must be prepared in consultation with the EPA to compare actual performance of construction of the CSSI against predicted performance.

It is not anticipated that any additional measures would be required given that the proposed modification does not substantially alter the scope, nature and footprint of construction works and given the comprehensive mitigation measures to be implemented under the Infrastructure Approval including the Air Quality CEMP Sub-plan (Condition C4(d)) and the Dust Deposition Monitoring Program (Condition C9(e)).

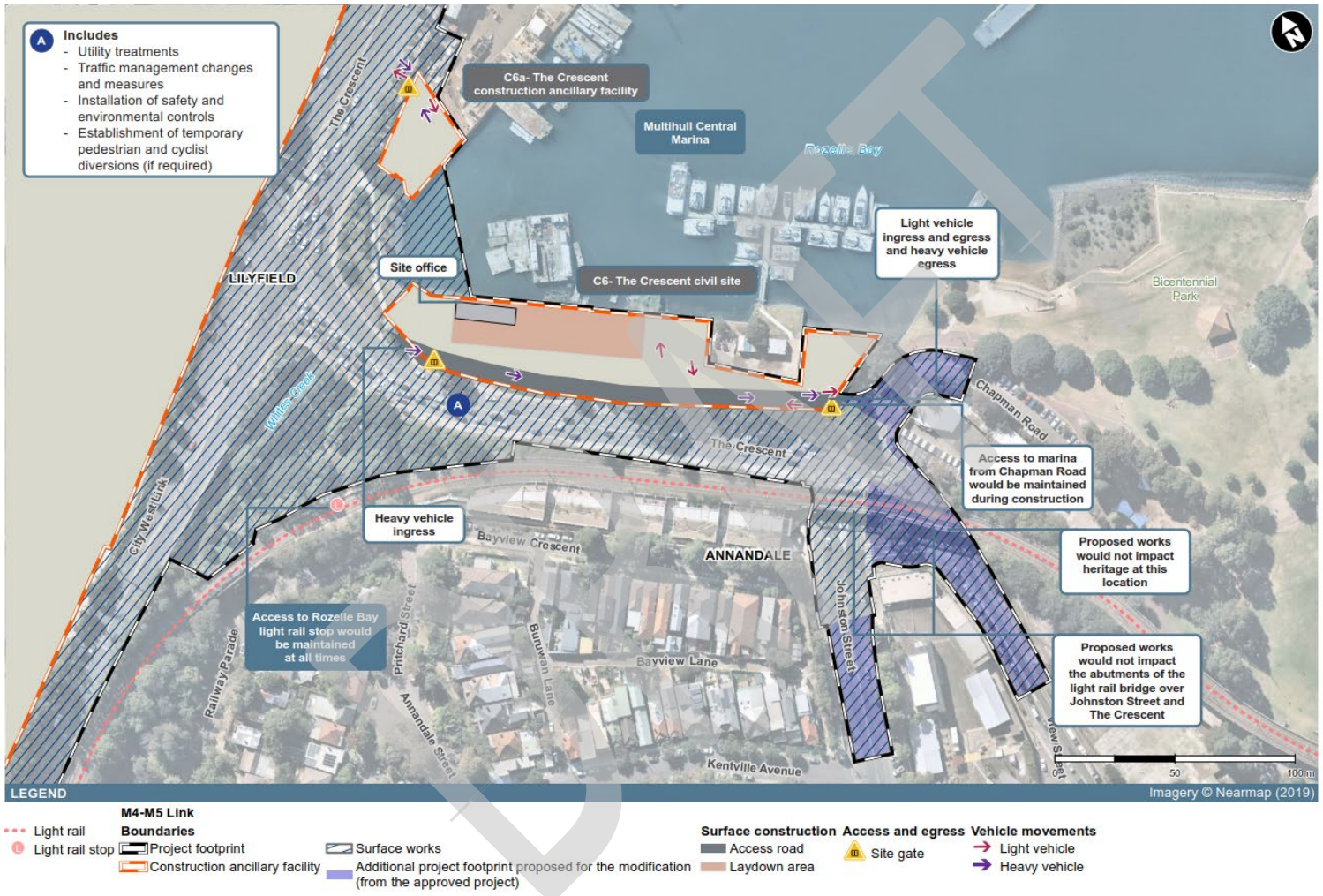

Figure 3-1 Proposed construction ancillary facility (C6a)

4 Air quality criteria

Air quality in the M4-M5 Link domain for the EIS, was assessed in relation to the criteria from the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016) (NSW Approved Methods). This is the same approach taken for the assessment of the proposed modification. The pollutants and criteria relevant for this study are summarised in **Table 4-1**. Most of these criteria apply to the cumulative concentration, that is, the existing background levels plus the project.

Table 4-1 Air quality criteria applicable to the project assessment

Pollutant/metric	Concentration	Averaging period
Cumulative concentrations		
NO_2	246 μg/m^3	1 hour
$PM_{2.5}$	25 μg/m^3	24 hours
	8 μg/m^3	1 year
Change in concentration		
$\Delta PM_{2.5}$	1.8 μg/m^3	1 year

Determining the cumulative NO_2 concentrations are not as simple as adding the background to the project contributions. Due to the chemical transformation that occurs to convert NO_X to NO_2, a different method is used. This empirical method is described in detail in Annexure G of the "*Technical working paper – air quality*" prepared for the EIS (Pacific Environment, 2017) and was used again here to calculate the 1-hour NO_2.

Given the high background levels for both maximum 24-hour and annual average $PM_{2.5}$, and that annual average levels already exceed the 8 μg/m^3 criterion across much of Sydney, assessing the project against these was problematic during the EIS process and the use of other metrics was investigated which were more meaningful from a health impact perspective.

The key metric that emerged during the assessment of the M4 East, New M5 and M4-M5 Link projects was the change in the annual mean $PM_{2.5}$ concentration ($\Delta PM_{2.5}$) (Pacific Environment, 2015a; Pacific Environment, 2015b; Pacific Environment, 2017). For the M4-M5 Link project EIS, the value for $PM_{2.5}$ was 1.8 μg/m^3, representing a risk threshold of 1 in 10,000 for all-cause mortality for ages 30 and over. A full description of the rationale and calculations used to determine this value can be found in the *"Technical working paper – air quality*" prepared for the EIS (Pacific Environment, 2017).

Each of these criteria will be discussed in relation to the modelling results in **Section 6**.

5 Operational traffic emissions

Total traffic emissions were calculated across the whole GRAL modelling domain shown in the EIS. However, a comparison between the EIS results and the proposed modification are based only on selected roads in the vicinity of the proposed modification. **Figure 5-1** presents the section of the model domain selected for comparison purposes.

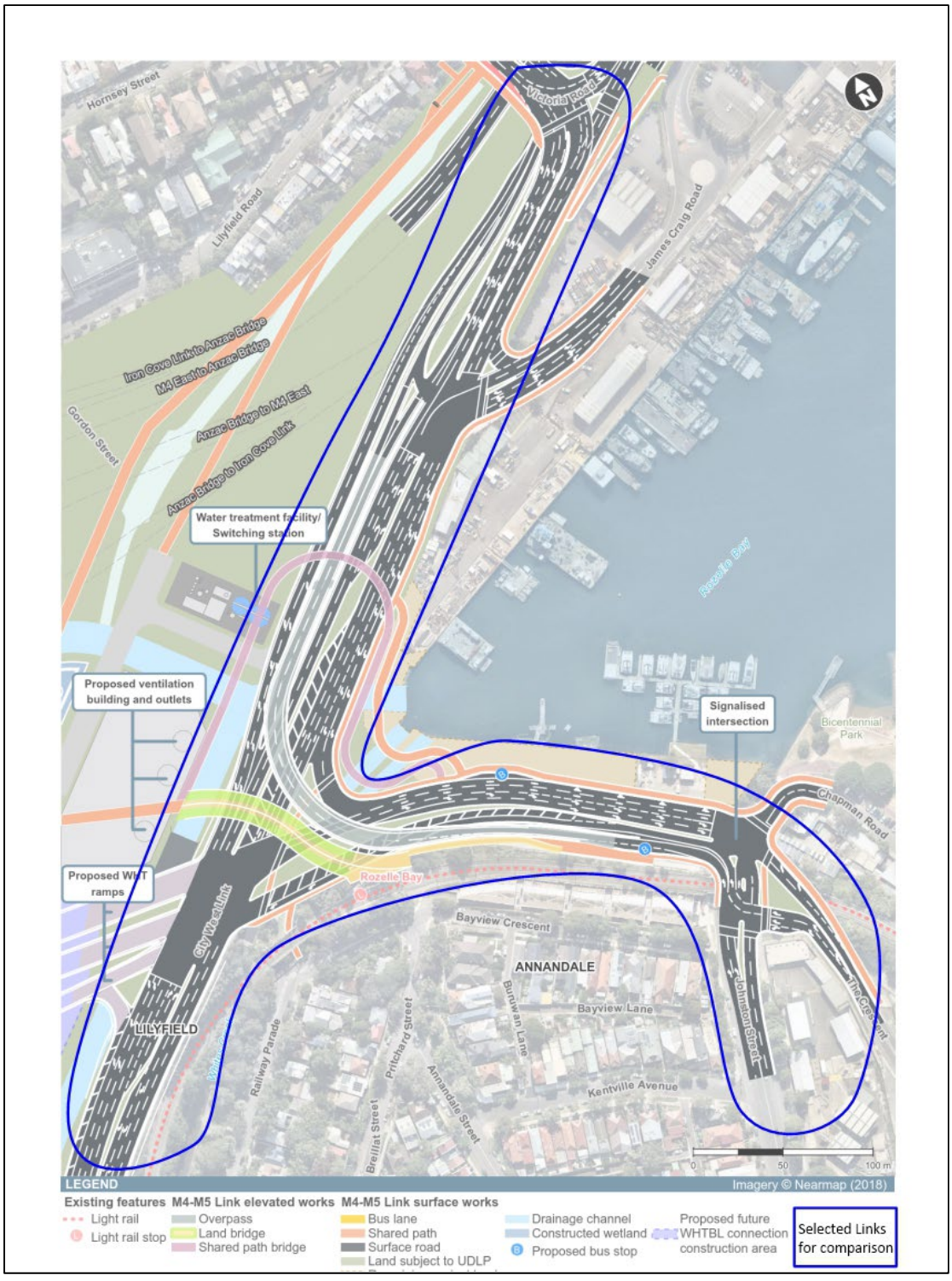

Figure 5-1 Total traffic emissions comparison area coverage

The total traffic emissions for selected road links in the EIS and the proposed modification modelling scenarios are presented in **Table 5-1** and are also presented in **Figure 5-2**. The change in emissions between scenarios for the selected links is shown in **Table 5-2**.

When compared to the Do Something Cumulative scenario in the EIS, there is an increase in NO_X and $PM_{2.5}$ emissions for the proposed modification. This is largely a result of the increased gradient due to introduction of the overpass which increases emissions. When compared to the Do Minimum scenario, both the EIS and Modification DSC scenarios show a reduction in emissions for both NO_X and $PM_{2.5}$.

Table 5-1 Total traffic emissions in the vicinity of the proposed project modification

Scenario code	Scenario description	Total emissions (tonnes/year)	
		NOx	$PM_{2.5}$
2033-DM EIS	2033 – Do Minimum (no M4-M5 Link)	76.5	4.0
2033-DSC EIS	2033 – Do Something Cumulative (with M4-M5 Link and all other projects)	36.0	2.4
2033-DSC MOD	2033 – Do Something Cumulative (with M4-M5 Link MOD and all other projects)	54.5	3.4

Table 5-2 Absolute changes in total traffic emissions in the vicinity of the proposed project modification

Scenario comparison	Change in total emissions (tonnes/year)	
	NOx	$PM_{2.5}$
Changes due to the project modification		
2033-DSC MOD vs 2033-DSC EIS	+18.4	+1.0
Changes due to the project in a given time		
2033-DSC EIS vs 2033-DM	-40.47	-1.62
2033-DSC MOD vs 2033-DM	-22.04	-0.63

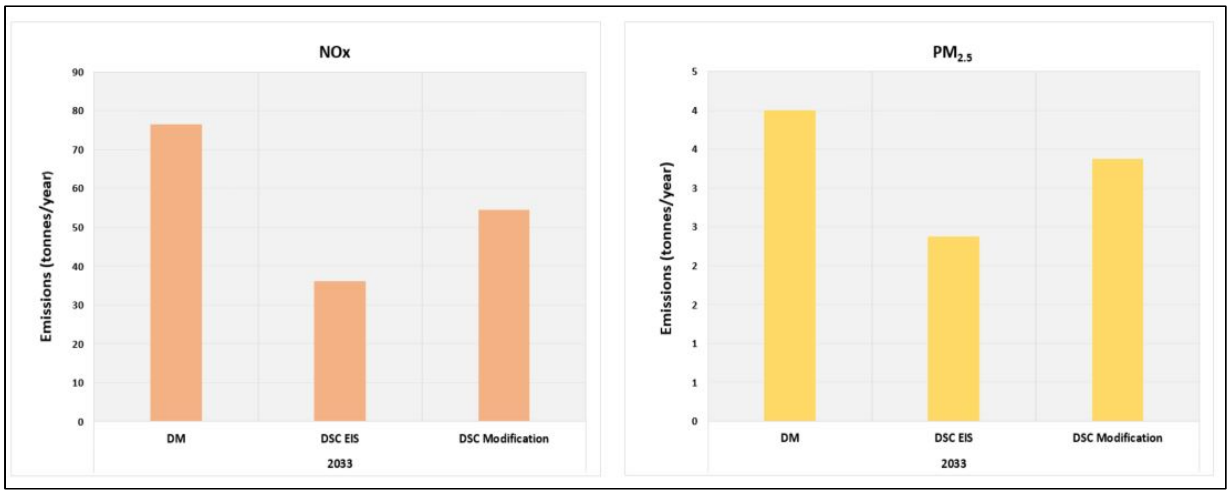

Figure 5-2 Total traffic emissions in the vicinity of the proposed project modification

6 Modelling results

This section compares the results from the EIS to the modelling predictions from the proposed modification at the nearest 400 RWR receptors. The comparison has only been done for the 2033 'cumulative scenario' (DSC-2033), which was the worst case for operational impacts in the EIS.

The pollutants assessed are consistent with the original Air Quality Impact Assessment in the EIS (Pacific Environment, 2017) and include:

- Maximum 24-hour average $PM_{2.5}$
- Annual average $PM_{2.5}$
- Maximum 1-hour average NO_2.

All the results presented in this section include all sources (roads and ventilation outlets). As previously mentioned, there were no changes to the locations or design of the ventilation outlets. Given that emissions from these outlets were also assumed to remain as per the EIS, the only changes resulting from the proposed modification are those related to the surface road emissions.

Background concentrations have also been included in the results for comparison against the NSW EPA criteria noted in the Approved Methods and discussed in **Section 4**. These concentrations are consistent with the EIS and they are listed below:

- Maximum 24-hour average $PM_{2.5}$: 25.1 $\mu g/m^3$
- Annual average $PM_{2.5}$: 8 $\mu g/m^3$
- Maximum 1-hour average NO_X: 769.6 $\mu g/m^3$ (used to convert NO_X results to NO_2).

Figure 6-1 and **Figure 6-2** compare the predictions for maximum 24-hour average $PM_{2.5}$ and annual average $PM_{2.5}$, respectively. These results are cumulative and include both background levels (as noted above) and the model predictions. The figures on the left present the results from the EIS modelling and the figures on the right show the proposed modification. Predicted maximum 1-hour average NO_2 concentrations for both the EIS and proposed modification are presented in **Figure 6-3**. As for the EIS, cumulative concentrations for each of the pollutants, exceed their relevant air quality criteria. As noted earlier, this is due to the high background values used.

No major changes can be identified between the EIS and the proposed modification. Differences can be attributed, in part, to the changes in elevation and the position of the traffic along The Crescent as it approaches the overpass from the southeast. The lanes are slightly closer to the light-rail line and Bayview Crescent for the proposed modification. There is also a gradient of around 6% as northbound traffic climbs the overpass which increases emissions at that location.

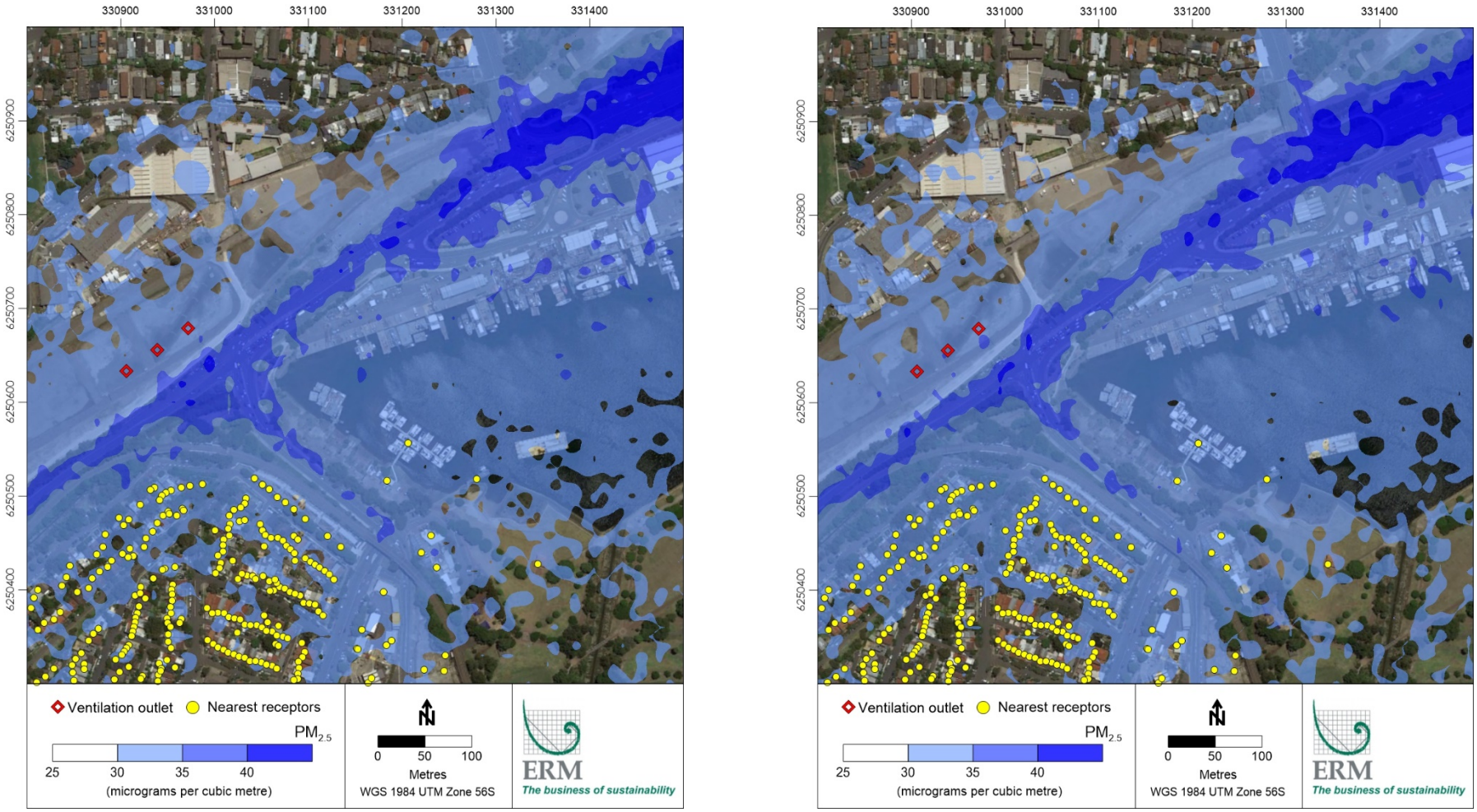

Figure 6-1 Predicted maximum 24-hour average $PM_{2.5}$ concentrations (including background) for the EIS (left) and proposed modification (right)

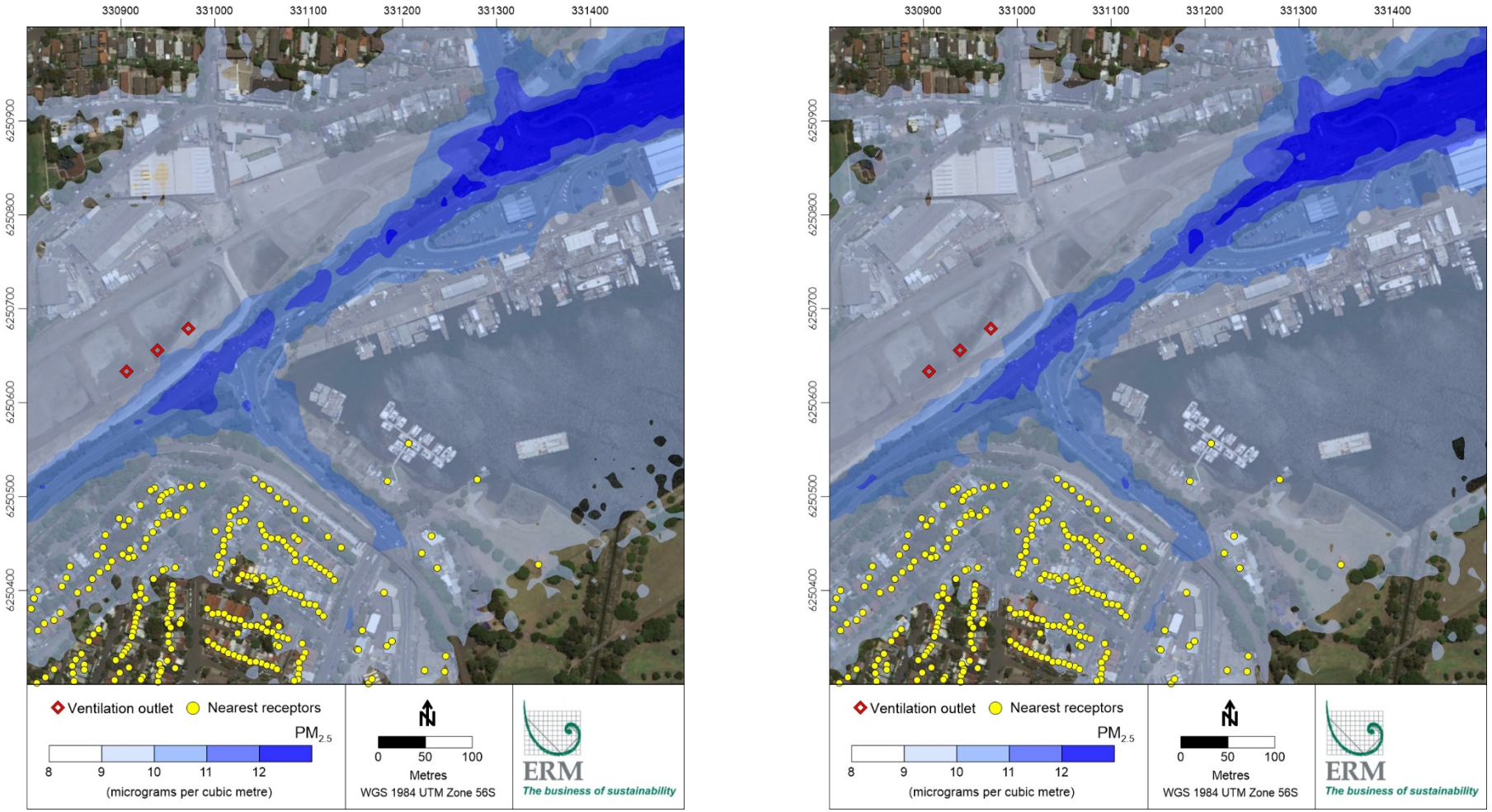

Figure 6-2 Predicted annual average $PM_{2.5}$ concentrations (including background) for the EIS (left) and proposed modification (right)

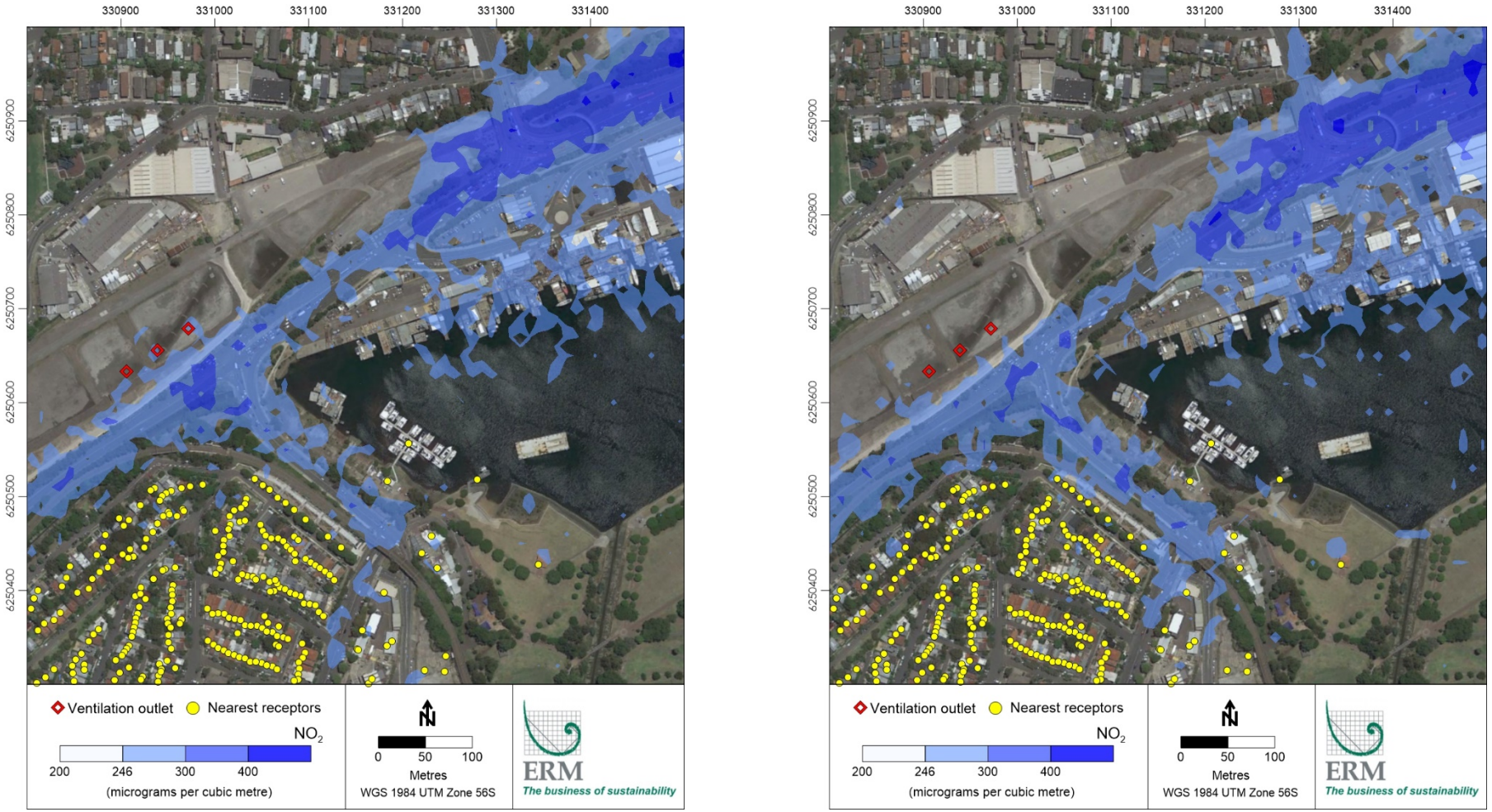

Figure 6-3 Predicted maximum 1-hour average NO_2 concentrations (including background) for surface roads for the EIS (left) and modification (right)

The EIS included a number of plots which showed the predicted changes in concentration due to the project. These have been repeated here for the proposed modification. The most relevant metric when predicting these changes and their significance for health impacts, is annual mean $PM_{2.5}$. As presented in the health risk assessment of the EIS, an increase in annual mean $PM_{2.5}$ of 1.8 µg/m3 is equivalent to a risk threshold of 1 in 10,000 for all cause mortality. When discussing the change (or increase) in annual mean $PM_{2.5}$, this represents the change due to the project. In other words, the difference between the DSC and DM scenarios for 2033.

Figure 6-4 shows the predicted changes in annual mean $PM_{2.5}$ for both the EIS (on the left) and the proposed modification (on the right). As anticipated, differences are discernible along Johnston Street and The Crescent where the main changes are associated with the proposed modification. Even though there is a larger area of increased annual mean $PM_{2.5}$ when compared to the EIS, these increases are well below 1.8 $\mu g/m^3$, with the largest increase in annual mean $PM_{2.5}$ at an RWR receptor being 0.32 $\mu g/m^3$. No change to potential health impacts are anticipated.

These increases in the Annandale area reflect changes in traffic, the movement of road links closer towards receptors along The Crescent, as well as the gradient of the overpass.

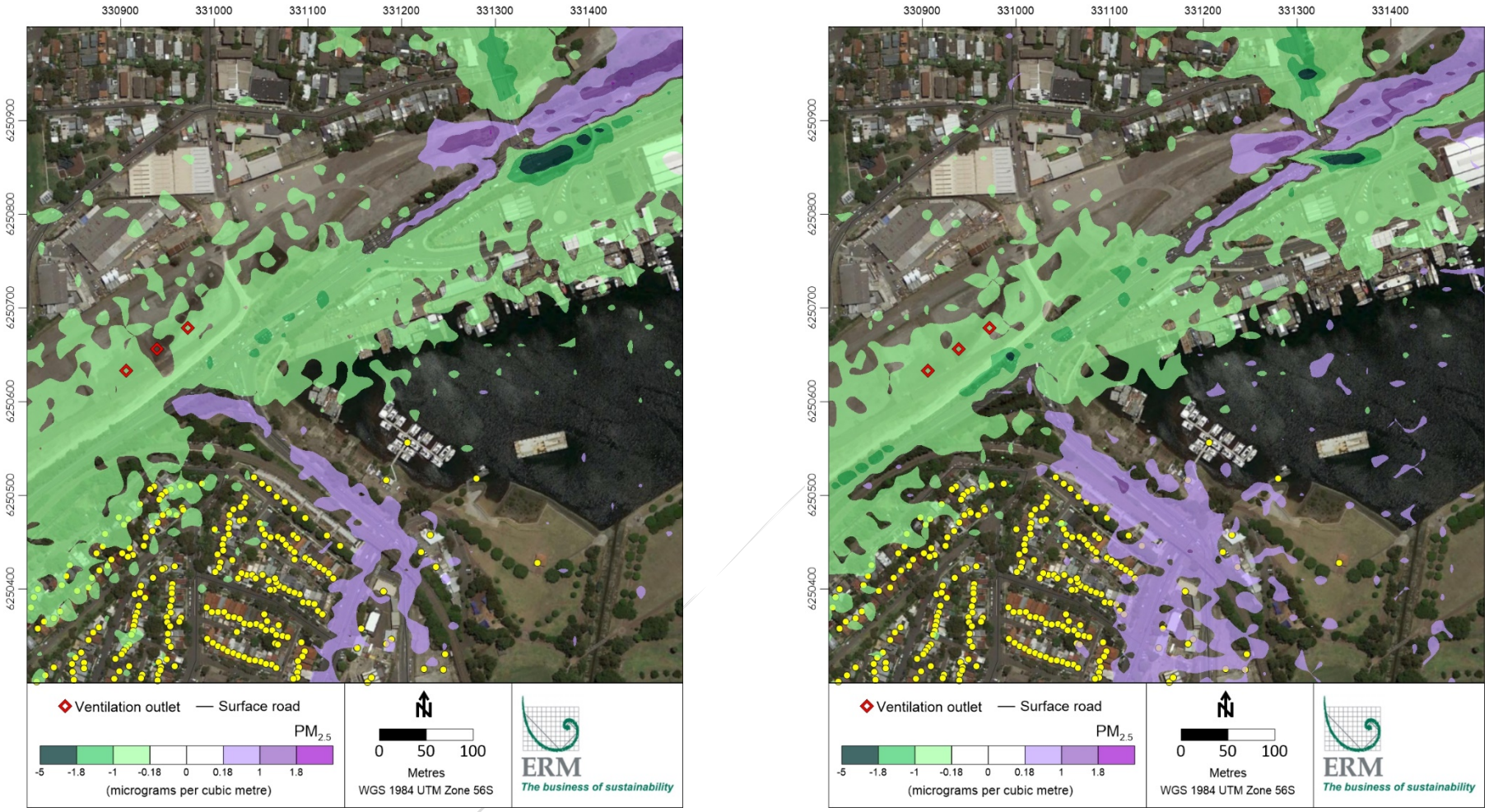

Figure 6-4 **Contour plot of change in annual average $PM_{2.5}$ concentrations for the EIS (2033-DSC minus 2033-DM) and proposed modification (2033-DSC minus 2033-DM)**

The plots above show the changes across the modelling domain, but changes at individual receptors can also be presented as follows. These figures show results for a subset (400) of the 86,375 RWR modelled in the EIS, and represent those receptors nearest to the proposed modification (shown in **Figure 2-1**).

Figure 6-5 and **Figure 6-6** show the predicted changes in maximum 24-hour average $PM_{2.5}$ due to the project as presented in the EIS and the proposed modification, respectively. It can be seen that while there are slightly more receptors that experience increases for the proposed modification, the maximum increases are still low. The maximum predicted change for these receptors in the EIS was 2.1 µg/m^3, compared to 2.9 µg/m^3 for the proposed modification.

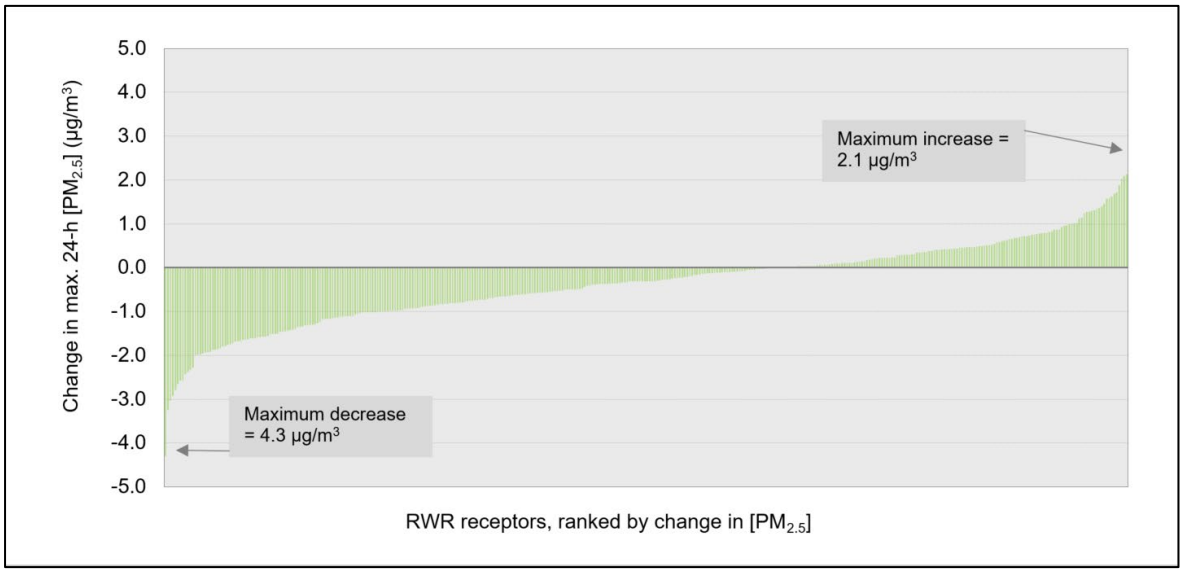

Figure 6-5 **Change in maximum 24-hour average $PM_{2.5}$ concentrations at the nearest RWR receptors for the EIS (2033-DSC minus 2033-DM)**

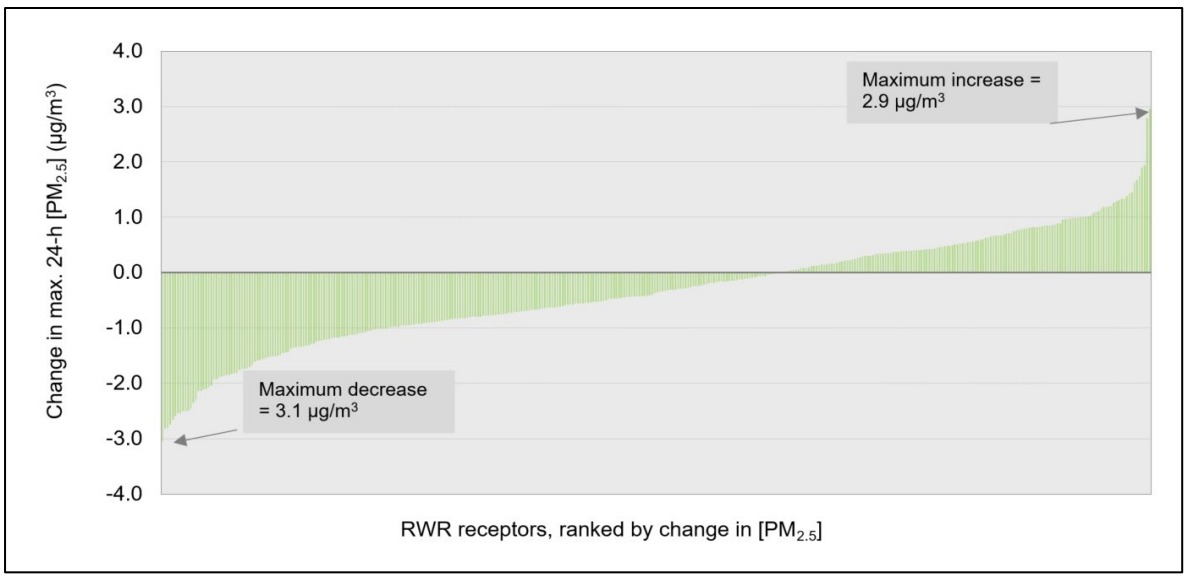

Figure 6-6 **Change in maximum 24-hour average $PM_{2.5}$ concentrations at the nearest RWR receptors for the proposed modification (2033-DSC minus 2033-DM)**

Results are similar for the changes in predicted annual mean $PM_{2.5}$ concentrations, with a maximum increase of 0.21 µg/m^3 for the EIS (**Figure 6-7**) and 0.32 µg/m^3 for the proposed modification (**Figure 6-8**), but not necessarily at the same receptor. There are more receptors which are predicted to experience an increase, but these increases are small and well below the value of 1.8 µg/m^3.

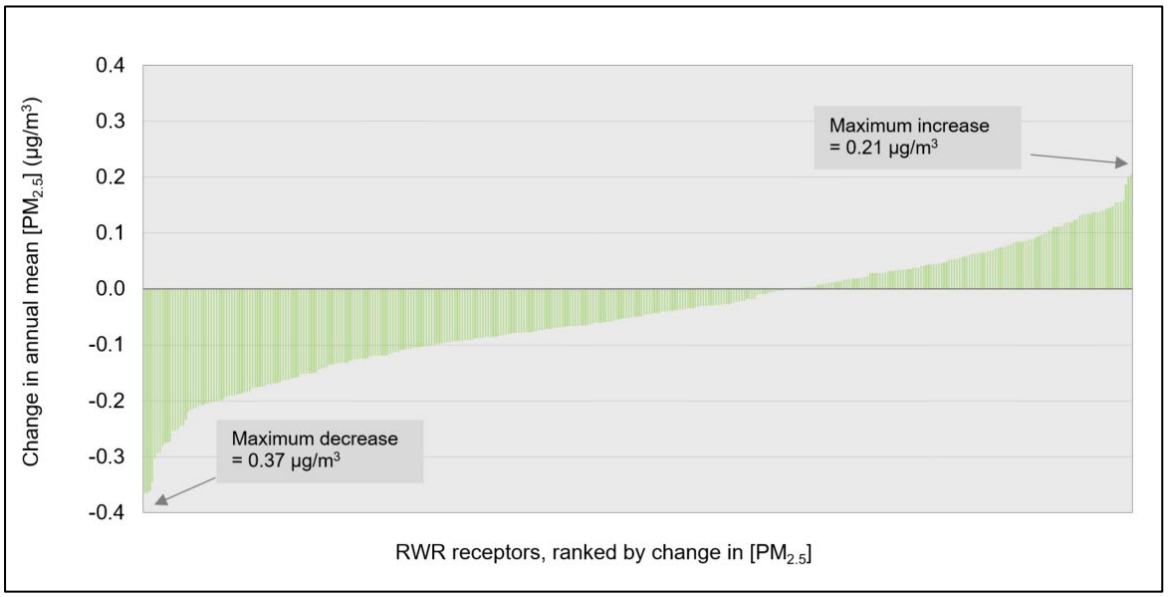

Figure 6-7 **Change in annual average $PM_{2.5}$ concentrations at the nearest RWR receptors for the EIS (2033-DSC minus 2033-DM)**

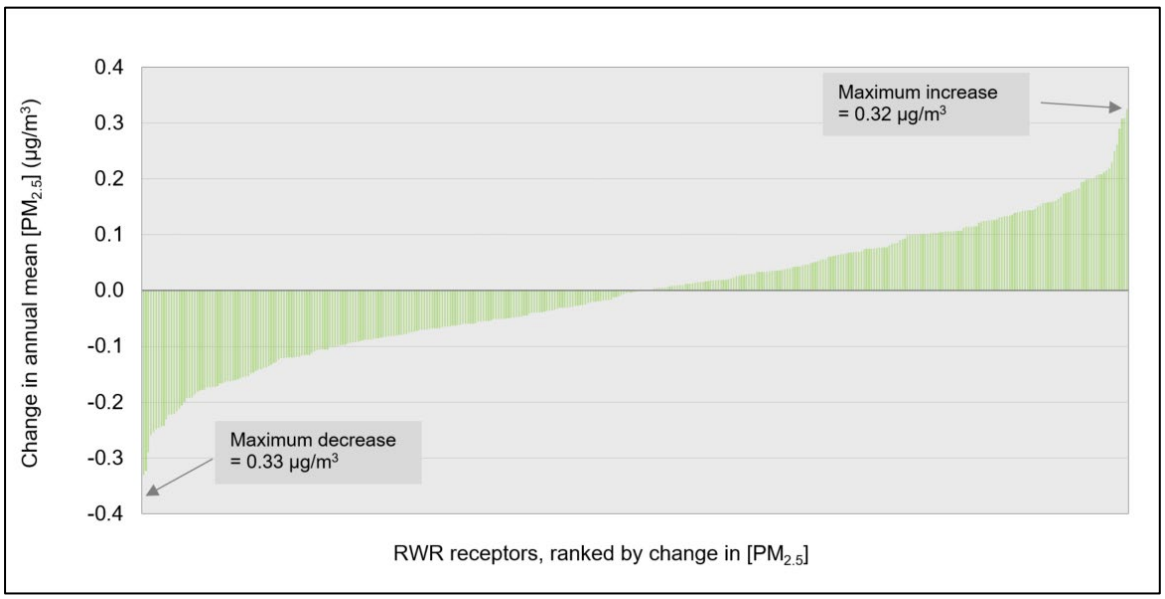

Figure 6-8 **Change in annual average $PM_{2.5}$ concentrations at the nearest RWR receptors for the proposed modification (2033-DSC minus 2033-DM)**

The results for changes in maximum 1-hour NO_2 concentrations for the EIS and proposed modification are shown in **Figure 6-9** and **Figure 6-10**, respectively. Again, there are more receptors showing a predicted increase for the proposed modification, but the increases are small.

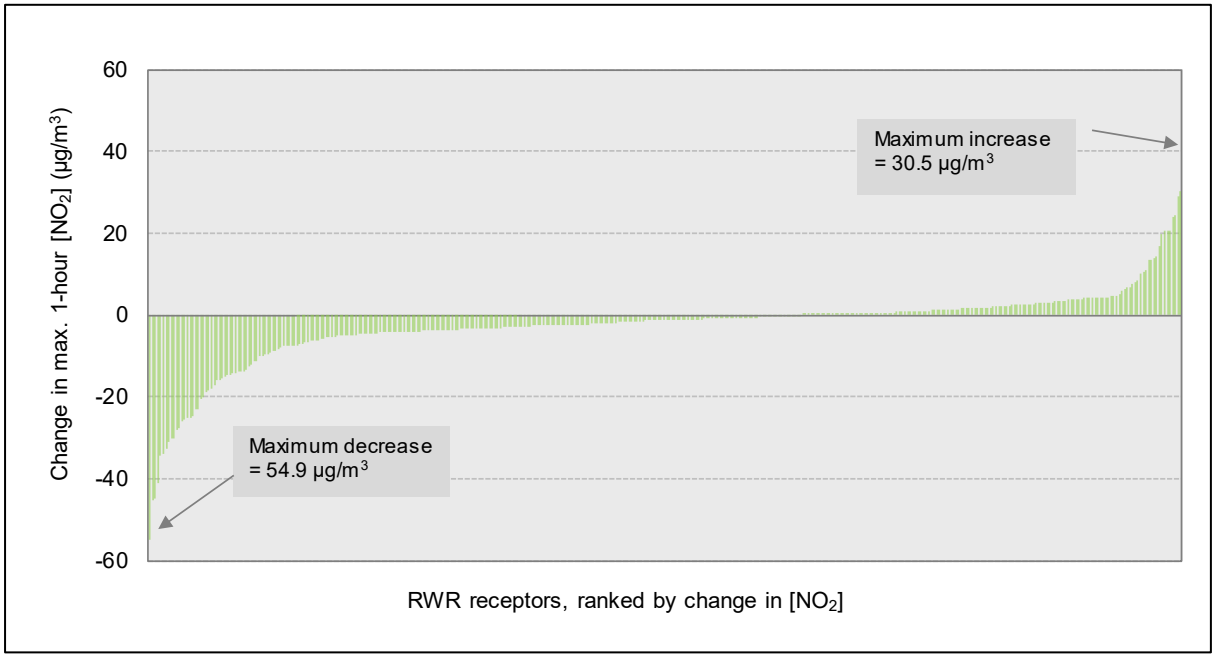

Figure 6-9 **Change in maximum 1-hour average NO_2 concentrations at the nearest RWR receptors for the EIS (2033-DSC minus 2033-DM)**

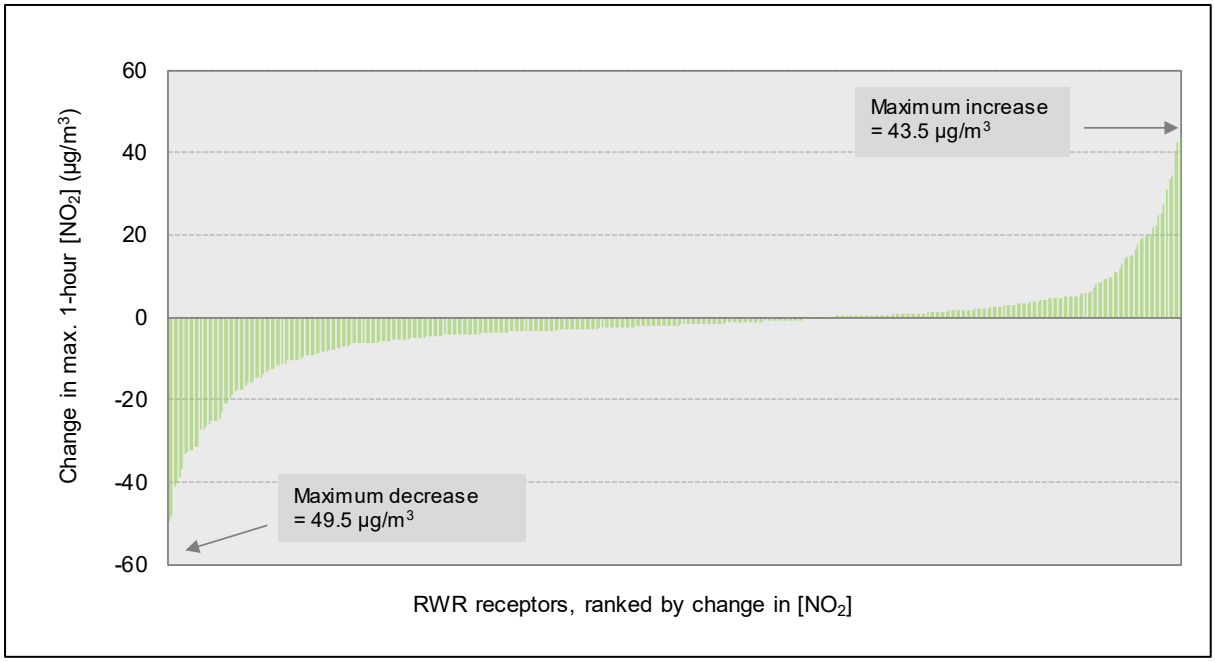

Figure 6-10 **Change in maximum 1-hour average NO_2 concentrations at the nearest RWR receptors for the proposed modification (2033-DSC minus 2033-DM)**

7 Conclusion

In relation to construction air quality impacts, the assessment has determined that the proposed modification does not substantially alter the scope, nature and footprint of the construction works assessed in the EIS. As a result it is not anticipated that the construction dust risk profile would be different to that assessed in the EIS. Therefore the construction mitigation measures proposed in the EIS would be appropriate for the proposed modification.

This assessment also shows the results of a dispersion modelling study for the proposed modification and compares them to the predictions made in the EIS. This assessment is focused on the area in the immediate vicinity of the proposed modification, that is, around the intersection of The Crescent and Johnston Street, and The Crescent overpass at the City West Link intersection.

Comparisons were made both across a small modelling domain and at 400 individual receptors closest to the proposed modification. These receptors were chosen to represent those most likely to be impacted by changes due to the proposed modification.

The results showed that while there are receptors predicted to experience increases due to the proposed modification when compared to the EIS, these increases are small. In addition, predictions for the most relevant metric when considering health impacts, the change in annual mean $PM_{2.5}$ concentrations, were well below the criterion used in the EIS. It is concluded that the differences in ground level concentrations due to the proposed modification when compared to the EIS, are minor, and do not change the outcomes of the EIS. No additional mitigation is considered necessary.

8 References

NSW EPA (2016). Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, Published in January 2017

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Pacific Environment (2015b). WestConnex New M5 – Environmental Impact Statement. Technical Working Paper: Air Quality. Appendix H, NSW Roads and Maritime Services, November 2015.

Pacific Environment (2017). WestConnex M4-M5 Link – Environmental Impact Statement. Technical Working Paper: Air Quality. Appendix I, NSW Roads and Maritime Services, August 2017.