WestConnex M4-M5 Link

Rozelle Interchange – Modification: Iron Cove ventilation underground

Modification report

November 2019

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Roads and Maritime Services

WestConnex - M4-M5 Link

Rozelle Interchange - Iron Cove Ventilation Underground Modification Report

Modification report

November 2019

Prepared for

Roads and Maritime Services

Prepared by

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Executive summary

Introduction

The M4-M5 Link project (the project) is part of the WestConnex program of works that, together with the proposed Sydney Gateway, will facilitate improved connections between western Sydney, Sydney Airport and Port Botany, and south and south-west Sydney, as well as better connectivity between the important economic centres along Sydney's Global Economic Corridor and through local communities.

The project includes the construction and operation of a new multi-lane road link between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters, 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).

Approval for the construction and operation of the project was granted on 17 April 2018 by the NSW Minister for Planning (application number SSI 7485).

The EIS describes construction and operation of the Project in two stages.

- Stage 1 (also commonly referred to as Stage 3A of the WestConnex program of works), as described in the EIS, included construction of the Mainline Tunnels between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters. These works commenced in 2018 with the Mainline Tunnels scheduled to open to traffic in 2022.
- Stage 2 (also commonly referred to as Stage 3B of the WestConnex program of works), as described in the EIS, Construction of the Rozelle Interchange and Iron Cove Link including connection to the stub tunnels at the Inner West subsurface interchange, connection to the surface road network at Lilyfield and Rozelle, and construction of tunnels, ramps and associated infrastructure as part of the Rozelle Interchange to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project.

Proposed modification

The proposed modification relates to Stage 2 of the approved project and includes the following key components:

- Relocation of the Iron Cove Motorway Operations Complex (MOC4), including the electrical substation and ventilation facilities, underground (the ventilation outlet would remain above ground in the same location shown in the EIS). Only a switch room, high voltage regulators, alternative Operational Motorway Control System (OMCS) room and a stair access leading down to the ventilation tunnel would be required on the surface
- Construction of a ventilation tunnel about 340 metres in length that connects the Iron Cove Link tunnel, at an underground location between Cambridge and Waterloo Streets, with the Iron Cove cut and cover structure near Callan Street
- The ventilation tunnel would include two caverns for the housing of ventilation equipment and the electrical substation, along with access tunnels for maintenance
- The Iron Cove cut and cover area would be extended on the southwestern side of Victoria Road to facilitate connection to the ventilation tunnel
- All plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns would be supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program.

There is no change to the Iron Cove Link ventilation outlet as described in the approved project.

Community and stakeholder consultation

Consultation activities carried out for the proposed modification included:

- Meetings with WestConnex Community Reference Groups – Rozelle Interchange
- Courtesy letter dropped to all properties located directly above a ventilation tunnel and caverns

- Doorknock of properties located directly above the proposed ventilation tunnels and caverns to ensure they are aware of the proposed modification and understand how to make a submission
- An interactive Online Tunnel Tool showing the alignment of the proposed new Iron Cove ventilation tunnel and caverns, marked as subject to modification approval made available
- Drop-in community information sessions
- Individual briefings on request
- Meetings with NSW Environment Protection Authority (EPA) and Department of Primary Industries Water
- Briefings/discussions with: − Inner West Councillors − Jamie Parker (Member for Balmain) − Anthony Albanese Member of Parliament (MP) − Inner West Councillors and Inner West and City of Sydney Council Officers
- Media releases to Sydney metropolitan news organisations
- M4-M5 Link Rozelle Interchange Community Update Brochure
- M4-M5 Link Rozelle Interchange Community Update Email.

The Modification Report will be exhibited from 20 November to 17 December 2019. The community and other stakeholders will be able to provide feedback on the proposed modification to the NSW Department of Planning, Industry and Environment (DPIE) as submissions.

Following exhibition of the Modification Report, Roads and Maritime will review the submissions received and respond to the issues raised in a Response to Submissions Report for the proposed modification. This report will be provided to DPIE and will be assessed prior to a determination being made. If during exhibition or during the response to the submissions process further changes to the proposed modification are identified, these changes would also be described and assessed.

Environmental assessment

Potential environmental impacts associated with the proposed modification have been assessed in the Modification Report and compared to the environmental impacts assessed in the EIS. Key environmental impacts for the proposed modification are summarised below.

Traffic and transport

- Construction of surface works on the western side of the realigned Victoria Road within the Iron Cove civil site (C8) would be reduced, compared to the approved project, due to the extent of the above ground ventilation infrastructure works required on the western side of Victoria Road reducing substantially
- The additional tunnelling required under the proposed modification would be supported predominantly from the Iron Cove civil site (C8) with some tunnelling also supported from the Rozelle civil and tunnel site (C5) later in the construction program. The additional construction traffic generated by the proposed modification would not impact the operational performance of intersections when compared to the performance of the intersections generated by the approved project. Utilising both the Iron Cove civil site (C8) and the Rozelle civil and tunnel site (C5) to support this tunnel excavation would disperse impacts on the road network
- The proposed modification would reduce the extent of operational traffic impacts in Callan, Toelle and Springside Streets, as the majority of maintenance operations for the underground ventilation fans and substation would be accessed from within the tunnel
- Appropriate measures to reduce the potential for construction traffic impacts have been included in the project Construction Traffic and Transport and Access Management Plan prepared in accordance with the Planning Approval.

Air quality

- The proposed modification does not significantly alter the scope and nature of the proposed construction works nor alter the construction phase vehicle emission and dust impacts assessed in the EIS
- The proposed modification would relocate the MOC4 underground within caverns housing the electrical substation and ventilation facilities and a ventilation tunnel connecting to the ventilation outlet, which

would remain above ground in the same location shown in the EIS. The proposed new ventilation tunnel and fan and substation caverns would operate as the ventilation facilities are described in the EIS and would not alter the potential air quality impacts reported in the EIS.

Noise and vibration

- The excavation of the new ventilation tunnel and caverns would result in relatively short-term ground-borne noise impacts on residences not identified in the EIS as being near the tunnel alignment. The extent of predicted impact is consistent with that associated with the approved ventilation tunnels and cavern. Mitigation measures would be implemented when predicted ground-borne noise levels are above relevant management levels
- During the establishment of the new tunnel support from within the cut and cover at Iron Cove, a temporary shed wall and roller door would be installed at the western end of the cut and cover structure. This wall, combined with the concrete roof of the cut and cover structure, would assist with minimising ambient noise and dust impacts during tunnelling and result in no properties being affected by construction noise associated with the tunnel support site operation during the day, evening and night
- The proposed modification would result in a shorter duration of surface works to the west of Victoria Road than the EIS concept design and greatly reduce the scope of works at Iron Cove, as only a switch room, High voltage regulator bays, alternative Operational Motorway Control System (OMCS) room and stair access need to be built
- A detailed construction noise and vibration assessment will be prepared for the proposed activities at the proposed Iron Cove tunnel support site in accordance with the approved Construction Noise and Vibration Management Plan to document the outputs of detailed noise and vibration modelling and confirm the optimum suite of noise and vibration mitigation measures
- The proposed relocation of the ventilation fans and substation underground would have a long-term acoustic benefit by reducing the operational noise impacts compared to the EIS. The predicted noise exceedance at Noise Catchment Areas (NCAs) 33 identified in the EIS would be avoided through selection of appropriate noise attenuators, and noise compliance achieved at all surrounding NCAs. Noise mitigation measures will be implemented to ensure High voltage regulators comply with the required noise criteria. Operational noise mitigation measures would be confirmed in the Operational Noise and Vibration Review to be prepared in accordance with the Planning Approval.

Potential groundwater drawdown and surface settlement

- As a result of the proposed modification, areas potentially subject to surface settlement would change accordingly and new areas not assessed in the EIS may also be affected. This notwithstanding, the tunnel and cavern excavation methodology would be in accordance with the EIS
- The preliminary settlement analysis completed to date on the concept design, which combines both excavation induced and short and long-term groundwater drawdown, predicts settlement impacts ranging from 0 to 20 millimetres, which is consistent with the settlement screening criteria set out in Planning Approval Condition E103
- Potential settlement associated with the proposed modification would continue to be assessed as part of the project-wide settlement modelling and impact assessment processes and will be finalised during detailed design
- The Planning Approval sets in place comprehensive requirements to ensure the potential impacts of the detailed design and construction methodology of the project, including the proposed modification, are assessed and potential impacts on property minimised.

Socio-economic, land use and property

- The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS and no additional land is required
- As a result of the proposed modification, the subsurface stratum acquisition requirements would be altered and, consistent with the EIS, the proposed modification would not affect the future use of property at the surface
- The proposed modification would decrease the surface footprint of the permanent works associated with the Iron Cove ventilation facilities. This could increase the amount of residual land available following the completion of the project. The final use of this land will be subject to the finalisation of the Residual Land

Management Plan (RLMP) required under Planning Approval Condition E112 in consultation with Inner West Council.

Urban design and visual amenity

- The proposed modification would decrease the surface footprint of the permanent works required for the Iron Cove ventilation facilities. Reducing surface infrastructure would also temporarily improve visual impacts on some receivers during construction, compared to the EIS, however the residents in Toelle and Callan Streets close to the switch room, high voltage regulators, alternative Operational Motorway Control System (OMCS) room and the separate stair access would still experience a high impact consistent with the EIS assessment
- The proposed modification aligns with the aspirations and objectives of the WestConnex Urban Design Framework. The proposed modification would decrease the surface footprint of the permanent works required for the Iron Cove ventilation facilities. Reducing surface infrastructure would also improve visual impacts compared to the EIS, particularly by a reduction in overshadowing due to the much smaller scale of permanent infrastructure
- The Urban Design and Landscape Plan(s) will be prepared under Planning Approval Condition E133 to E137. Overshadowing will be assessed with a Solar Access and Overshadowing Report under Planning Approval Condition E138. The Urban Design and Landscape Plan(s) and Overshadowing will be reviewed by the Design Review Panel and the Urban Design and Landscape Plan(s) will be approved by the Secretary of the Department of Planning, Industry and Environment.

Water management

- The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS and groundwater inflows to the tunnel and caverns is predicted to be minimal. Appropriate measures to reduce the potential for construction water impacts have been included in the project Construction Soil and Surface Water Management Plan and the Construction Groundwater Management Plan prepared in accordance with the Planning Approval
- The type, arrangement and performance of construction water treatment facilities would be further refined during detailed design. The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for construction water quality impacts.

Resource use and waste minimisation

- About 61,000 bank cubic metres (BCM) of spoil would be excavated to construct the ventilation tunnel at Iron Cove. This increase in spoil volume is negligible in the context of the entire project. Spoil would be reused beneficially where feasible and reasonable
- Construction of the proposed modification would generate a number of waste streams that would require management and disposal in accordance with the waste hierarchy established under the Waste Avoidance and Resource Recovery Act 2001. Avoiding the generation of waste would be the first preference.

Hazard and risk

- The additional High voltage regulators to be installed as part of the proposed modification are electrical transformers and are required for the project as a whole to maintain the voltage fluctuations from the high voltage source of supply to prevent damage to equipment and injury to personnel. There would be a bund, oil separator and a flame trap within the transformer bay to contain any leaks. The transformer walls would be rated to a 4-hour fire rating. The proposed modification has been designed to minimise the likelihood of incidents and risks to public safety.
- No changes to the Planning Approval or the environmental management measures have been proposed to accommodate the proposed modification, other than to refer to this assessment in Planning Approval Conditions A1 and A2.

The proposed new ventilation tunnel and caverns would equate to a total length of about 425 metres. This calculation is based on a length of about 340 metres for the ventilation tunnel alignment and the ventilation fan cavern, 65 metres for the substation cavern and about 20 metres of access tunnel connecting the two caverns. It is important to note that Rozelle Interchange (i.e. Stage 2 of the M4-M5 Link Project) includes excavation of approximately 23 kilometres of tunnels and that the proposed modification is limited to the construction of about 425 metres of additional tunnels and caverns, which represents a very small increase in the extent of tunnelling and associated construction noise and vibration and traffic impacts.

Planning Approval and environmental management measures

No changes to the Planning Approval or the environmental management measures have been proposed to accommodate the proposed modification, other than to refer to this assessment in Planning Approval Conditions A1 and A2.

Contents

1 Introduction 1
1.1 Purpose of this report 1
1.2 Overview of WestConnex 1
1.3 M4-M5 Link project 3
1.4 Modifications to WestConnex M4-M5 Link 5
1.5 Relevant approved activities 5
1.6 The proposed modification 5
1.7 Report structure 7
2 Assessment process 8
2.1 Approval framework 8
2.2 Environmental planning instruments 9
2.3 Other NSW legislation 9
2.4 Commonwealth legislation 9
3 Approved project 10
3.1 Overview 10
3.2 Iron Cove 10
3.3 Ventilation tunnels 14
3.4 Rozelle tunnel and civil site (C5) 14
4 Alternatives considered and identification of the preferred option 16
4.1 Options considered 16
4.2 Identification of the preferred option 17
5 Proposed modification 18
5.1 Overview of the proposed modification 18
5.2 Details of the proposed modification 18
5.3 Changes to construction methodology 25
5.4 Construction program 28
5.5 Construction workforce 29
5.6 Construction hours and justification for 24-hour tunnelling 29
5.7 Operation of the proposed modification 29
5.8 Conditions of approval 30
6 Consultation 31
6.1 Introduction 31
6.2 Consultation during the preparation of the proposed modification 31
6.3 Consultation during the exhibition of proposed modification 34
6.4 Consultation during and following DPIE assessment 34
6.5 Ongoing consultation 35
7 Environmental assessment 36
7.1 Environmental scoping 36
7.2 Traffic and transport 38
7.3 Air quality 41
7.4 Noise and vibration 42
7.5 Potential groundwater drawdown and surface settlement 49
7.6 Socio-economic, land use and property 53
7.7 Urban design and visual amenity 54
7.8 Water management 62
7.9 Resource use and waste minimisation 63
7.10 Hazard and risk 64

8 Conditions of Approval 65
8.1 Conditions to be amended or removed 65
9 Environmental management measures 66
10 Justification and conclusions 67
10.1 Need for the proposed modification 67
10.2 Environmental assessment 67
10.3 Planning Approval and environmental management measures 70
10.4 Community and stakeholder consultation 70
11 References 71

Appendices

Appendix A: Secretary's environmental assessment requirements

Appendix B: Construction traffic and transport assessment

Appendix C: Operational air quality

Appendix D: Noise and vibration assessment

Appendix E: Groundwater drawdown and potential surface settlement

Appendix F: Urban design and visual amenity

Figures

Figure 1-1 Overview of WestConnex and related projects (EIS figure 1-4) 2
Figure 1-2 Overview of the M4-M5 Link project as described in the EIS 4
Figure 3-1 Indicative MOC4 (EIS Figure 5-47) 11
Figure 3-2 Indicative Overshadowing diagram for the MOC4 (EIS Appendix M) 12
Figure 3-3 Indicative underground substation layout (EIS Figure 5-53) 14
Figure 5-1 Alignment of proposed new ventilation tunnel and caverns at Iron Cove 19
Figure 5-2 Cross-section showing indicative arrangement of ventilation tunnel connection to ventilation outlet 20
Figure 5-3 Indicative depth from ground level to crown of ventilation tunnel and caverns 22
Figure 5-4 Indicative location of proposed above-ground structures at Iron Cove 24
Figure 5-5 Indicative Iron Cove cut and cover tunnel support site layout 26
Figure 5-6 Indicative Iron Cove cut and cover tunnel support site (ground surface removed from the image to provide visibility underground). Aspect from Victoria Rd looking towards Callan St. 27
Figure 7-1 Haulage routes via the Iron Cove Civil Site (C8) 39
Figure 7-2 Maximum predicted GBN levels (ventilation tunnel and caverns in light blue). Properties within dashed pink area will also receive GBN from Iron Cove link tunnel excavation. 44
Figure 7-3 Iron Cove ventilation tunnel geological cross-section. Orange represents the top of the tunnel and blue represents the base of the tunnel. 50
Figure 7-4 Preliminary settlement analysis of proposed modification (note this is subject to design development) 52
Figure 7-5 Artist's impression at 10 years of operation, looking east along Toelle Street toward the proposed ancillary facilities. Note: Operation infrastructure subject to detailed design. This modification does not alter the ventilation outlet from the approved project. Exterior design of the ventilation outlet is subject to the Urban Design and Landscape Plan. Pedestrian traffic lights on Victoria Rd will be included in detailed design. 56

Figure 7-6 3D Artist's impression at 10 years of operation looking south along Victoria Road toward the proposed ancillary facilities. Note: Pedestrian traffic lights will be included in detailed design. 56
Figure 7-7 Typical cross-section AA location of proposed modification 57
Figure 7-8 Iron Cove Link - Typical section AA..... 58
Figure 7-9 Indicative Overshadowing diagram 9am 21 June. Note: No change is proposed to the ventilation outlet in the approved project. 60
Figure 7-10 Indicative Overshadowing diagram 3pm 21 June. Note: No change is proposed to the ventilation outlet in the approved project. 61

Tables

Table 3-1 Iron Cove civil site (C8) indicative construction program (extract from EIS Table 6-16)..... 14
Table 5-1 Indicative construction program for the proposed modification..... 29
Table 7-1 Scoping summary of the environmental assessment of the proposed modification 36
Table 7-2 Peak Hour Construction Traffic Volumes at the Iron Cove Civil Works Site (C8) for Approved Project and Proposed Modification..... 40
Table 7-3 Worst predicted ground-borne noise levels during excavation of the proposed ventilation tunnel and caverns..... 44
Table 7-4 EIS and JHCPB comparison – number of receivers above EIS NMLs for ICL cut and cover 45
Table 7-5 EIS and contractor comparison – number of receivers above EIS NMLs for ICL-14 (daytime) 46
Table 7-6 Operational noise levels at the closet residential receivers – Iron Cove fixed facilities 47
Table 7-7 Comparison of preliminary settlement analysis against the screening criteria in MCoA E103 51
Table 8-1 Conditions of approval to be amended or removed 65
Table 11-1 Key assessment requirements for the proposed modification. 0

Abbreviations and Glossary

Acronym	Definition
AIMS	Aboriginal Heritage Information Management System
ASS	Acid sulphate Soils
BCM	Bank cubic metres
CASA	Civil Aviation Safety Authority
CEMP	Construction environmental management plan
CO	Carbon monoxide
Critical SSI	Critical State Significant Infrastructure
DPIE	Department of Planning, Industry and Environment, NSW (formerly the Department of Planning and Environment)
EIS	Environmental Impact Statement
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPIs	Environmental Planning Instruments
EPL	Environment Protection Licence
GBN	Ground-borne noise
GBNML	Ground-borne noise management level
HV Regulator	High voltage Regulator
ICNG	Interim Construction Noise Guideline (DECCW, 2009)
INP	Industrial Noise Policy
LGA	Local government area
MCoA	Minister's Conditions of Approval or Planning Approval Conditions
MOC	Motorway Operations Complex
MOC2	Rozelle West motorway operations complex
MOC3	Rozelle East motorway operations complex
MOC4	Iron Cove Link motorway operations complex
MOD1	Modification 1 Report, WestConnex M4-M5 Link Mainline Tunnel Modification Report SSI 7485 (dated September 2018)

Acronym	Definition
NML	Noise management level
NO_2	Nitrogen dioxide
NVMP	Noise and vibration management plan
OEH	Office of Environment and Heritage
OLS	Obstacle limitation surface
OLTC	On load tap changers
OMCS	Operational Motorway Control System
PANS-OPS	Procedures for Air Navigation Services – Aircraft Operations
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
RBL	Rating background noise level
REMM	Revised environmental mitigation measure
RLMP	Residual Land Management Plan
Roads and Maritime	Roads and Maritime Services
RTS	Response to Submissions
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SPIR	Submissions and Preferred Infrastructure Report
SSI	State Significant Infrastructure
SSIAR	State Significant Infrastructure Assessment Report
VENM	Virgin Excavated Natural Material
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
WTP	Water Treatment Plant

1 Introduction

1.1 Purpose of this report

This Modification Report (report) provides the environmental assessment for the proposed modification to the M4-M5 Link project) (the project) in accordance with Section 5.25 of *the Environmental Planning & Assessment Act 1979* (NSW) (EP&A Act). The proposed modification relates to the Rozelle Interchange stage of the project (Stage 2) and specifically, works at Iron Cove. This report includes:

- An overview of the approved project
- A description of the proposed modification to the approved project
- An assessment of the potential environmental impacts of the proposed modification
- Details of the changes to the conditions of the project approval required by the proposed modification
- Details of the changes to the approved environmental management measures required by the proposed modification
- Justification for the proposed modification.

The Environmental Impact Statement (EIS) described an electrical substation and ventilation exhaust facility located in separate buildings on the surface that together would comprise the Iron Cove Motorway Operations Complex 4 (MOC4). The proposed modification would relocate the MOC4 underground, including the electrical substation and ventilation facilities (the ventilation outlet would remain above ground in the same location). Only a switch room, high voltage regulators, an alternative Operational Motorway Control System (OMCS) room and a stair access leading down to the ventilation tunnel would be required on the surface. The proposed modification is described in section 1.6 and in more detail in Chapter 5 (Proposed modification).

1.2 Overview of WestConnex

WestConnex is one of the NSW Government's key infrastructure projects. The WestConnex program of works and the proposed Sydney Gateway project will facilitate improved connections between western Sydney, Sydney Airport, Port Botany and south and south-western Sydney, as well as better connectivity between the important economic centres along Sydney's Global Economic Corridor and local communities.

Separate planning applications and assessments have been completed for each of the approved WestConnex projects. NSW Roads and Maritime Services (Roads and Maritime) is the proponent for the program of works.

An overview of the WestConnex program of works is provided in Figure 1-1 and includes:

- **M4 Widening** – widening of the existing M4 Motorway from Parramatta to Homebush (open to traffic)
- **M4 East** – extension of the M4 Motorway in tunnels between Homebush and Haberfield via Concord (open to traffic)
- **King Georges Road Interchange Upgrade** – upgrade of the King Georges Road interchange between the M5 West and M5 East at Beverly Hills (open to traffic)
- **New M5** – duplication of the M5 East from King Georges Road at Beverly Hills with tunnels from Kingsgrove to a new interchange at St Peters (approved and under construction)
- **M4–M5 Link** – tunnels connecting to the M4 East at Haberfield and the New M5 at St Peters (approved and under construction)
- **M4-M5 Link** – Rozelle Interchange and Iron Cove Link (approved and under construction).

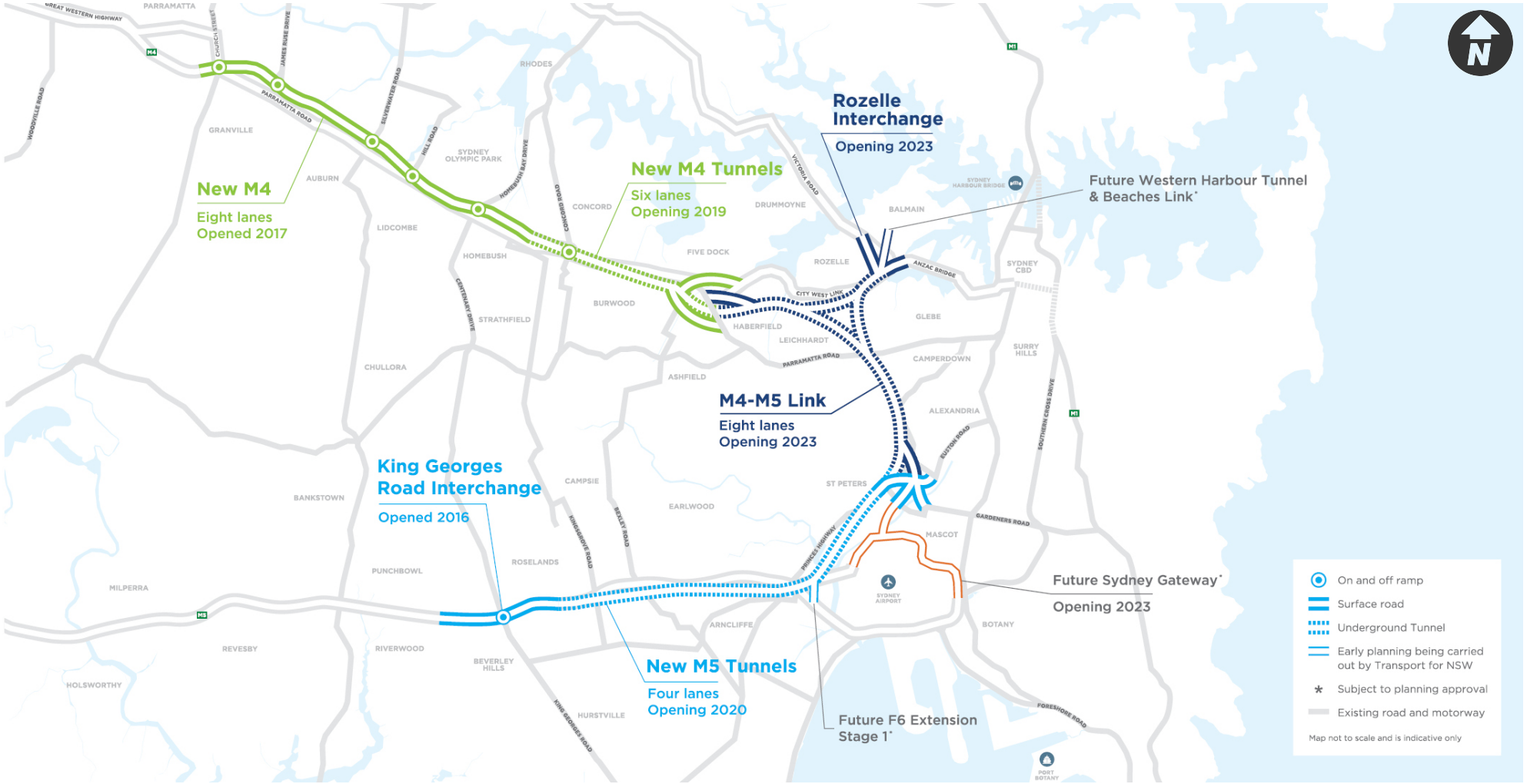

Figure 1-1 Overview of WestConnex and related projects (EIS figure 1-4)

1.3 M4-M5 Link project

Approval for the construction and operation of the project was granted on 17 April 2018 by the NSW Minister for Planning (application number SSI 7485). Figure 1-2 provides an overview of the approved project.

The EIS describes construction and operation of the project in two stages.

Stage 1 (also commonly referred to as Stage 3A of the WestConnex program of works), as described in the EIS included:

- Construction of the mainline tunnels between the M4 East Motorway at Haberfield and the New M5 Motorway at St Peters, stub tunnels to the Rozelle interchange (at the Inner West subsurface interchange) and ancillary infrastructure at the Darley Road motorway operations complex (MOC1), which was subsequently removed (refer to section 1.4), and the Campbell Road motorway operations complex (MOC5).
- These works commenced in 2018 with the mainline tunnel anticipated to be open to traffic in 2022.

Stage 2 (also commonly referred to as Stage 3B of the WestConnex program of works), as described in the EIS, included:

- Construction of the Rozelle Interchange and Iron Cove Link including connection to the stub tunnels at the Inner West subsurface interchange, connection to the surface road network at Lilyfield and Rozelle, and construction of tunnels, ramps and associated infrastructure as part of the Rozelle Interchange to provide connections to the proposed future Western Harbour Tunnel and Beaches Link project. Ancillary infrastructure will be provided at the Rozelle West motorway operations complex (MOC2), the Rozelle East motorway operations complex (MOC3) and the MOC4.
- Stage 2 works commenced in 2019 with these components of the project anticipated to be open to traffic in 2023.

The M4-M5 Link project is part of the WestConnex program of works that, together with the proposed future Sydney Gateway, would facilitate improved connections between western Sydney, Sydney Airport and Port Botany and south and south-west Sydney, as well as better connectivity between the important economic centres along Sydney's Global Economic Corridor and through local communities.

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 EIS and the Submissions and Preferred Infrastructure Report (SPIR).

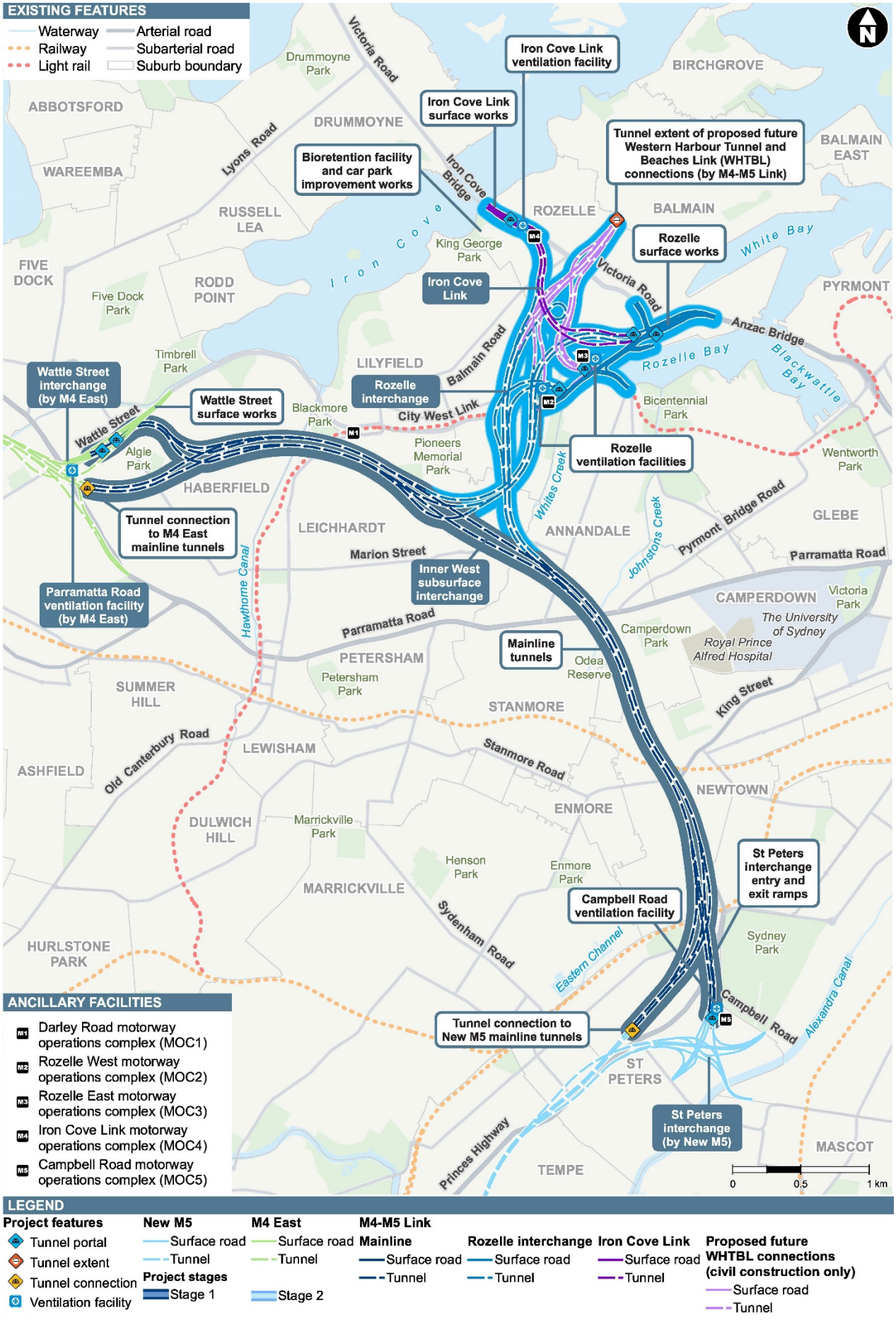

Figure 1-2 Overview of the M4-M5 Link project as described in the EIS

1.4 Modifications to WestConnex M4-M5 Link

Following approval on 17 April 2018, Roads and Maritime submitted an initial modification of the project under Section 5.25 of the EP&A Act (application number SSI 7485 MOD1). The modification related to Stage 1 of the approved project (the mainline tunnel) and was approved by the NSW Minister for Planning on 25 February 2019. Key features of the modification included:

- The Northcote Street civil site (C3a) would become a civil and tunnel site. This would result in 24-hour, seven days a week tunnelling works being carried out from this location within an existing acoustic shed
- The Parramatta Road West and Parramatta Road East civil sites (C1b and C3b) would be used as civil sites. The sites would be used for site offices, light and heavy vehicle car parking, shuttle bus services, workshop and storage of equipment, materials and construction vehicles
- The Darley Road civil and tunnel site (C4) would be removed from the project
- The operational water treatment plant would be relocated from the Darley Road site to the Campbell Road motorway operations complex at the St Peters interchange

A more comprehensive description is provided within the Modification Report for these works. The Modification Report can be found at the following webpage:

http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=9612

An additional modification to the M4-M5 Link, proposing to alter The Crescent overpass and active transport links, has been lodged with the Department of Planning, Industry and Environment (DPIE). This additional modification application is being assessed separately from this modification that is the subject of this report.

1.5 Relevant approved activities

As stated in section 1.3, Stage 2 of the approved project involves the construction of the Rozelle Interchange and Iron Cove Link. This modification report relates to activities to be conducted as part of Stage 2. Further detail is provided in Chapter 3 (Approved Project) of this report.

Key components of the approved project at Iron Cove include:

- Establishment of the Iron Cove civil site (C8) along the southern side of Victoria Road at Rozelle between Byrnes Street and Springside Street. The site would be used to support construction of the Iron Cove Link surface works, including tunnel entry and exit ramps, upgrades and modifications to the eastbound and westbound carriageways of Victoria Road
- Construction and operation of the Iron Cove Link motorway operations complex (MOC4) on the western side of Victoria Road including the Iron Cove Link ventilation facility building located between Springside and Callan Streets and an intake substation located between Callan and Toelle Streets
- Construction and operation of a ventilation outlet between the eastbound and westbound carriageways of Victoria Road above the Iron Cove Link cut and cover

No provision was made to operate roadheaders at the Iron Cove civil site. All tunnelling work associated with construction of the Rozelle Interchange and Iron Cove Link would occur from the Rozelle civil and tunnel site (C5).

Further detail on the approved project is provided in Chapter 3 (Approved Project) of this report and Sections 5.7 and 6.5.12 of the EIS.

1.6 The proposed modification

1.6.1 Description of the proposed modification

The proposed modification relates to Stage 2 of the approved project and includes the following key components:

- Relocation of the MOC4, including the electrical substation and ventilation facilities, underground (the ventilation outlet would remain above ground in the same location illustrated in the EIS). Only a switch room, high voltage regulators, alternative Operational Motorway Control System (OMCS) room and a stair access leading down to the ventilation tunnel would be required on the surface

- Construction of a ventilation tunnel about 340 metres in length that connects the Iron Cove Link tunnel, at an underground location between Cambridge and Waterloo Streets, with the Iron Cove cut and cover structure near Callan Street
- The ventilation tunnel would include two caverns for the housing of ventilation equipment and the electrical substation, along with access tunnels for maintenance
- The Iron Cove Link cut and cover area would be extended on the southwestern side of Victoria Road to facilitate connection to the ventilation tunnel
- All plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns would be supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program.

There is no change to the Iron Cove Link ventilation outlet as described in the approved project.

Chapter 5 (Proposed modification) of this report provides a detailed description of the proposed modification. Proposed changes to the project approval are detailed in Chapter 8 (Conditions of approval).

1.6.2 Need and benefits of the proposed modification

The proposed modification aims to improve the visual impacts associated with the MOC4 by undergrounding the ventilation infrastructure. The proposed modification would:

- Decrease the surface footprint of the permanent works associated with the Iron Cove ventilation facilities potentially increasing the availability of residual land at the completion of construction (see section 6.7)
- Improve visual impacts, particularly overshadowing, by reducing the scale of the operational infrastructure (see section 6.8)
- Improve operational noise impacts by placing the ventilation facilities and substation underground. Operation of the proposed modification would comply with relevant noise criteria in all noise catchment areas, compared to the EIS which predicted exceedances of up to 12dB (see section 6.5.4)
- Provide additional access and egress for tunnel workers, plant, deliveries, ventilation and spoil and work improving safety during construction. Housing the ventilation facilities underground means that the majority of construction would also be underground
- Potentially allow the project to commence commissioning two to three months early, providing more opportunity to finish early and more certainty of finishing dates. Commissioning of the entire project would begin at Iron Cove Link

Alternative design options have been considered including horizontal and vertical arrangements for the fans above ground, an underground arrangement within a ventilation building with a depth of about 40 metres, and the relocation of the ventilation facility to above the cut and cover structure on Victoria Road. The proposed modification significantly reduces and, in some cases, eliminates impacts associated with these options. By locating the ventilation facility underground impacts related to the construction of a link between the ventilation outlet and a ventilation facility on the surface are avoided. These include:

- Elimination of a long duration excavation at the MOC4 site. This excavation would likely be undertaken by excavators with rock hammers. As this is directly adjacent to residential properties rock hammering impacts including potential property damage, high vibration, high intensive noise and dust are avoided
- Potential constriction of Victoria Road traffic (Drummoyne bound) to accommodate the construction footprint while constructing a ventilation link between an above ground ventilation facility and the ventilation outlet. This potential impact would have a significant effect on traffic flow by reducing the Drummoyne bound lanes available to traffic
- Elimination of the operational impacts related to the above ground ventilation facility, detailed above, such as long-term operational noise, overshadowing and amenity reduction.

Should the proposed modification not proceed, additional assessment and approval may be required to provide the necessary connectivity between the ventilation outlet, the road tunnels and the ventilation exhaust facility.

Chapter 4 (Alternatives considered and identification of the preferred option) of this report provides more detail on the identification for the proposed modification.

1.7 Report structure

This report is structured as follows:

- **Chapter 1** (Introduction) provides an overview of the modification, its scope and purpose.
- **Chapter 2** (Assessment process) outlines the statutory assessment requirements and explains the steps in the assessment and approval process.
- **Chapter 3** (Approved project) provides a description of the approved project with a more detailed focus on the elements that are proposed to be changed by the modification.
- **Chapter 4** (Alternatives considered and identification of the preferred option) of this report provides more detail on the need and justification for the modification and alternatives considered.
- **Chapter 5** (Proposed modification) provides a detailed description of the modification to the approved project.
- **Chapter 6** (Consultation) outlines the consultation activities undertaken to date and in the future.
- **Chapter 7** (Environmental assessment) identifies the relevant environmental issues, assesses the potential impacts of the modification and presents environmental management measures in response to those impacts.
- **Chapter 8** (Conditions of approval) identifies the conditions of the project approval that are required to be amended as part of this modification.
- **Chapter 9** (Environmental management measures) details changes to the approved environmental management measures as a result of this modification.
- **Chapter 10** (Modification justification and conclusions) presents the justification for the modification. The

report includes the following supporting appendices:

- **Appendix A**: Environmental assessment requirements for modification
- **Appendix B**: Construction traffic
- **Appendix C**: Operational air quality
- **Appendix D**: Noise and vibration
- **Appendix E**: Potential settlement and property impact
- **Appendix F**: Urban design and visual amenity.

2 Assessment process

This chapter describes the planning approval process and framework for the modification of the WestConnex M4-M5 Link (the project). The proposed modification is related to Stage 2 of the project as described in Chapter 1 (Introduction).

2.1 Approval framework

2.1.1 Project approval

The project was declared as State Significant Infrastructure (SSI) and Critical State Significant Infrastructure (critical SSI) and therefore assessed and approved under Part 5 of the *Environmental Planning and Assessment Act 1979* (NSW) (EP&A Act). An Environmental Impact Statement (EIS) was prepared and placed on public exhibition from 18 August to 16 October 2017.

Following the public exhibition, over 13,000 submissions were received from the community and from NSW Government agencies and local councils. A Submissions and Preferred Infrastructure Report (SPIR) was produced to document the responses to the issues raised and to assess design changes in response to the submissions received. The SPIR was lodged with the NSW Department of Planning, Industry and Environment (DPIE) (formerly the Department of Planning and Environment) in January 2018.

Planning approval was granted by the NSW Minister for Planning on 17 April 2018 (application number SSI 7485) and was subject to a number of conditions relating to the construction and operation of the project.

As noted in Section 1.4, following receipt of planning approval, Roads and Maritime submitted a modification of the project under Section 5.25 of the *EP&A Act* (MOD1 Modification Report) relating to Stage 1 (mainline tunnels) of the approved project and the report was approved by the NSW Minister for Planning on 25 February 2019.

An additional modification to the M4-M5 Link has been proposed to The Crescent overpass and active transport links. That modification application is being assessed separately from the modification that is the subject of this report.

2.1.2 Modification application

Roads and Maritime, as the proponent for the project, is proposing to modify project planning approval SSI 7485 under Section 5.25 of the EP&A Act, which states that *"the proponent may request the Minister to modify the Minister's approval for State Significant Infrastructure. The Minister's approval for a modification is not required if the infrastructure as modified will be consistent with the existing approval under this Division".*

Section 5.25(3) states that *"the request for the Minister's approval is to be lodged with the Planning Secretary. The Planning Secretary may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister". Section 5.25(4) states that "the Minister may modify the approval (with or without conditions) or disapprove of the modification".*

No conditions of approval would need to be deleted or modified as a result of the changes proposed in the Iron Cove ventilation underground modification, other than to reference this report in Planning Approval Conditions A1 and A2, along with the Response to Submissions (RTS) report to be prepared following exhibition of this modification application. The proposed changes in the context of the conditions of approval are discussed further in Chapter 7 (Conditions of approval).

2.1.3 Secretary's environmental assessment requirements

Roads and Maritime and the design and construction contractor have had regular meetings and engagement with the DPIE to confirm assessment and consultation requirements and provide updates on the development and assessment of the proposed modification.

The Planning Secretary's Environmental Assessment Requirements (SEARs) for the project were issued in May 2017. DPIE advised that this modification report should address the SEARs issued used in May 2017 as relevant. The relevant SEARs are set out in Appendix A, including cross references to where the issues are addressed in this report.

2.2 Environmental planning instruments

Section 2.2 of the EIS provides an overview of the environmental planning instruments (EPIs) relevant to the project. This section notes that *"in general, Section 115ZF(2) of the EP&A Act (now Section 5.22(2)) excludes the application of environmental planning instruments to SSI projects except as those instruments apply to the declaration of SSI or critical SSI".* Nevertheless, a review of Section 2.2 of the EIS has confirmed that the discussion of the various EPIs relevant to the project remains valid for this modification application and as such it has not been repeated below.

A review of current EPIs identified that two new State Environmental Planning Policies (SEPPs) had been gazetted since lodgement of the EIS for the project. These are the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017* (Vegetation SEPP) and the *State Environmental Planning Policy (Coastal Management) 2018 (Coastal SEPP)*. A review of these SEPPs confirmed that the Vegetation SEPP is not relevant for the modification application as no vegetation is likely to be impacted as a result of this proposed modification. The Coastal SEPP is also not relevant as the proposed modification is located on land where the SEPP does not apply.

2.3 Other NSW legislation

Section 2.3 of the EIS provides an overview of the other NSW legislation relevant to the project. A review of Section 2.3 of the EIS confirmed that the discussion of the other NSW legislation relevant to the project remains valid for this modification application and as such it has not been repeated below. This includes the need for an Environment Protection Licence under Chapter 3 of the *Protection of the Environment Operations Act 1997* (NSW) (POEO Act). In accordance with clause 35 of Schedule 1 of the *POEO Act*, an Environment Protection Licence would be required for construction of the project.

2.4 Commonwealth legislation

Section 2.4 of the EIS provides an overview of Commonwealth legislation that is relevant to the project. It considered the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* (Cwth) (EPBC Act) and the *Airports Act 1996* (Cwth).

Consistent with the approved project described in the EIS and SPIR, the nature of the activities associated with the proposed modification means that no matters of national environmental significance are likely to be impacted. As such, the modification application has not been referred to the Australian Government Department of the Environment and Energy for further assessment or approval under the EPBC Act.

The Iron Cove Link facilities are located within the Sydney Airport airspace planning scheme, which includes both the Obstacle Limitation Surface (OLS), and the Procedures for Air Navigation Services – Aircraft Operations (PANS-OPS) surface.

Exhaust plumes from ventilation facilities have the potential to penetrate either or both the obstruction limitation surface (OLS) or procedures for air navigation systems operations (PANS-OPS) levels. This is discussed further in section 2.4.2 and Chapter 25 of the EIS. A plume rise assessment was carried out in September 2017 that indicated that the Civil Aviation Safety Authority's (CASA's) threshold vertical velocity at the OLS and PANS-OPS surfaces would not be exceeded. Based on this assessment, the Commonwealth Department of Infrastructure and Regional Development advised on 23 November 2017 that the Iron Cove Link site did not constitute a controlled activity as defined in Section 183 of the *Airports Act 1996 (*Cwth).

The proposed modification would not alter the ventilation outlet at Iron Cove that would see it remaining above ground in the same location indicated in the EIS. Given that the proposed new ventilation tunnel and caverns would not change the location or operation of the ventilation outlet described in the EIS, the proposed modification would not constitute a controlled action, as per the above decision.

3 Approved project

This chapter provides a general overview of the approved project with a more detailed description of the part of the project proposed to be modified. The approved project is described in Chapter 5 and Chapter 6 of the EIS and Part D of the SPIR for the project as modified by the application documentation for SSI 7485 MOD1.

3.1 Overview

As noted in section 1.3, the project is being constructed in stages. The proposed modification presented in this report is relevant to the Stage 2 works. Approved construction activities for Stage 2 are described in Chapter 6 of the EIS.

As the proposed modification to the project addressed in this report relates to the Iron Cove Link MOC4 within the Iron Cove Link site (EIS C8 compound), an overview of the concept design set out in the EIS for MOC4 is provided in section 3.2.1.

As all plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns would be supported from a new surface tunnel support site proposed to be established and operated within in the Iron Cove civil site (C8), following the completion of the southern half of the cut and cover structure, an overview of relevant activities within this site is provided in section 3.2.2.

As the proposed modification involves additional tunnelling works, the excavation methodology detailed in the EIS is summarised in section 3.3.

As there is also the potential for some tunnelling of the proposed new vent tunnel and caverns to be supported from the Rozelle civil and tunnel site (EIS C5) an overview of this construction site is provided in section 4.4.

3.2 Iron Cove

3.2.1 Iron Cove Link motorway operations complex

The MOC4 described in the EIS would be constructed on the southern side of the realigned Victoria Road, on land occupied during construction by the Iron Cove civil site (C8). The electrical substation, which provides power for the operation of the ventilation facilities, would be about four metres high and located on the corner of Victoria Road and Callan Street, while the ventilation exhaust facilities building would be located between Callan Street and Springside Street and be around 10 metres above ground level, about 50 metres in length and adjacent to residential properties.

In relation to substations, the EIS notes that intake substations (substations that would connect to the Ausgrid network and would manage the intake and distribution of the project's power needs) would be required. The MOC4 above-ground substation and ventilation facility is illustrated in EIS Figure 5-47, which is reproduced in Figure 3-1.

Land between the eastbound and westbound carriageways of Victoria Road would accommodate the ventilation outlet for the Iron Cove Link ventilation facility. The ventilation outlet would have a height of around 20 metres above the existing ground level and would meet project air quality criteria, urban design and visual amenity objectives.

The substation and ventilation facilities would operate 24 hours a day, seven days a week.

EIS Table 5-7 indicates that parking would be provided at MOC4 but the location and extent of parking is not shown.

The overshadowing diagram for MOC4 from EIS Appendix N is reproduced in Figure 3-2.

Figure 3-1 Indicative MOC4 (EIS Figure 5-47)

Figure 3-2 Indicative Overshadowing diagram for the MOC4 (EIS Appendix M)

3.2.2 Iron Cove civil site (C8)

As described in the EIS, the Iron Cove civil site (C8) would be located along the southern side of Victoria Road at Rozelle between Byrnes Street and Springside Street. The ancillary facility on the southern side of Victoria Road would include offices, amenities, parking, workshop and maintenance facility, laydown and parking. The site would be used to support construction of the Iron Cove Link surface works, including tunnel entry and exit ramps, upgrades and modifications to the eastbound and westbound carriageways of Victoria Road.

Key construction activities to be carried out at and supported by the Iron Cove civil site (C8) relevant to the proposed modification include construction of the MOC4 including the Iron Cove Link ventilation facility and one ventilation outlet.

Construction of the ventilation facility and substation on the western side of Victoria Road, as described in the EIS, included:

- Excavation, footing and base slab installation
- Erection of precast or in situ poured concrete wall panels for shaft structure stability
- Installation of precast floor or in situ poured elements at the fan room and damper levels
- Installation of roof panels and stair structures for maintenance, access and monitoring of the facilities
- Fixture of façade support structures to shaft walls as per architectural and urban design requirements
- Internal fitout of plant areas, equipment installation and commissioning.

This proposed modification does not alter the portal location or design. The Iron Cove cut and cover would be constructed in stages between the eastbound and westbound Victoria Road carriageways. Construction activities would include:

- Utility works including protection and/or adjustment of existing utilities, removal of redundant utilities and installation of new utilities
- Piling for the dive structure walls
- Bulk excavation of the dive structure and portal
- Casting of a concrete slab in the cut and cover section
- Finishing works including asphalting, line marking and signage installation
- Landscaping, installation of road furniture and commissioning.

Spoil haulage vehicles would use Victoria Road.

3.2.3 Construction hours

The approved project would be undertaken as a mix of both standard and out of hours construction works. Planning Approval Condition E68 defines standard construction hours as:

- Monday to Friday 7am to 6pm
- Saturday 8am to 1pm
- No work on Sundays or public holidays.

Planning Approval Condition E69 allows works to be undertaken between 1pm and 6pm on Saturdays. Daytime works for the proposed modification would be undertaken during these hours. The Planning Approval permits work at the Iron Cove civil and site between 7am to 6pm Monday to Friday and 8am to 6pm Saturday.

3.2.4 Construction program

An indicative construction program is provided in Table 6-16 of the EIS. Relevant extracts are reproduced in Table 3-1.

Table 3-1 Iron Cove civil site (C8) indicative construction program (extract from EIS Table 6-16)

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Construction of cut and cover and tunnel portals																								
Construction of motorway operational infrastructure																								
Site rehabilitation and landscaping																								
Testing and commissioning																								

3.3 Ventilation tunnels

As noted in section 3.1, the EIS included diagrams of the arrangement of ventilation tunnels that would connect the road tunnels with ventilation facilities at Rozelle and St Peters, however the design and construction of the ventilation arrangement for the Iron Cove Link Tunnel was not detailed in the EIS.

The EIS also notes that the project would also include a series of underground substations at a spacing not exceeding around 1.2 kilometres within the tunnel. An indicative layout of an underground substation is shown in EIS Figure 5-53, which is reproduced in Figure 3-3.

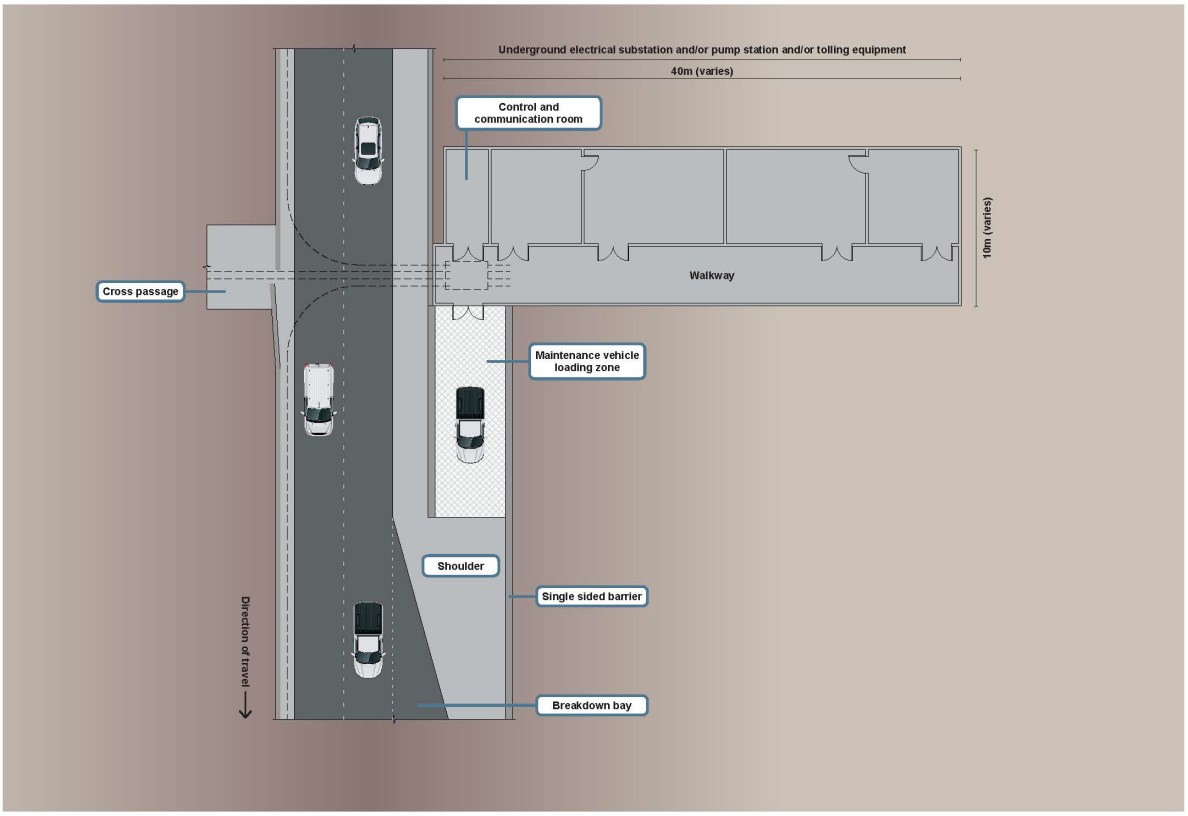

Figure 3-3 Indicative underground substation layout (EIS Figure 5-53)

The EIS indicates that tunnel excavation would be carried out in a staged process. An indicative tunnel excavation method using roadheaders is illustrated in EIS Figure 6-13.

3.4 Rozelle tunnel and civil site (C5)

The Rozelle civil and tunnel site is located between Lilyfield Road to the north, City West Link and The Crescent to the south, Victoria Road to the east and the Sydney CBD and South East Light Rail maintenance depot to the west. The site is predominantly located on disused land that forms part of the Rozelle Rail Yards.

The EIS describes how roadheaders and other excavation plant and equipment would be launched from this site to excavate the Rozelle Interchange and the Iron Cove Link, as well as ventilation tunnels and cross-passages. Three acoustic sheds would be constructed to mitigate the noise impacts of works undertaken outside standard day time construction hours. Tunnel excavation and associated support activities, including spoil handling and haulage, would occur 24 hours a day, seven days a week from this site.

4 Alternatives considered and identification of the preferred option

4.1 Options considered

As stated in Chapter 5 of the EIS, the EIS assessed an indicative concept design that would continue to be refined, where relevant, to improve road network and safety performance, minimise impacts on receivers and the environment, and in response to feedback from stakeholders. Chapter 5 also notes that the EIS has been prepared prior to the appointment of a design and construction contractor and as such, the construction strategy presented and assessed in the EIS aimed to provide an assessment of probable construction methodologies. The EIS concludes that this means the detail of the design and construction approach presented in the EIS concept design is indicative only and is subject to the detailed design carried out by the design and construction contractor.

Further concept design development was undertaken for the MOC4 including the extent of surface works, in particular, the size of the aboveground MOC4 building structure and the underground connection between the ventilation outlet and MOC4. Further design considerations were analysed against the following constraints:

- Design and construction considerations including:
  - available land
  - impacts on existing infrastructure
  - construction staging and program
  - impacts on utility corridors
  - efficient designs that resolve constructability challenges.
- Operation and maintenance considerations including:
  - performance requirements including required air flow rates
  - safe and efficient maintenance access.
- Environmental considerations including:
  - construction and operational noise and vibration impacts
  - visual impacts
  - urban and landscape amenity with emphasis on minimising impacts associated with the acquisition of residential and commercial properties.

Alternative design options considered including horizontal and vertical arrangements for the fans above ground, an underground arrangement within a ventilation building with a depth of about 40 metres, and the relocation of the ventilation facility to above the cut and cover structure on Victoria Road. Additional design development determined that there were further constructability issues to be resolved including:

- Insufficient surface work area available to construct both the cut and cover for the Iron Cove Link tunnel portal and the ventilation facilities in the location proposed in the EIS concept design without having a negative impact on Victoria Road traffic or adjacent properties. Potential constriction of Victoria Road traffic (Drummoyne bound) to accommodate the construction footprint while constructing a ventilation link between an above ground ventilation facility and the ventilation outlet. This potential impact would have a significant effect on traffic flow by reducing the Drummoyne bound lanes available to traffic
- Increased safety risks for construction personnel working in close proximity to live traffic on Victoria Road
- Potential to alter the construction sequence at Iron Cove, associated traffic staging, the extent of night works required and the time required to construct the project
- Long duration of excavation at the MOC4 site: This excavation would likely be undertaken by excavators with rock hammers. As this is directly adjacent to residential properties, rock hammering impacts including potential property damage, high vibration, high intensive noise and dust are avoided. It is estimated that such an excavation would take approximately eight months using rock hammers

- The bulk and scale of the ventilation building, particularly noting the potential solar access and overshadowing impacts on surrounding residences and the requirement of Planning Approval Condition E138
- Minimisation of operational noise impacts, given the significant exceedances of the night-time design criteria of 45dB(A) identified in the EIS
- Maintenance access during operation, which was compromised due to space constraints.

4.2 Identification of the preferred option

It was identified that these challenges could be addressed by undergrounding the ventilation and substation infrastructure and the following were considered in developing this design:

- Avoidance of any significant alterations to the complex Iron Cove Link cut and cover arrangement
- Proximity to the Iron Cove ventilation outlet location illustrated in the EIS
- Need for separate caverns due to space requirements
- Location of the substation cavern close to the ventilation cavern
- The need for the ventilation tunnel to connect to the end of the vent cavern (A design where a ventilation tunnel connects to the middle of the ventilation cavern is not possible)
- Alignment in sound rock (i.e. sandstone)
- Consideration of the topography of the land on the surface
- Need for safe operational and maintenance access from the road tunnel and from the surface
- Avoidance of any increase in the duration of the construction program
- The ability to excavate the ventilation tunnel and caverns from beneath the Iron Cove Link cut and cover structure.

Based on these requirements, the concept design for relocating MOC4, including the electrical substation and ventilation facilities, underground (the ventilation outlet would remain above ground in the same location shown in the EIS) was developed and includes:

- Construction of a ventilation tunnel about 340 metres in length that connects the Iron Cove Link tunnel, at an underground location between Cambridge and Waterloo Streets, with the Iron Cove cut and cover structure near Callan Street
- The ventilation tunnel that includes two caverns for the housing of ventilation equipment and the electrical substation, along with access tunnels for maintenance
- The extension of the Iron Cove cut and cover area on the southwestern side of Victoria Road to facilitate connection to the ventilation tunnel.

No change in tunnel excavation methodology would be required, however an additional surface tunnel support site would need to be established within the Iron Cove cut and cover. All plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns would be supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program.

The only remaining surface permanent infrastructure would be a switch room, high voltage regulators, an alternative Operational Motorway Control System (OMCS) room and a separate access staircase located where the above-ground substation was shown in the EIS and within the boundaries of the Iron Cove civil site (C8). It is not possible to locate this infrastructure underground because:

- Maintenance access from the surface to the tunnel is required at this location
- The switch room must be readily accessible for frequent maintenance access during operations
- The high voltage regulators need to be located as close to the switch room as possible. The transformers with suitable capacity for the Rozelle Interchange are only available with oil insulation which would not be suitable to locate underground
- The alternative OMCS room would be used in the event of an incident to control and operate the tunnel. This is an essential backup system that is required to ensure the safe operation of the motorway.

5 Proposed modification

This chapter describes the proposed modification to the approved project related to relocating the MOC4 underground.

5.1 Overview of the proposed modification

The proposed modification would relocate the MOC4 underground within caverns housing the electrical substation and ventilation facilities and a ventilation tunnel connecting to the ventilation outlet, which would remain above ground in the same location as shown in the EIS. Only a switch room, high voltage regulators, an alternative Operational Motorway Control System (OMCS) room and a separate stair access leading down to the ventilation tunnel would be required on the surface on the southwestern side of Victoria Road between Toelle and Callan Streets.

The main elements of the proposed modification include:

- Construction of a ventilation tunnel about 340 metres in length that connects the Iron Cove Link tunnel, at an underground location between Cambridge and Waterloo Streets, with the Iron Cove cut and cover structure near Callan Street
- The ventilation tunnel that includes two caverns for the housing of ventilation equipment and the electrical substation, along with access tunnels to be used for maintenance
- Extension of the Iron Cove cut and cover area on the southwestern side of Victoria Road to facilitate connection to the ventilation tunnel
- All plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program.

The following sections provide a more detailed description of the proposed modification to the project.

5.2 Details of the proposed modification

5.2.1 Undergrounding of ventilation facilities and substation

As stated in section 3.2.1, the EIS proposed to locate the substation and ventilation facilities above ground on the southern side of Victoria Road, between Toelle Street and Callan Street, in the area used during construction of the project by the Iron Cove civil site (C8).

By relocating the substation and ventilation facilities underground, the only above-ground structures to be constructed at this location would be a switch room, high voltage regulators, an alternative Operational Motorway Control System (OMCS) room and a stair access to the ventilation tunnel.

A ventilation tunnel, including caverns, would be constructed to connect the Iron Cove Link tunnel with ventilation exhaust facilities, substation and the ventilation outlet. The ventilation tunnel would connect with the Iron Cove Link tunnel underground near the tunnel portals and at a side extraction point south of Moodie Street, between Waterloo and Cambridge Streets.

The alignment of the proposed new ventilation tunnel and caverns at Iron Cove for the proposed modifications are shown in Figure 5-1. The approved Iron Cove Link road tunnels are shown in orange and the approved cross passages shown in brown. A cross-section showing indicative arrangement of ventilation tunnel connection to ventilation outlet is shown in Figure 5-2.

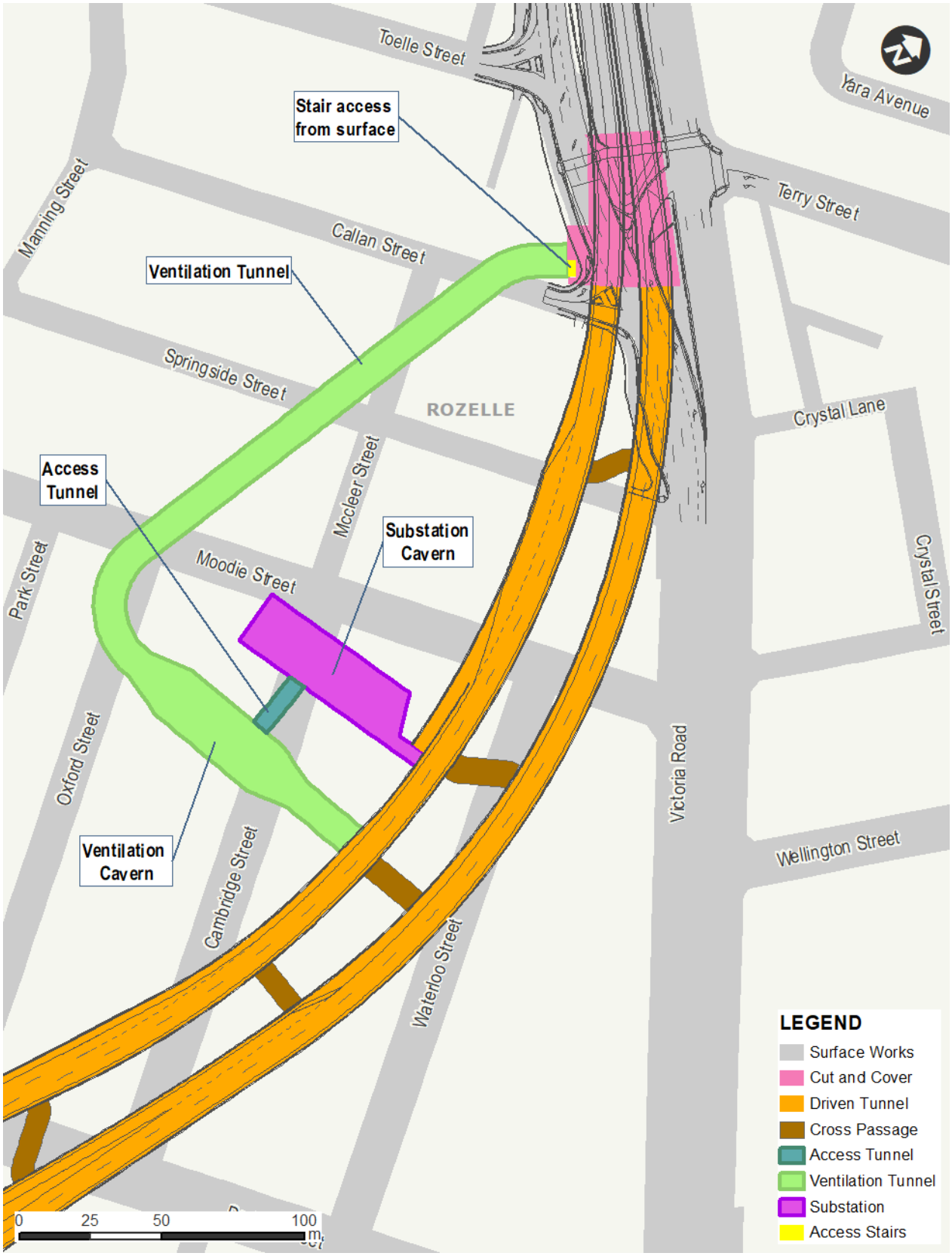

Figure 5-1 Alignment of proposed new ventilation tunnel and caverns at Iron Cove

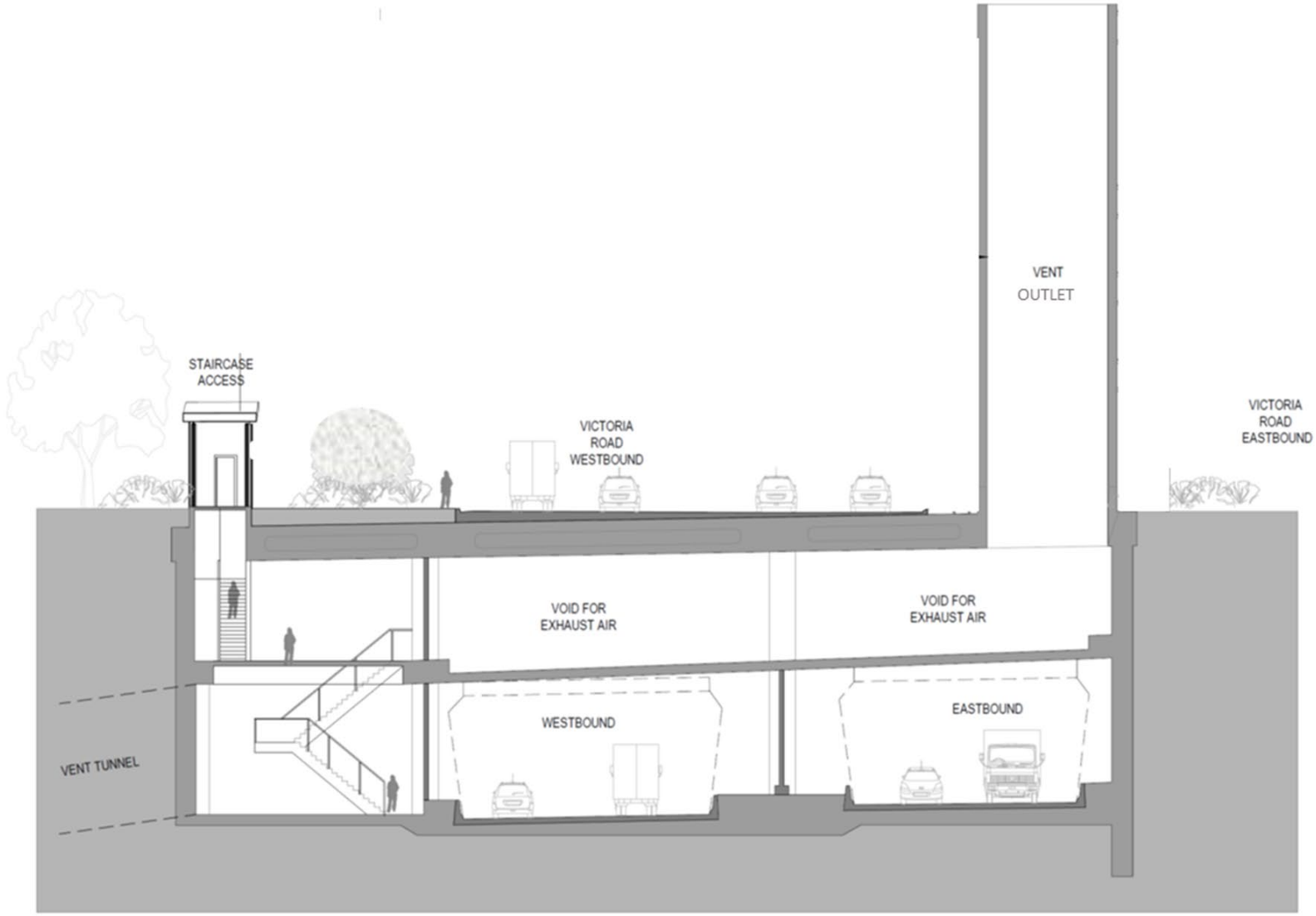

Figure 5-2 Cross-section showing indicative arrangement of ventilation tunnel connection to ventilation outlet

The ventilation tunnel and caverns would have the following features:

- The ventilation tunnel would be about 340 metres in length. This ventilation tunnel would be on average about seven metres high and about 10 metres wide. The depth of the ventilation tunnel would vary from about eight metres (from ground level to tunnel crown) at its shallowest to about 25 metres (from ground level to tunnel crown) at its deepest (see Figure 5-3)
- The ventilation tunnel would include two caverns for the housing of ventilation equipment and the electrical substation:
  - A cavern containing ventilation exhaust facilities, including four ventilation fans laid horizontally, with associated attenuators and dampers. The dimensions of the ventilation cavern would be about 25 metres wide, 15 metres high and 70 metres long
  - A cavern containing the electrical substation, parallel to the cavern containing the ventilation facilities. The dimensions of the substation cavern would be about 20 metres wide, 10 metres high and 65 metres long.
- An access tunnel about five metres wide and 20 metre long, to facilitate maintenance access from the ventilation cavern into the substation cavern
- The Iron Cove cut and cover area would include a side access for the vent tunnel to connect to the cut and cover about seven metres wide and 17 metres long. This area would also accommodate the access stairs to the surface.

Maintenance access to the substation cavern for maintenance personnel and heavy maintenance vehicles would be provided via an approved breakdown bay located off the westbound lanes within the Iron Cove Link tunnel as well as via a stairwell to the surface.

The underground arrangement proposed in this modification has been designed to meet the in-tunnel air quality outcomes as per the EIS and Planning Approval (see section 6.4 Air Quality).

The ventilation tunnel and caverns would be drained, and a sprayed shotcrete lining would generally be used, consistent with the other ventilation tunnels and caverns to be constructed as part of the approved project (see section 6.10 Groundwater). During operation, any groundwater seeping into the tunnel would drain towards the Iron Cove Link tunnel drainage system, where it would be pumped to the operational water treatment plant at Rozelle Rail Yards, as described in Section 5.9.1 of the EIS.

No changes are proposed to the Iron Cove ventilation outlet. This would remain in the location shown in the EIS, between the eastbound and westbound carriageways of Victoria Road.

Figure 5-3 Indicative depth from ground level to crown of ventilation tunnel and caverns

5.2.2 Surface infrastructure

The proposed modification includes undergrounding of the electrical substation and ventilation facilities. By locating the substation and ventilation facilities underground, the only above-ground facilities buildings to be constructed on the southwestern side of Victoria Road near the Iron Cove Link portals would be located between Toelle and Callan Streets and limited to a switch room, high voltage regulators, an alternative Operational Motorway Control System (OMCS) and a small structure containing stair access to the ventilation tunnel.

The switch room would house equipment, such as electrical meters, which would be used to monitor the operation of the substation and ventilation facilities. The combined switch room and high voltage regulator structure would be about six metres wide and 30 metres long, with a height of up to five metres. This structure would be adjacent to the Victoria Road Shared Use Path on the eastern side of the intersection of Victoria Road and Toelle Street. Within the same area would be the smaller 'L'-shaped OMCS room with a footprint of approximately nine metres wide by nine metres long and five metres high.

This residual infrastructure which cannot be located underground is required to support the fans and substations underground. This infrastructure has been placed on the southwestern side of Victoria Road between Toelle and Callan Streets as this is the location closest to which the ventilation tunnel will pass and can fit the structures. At this point above and below ground infrastructure can be connected. No buildings are proposed to remain on Victoria Road between Springside Street and Callan Street as there is no connectivity to the tunnel at this location.

A small above-ground structure in the vicinity of Callan Street, about two metres wide, six metres long and three metres high would contain an access door and a stairway. The staircase would provide an alternative safe maintenance and emergency access to and from the ventilation tunnel from the surface, with the main access from within the road tunnels.

Dedicated parking would be provided for operations and maintenance personnel with access off Clubb Street and within the switch room site with access off Toelle Street. The parking at Clubb Street will support all operational infrastructure near the Iron Cove Link western portal, including; water quality drainage devices, intelligent traffic system assets and the infrastructure subject to this report between Toelle Street and Callan Street.

The proposed modification would decrease the surface footprint of the permanent works associated with the Iron Cove ventilation facilities. This would increase the amount of residual land available following the completion of the project (see section 6.7).

An indicative layout is shown in Figure 5-4.

Figure 5-4 Indicative location of proposed above-ground structures at Iron Cove

5.3 Changes to construction methodology

5.3.1 Surface works

The proposed modification substantially reduces the extent of permanent surface works required at Iron Cove.

Construction of switch room, high voltage regulators, the alternative Operational Motorway Control System (OMCS) room and stair access would entail minor excavation, foundation preparation, drainage works, concrete works and structural works as well as mechanical and electrical fit out. Commissioning of the entire project would begin at Iron Cove Link and the alternative OMCS room would also be used to support commissioning and testing of motorway systems to ensure they are safe and meet required specifications.

5.3.2 Ventilation tunnel and cavern excavation

The proposed new ventilation tunnel and caverns would be constructed in sound rock (i.e. sandstone) and be excavated as described for the project's other ventilation tunnels in section 6.4.2 of the EIS and EIS Figure 6-13.

Approximately 61,000 bank cubic metres (BCM) of spoil would be excavated to construct the new ventilation tunnel and caverns. Tunnel lining would be installed progressively following tunnel excavation. As noted in section 4.2.2, the ventilation tunnel would be drained, and a sprayed shotcrete lining would generally be used.

5.3.3 Tunnelling support from within Iron Cove cut and cover

All plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns would be supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program (see section 5.3.5).

The proposed new Iron Cove ventilation tunnel and caverns can be easily accessed from within the Iron Cove cut and cover and would not require any change to the design or construction of the cut and cover. Tunnelling supported from the Iron Cove civil site (C8) would be undertaken within the cut and cover using a single roadheader. Other techniques for non-heading excavation would also be undertaken consistent with the EIS. Noise will be mitigated in accordance with the requirements of the Planning Approval and the Construction Noise and Vibration Management Plan as approved by the Secretary of the Department of Planning, Industry and Environment or delegate.

Tunnelling works would use a roadheader launched from Iron Cove. It is anticipated that the roadheader would be used to excavate the rock beneath the cut and cover structure to gain access to the tunnel portal located under the cut and cover structure. This rock would ordinarily be excavated using large excavators with rock breakers as part of surface construction works. Using a roadheader for this work would reduce noise and vibration impacts on the community.

Once the rock beneath the cut and cover structure has been removed, the chamber beneath the roof of the cut and cover structure would be temporarily converted into an acoustic shed. A temporary shed wall and roller door would be installed at the western end of the cut and cover structure, and this wall combined with the concrete roof of the cut and cover structure would assist with minimising ambient noise and dust impacts during tunnelling. An indicative site layout is provided in Figure 5-5 and an additional layout in Figure 5-6 which shows a three dimensional layout where the ground surface has been removed from the image to show how the site will be configured underground.

A generator, dust collector, water treatment plant and ventilation fans would be installed inside the enclosed cut and cover structure and/or the dive structure as appropriate to support the tunnelling works. Tunnelling would take place from within the enclosed cut and cover structure and include the excavation of the proposed Iron Cove ventilation tunnel and two caverns.

Spoil from tunnelling would be loaded into off-road trucks at the tunnel face. Spoil generated at night-time would be transported from the tunnel face and stockpiled in the enclosed cut and cover structure, and rehandled and loaded, using a wheel/track loader or excavator, into spoil trucks during daytime hours for disposal off-site. During daytime hours, tunnel spoil would be transported and stockpiled in the dive structure area and loaded into trucks for off-site disposal. Concrete deliveries would be required regularly during tunnelling for tunnel ground support and concrete lining works.

A scaffold stairway is proposed to be installed to provide a link for tunnel workers to access the enclosed cut and cover structure from the surface of the Iron Cove civil works site (C8). The surface civil compound facilities at the Iron Cove civil works site (C8), including crib rooms and amenities, would be jointly used by the tunnelling workforce and supervision. Light vehicles and delivery vehicles would access the Iron Cove civil works site (C8) and the enclosed cut and cover structure regularly to support tunnelling operations.

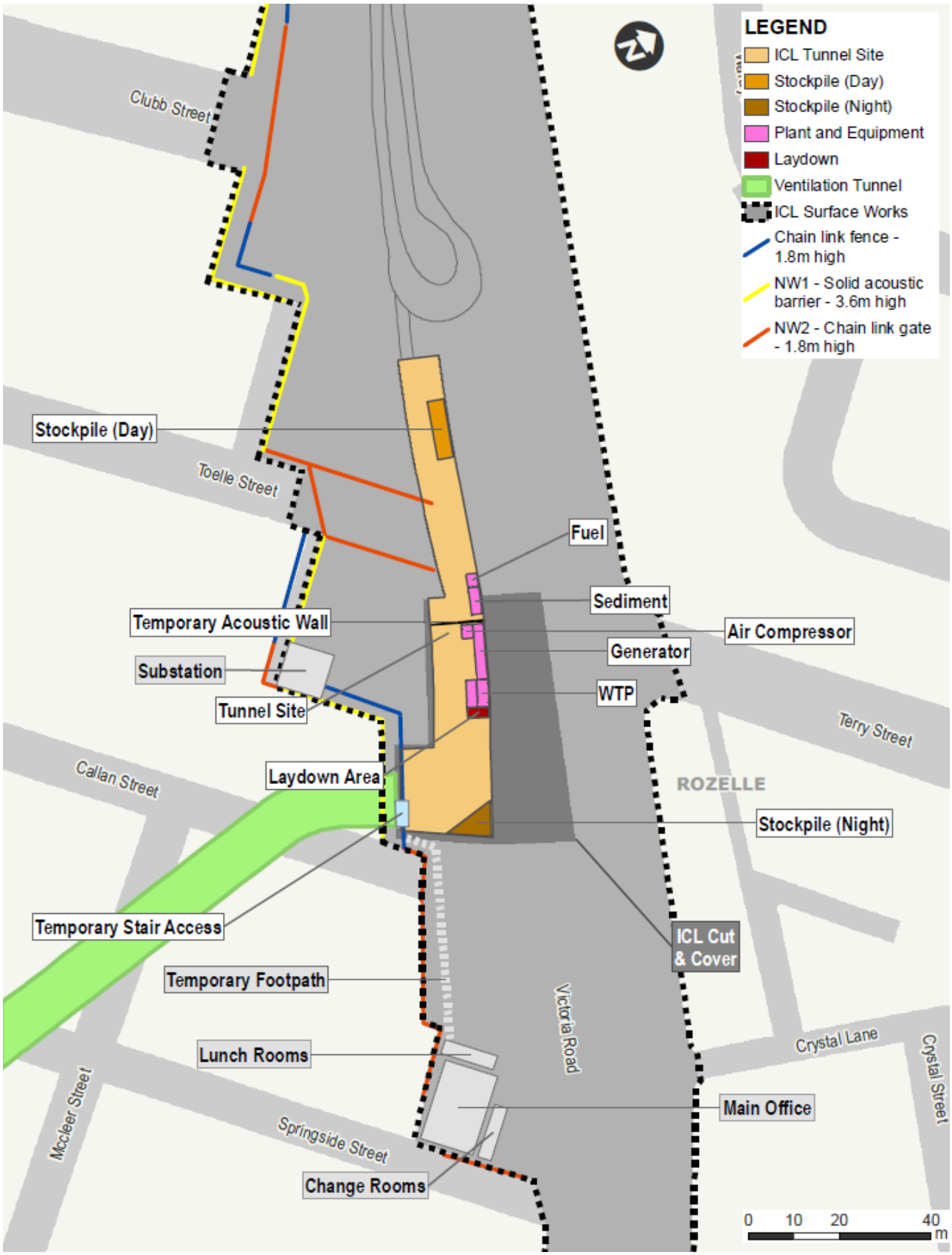

Figure 5-5 Indicative Iron Cove cut and cover tunnel support site layout

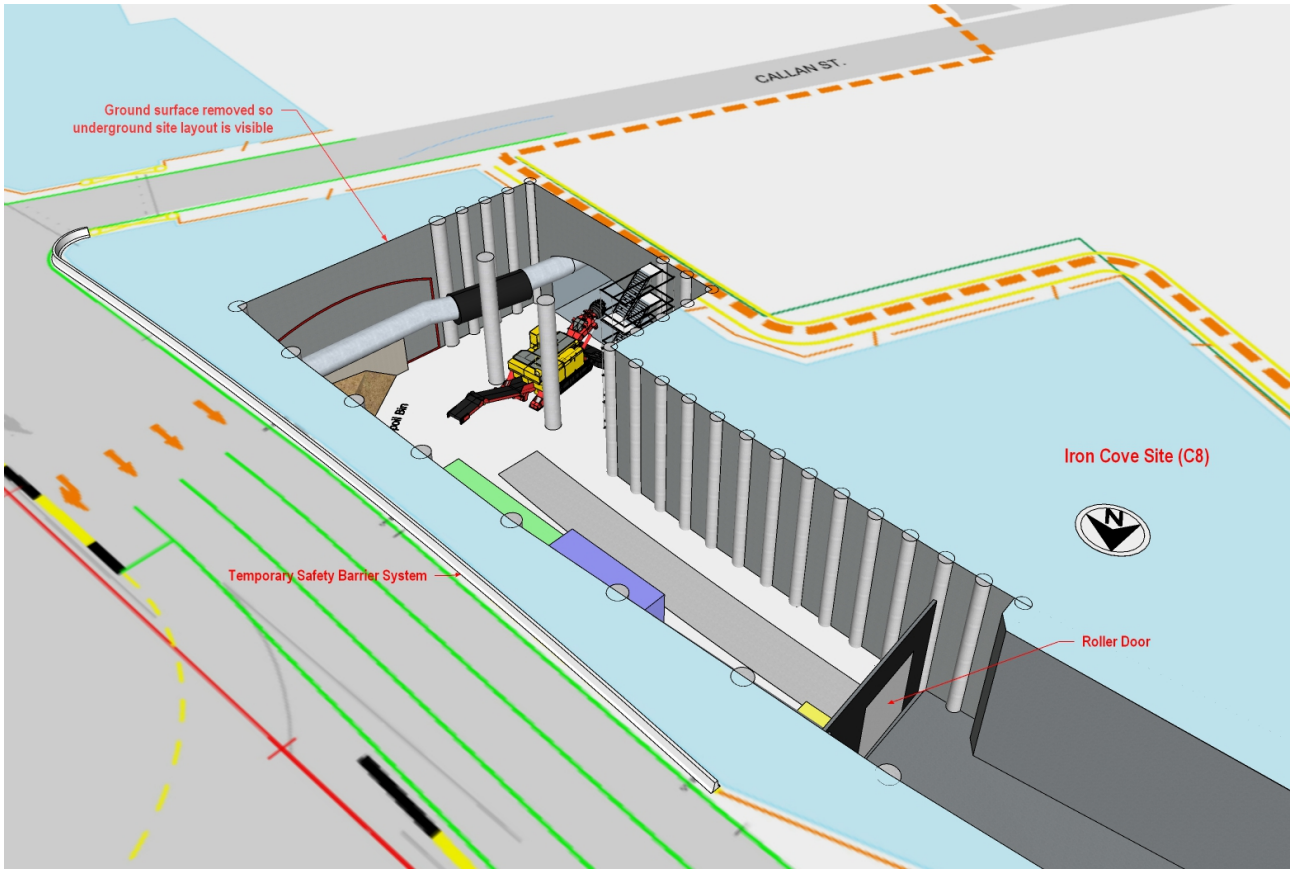

Figure 5-6 Indicative Iron Cove cut and cover tunnel support site (ground surface removed from the image to provide visibility underground). Aspect from Victoria Rd looking towards Callan St.

5.3.4 Additional plant and equipment

The additional plant and equipment that would be used at the Iron Cove cut and cover site (C8) to support these additional tunnelling activities would be:

- Scaffold access
- Dust collector and ventilation fans
- Water treatment plant
- Roadheader
- Wheel loader
- Dump trucks
- Drilling/bolting rig
- Generator and air compressor
- Shotcrete rig
- Excavators
- Delivery trucks including concrete trucks
- Light vehicles
- Spoil trucks.

Reasonable and feasible methods to reduce potential impacts, such as using surface miners and/or blasting, would be further considered during detailed construction planning.

5.3.5 Tunnelling support from Rozelle civil and tunnelling site (C5)

Any tunnelling of the proposed new ventilation tunnel and caverns supported from the Rozelle civil and tunnelling site (C5) would be commenced from within the Iron Cove Link Tunnel once it is excavated. This would not require the installation of any additional temporary surface support infrastructure at the Rozelle civil and tunnelling site (C5).

5.3.6 Utilities

The proposed modification would not alter the extent of utility works required for the project.

5.4 Construction program

The indicative program for construction of the proposed modification is outlined in Table 5-1.

Tunnelling works at the Iron Cove cut and cover would commence once the southern half of the cut and cover structure has been constructed in about Q3 2020. The tunnelling works, including tunnel excavation, ground support and tunnel lining as well as the concrete works in the floor of the tunnel, are anticipated to be completed by the end of 2021.

Commissioning of the entire project would begin at Iron Cove Link. Tunnelling of the proposed new ventilation tunnel and caverns from Iron Cove would potentially allow the project to commence commissioning two to three months early. Starting commissioning earlier would give the project more opportunity to finish early and more certainty that it would finish on time.

Any tunnelling supported from the Rozelle tunnel and civil site (C5) would commence later in the construction program in about Q2 of 2021. As the proposed new ventilation tunnel and cavern works would be supported from the Iron Cove civil site (C8) with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program, this assessment has been completed assuming the worst case impacts of all deliveries and spoil transportation occurring from either of these sites.

Table 5-1 Indicative construction program for the proposed modification

Construction activity	Indicative construction timeframe																							
	2018				2019				2020				2021				2022				2023			
Construction of cut and cover and tunnel portals (EIS Table 6-16)																								
Excavation of proposed new ventilation tunnel and caverns from C8																								
Mechanical and electrical fitout																								
Construction switch room, HV regulators, OMCS and access stair structure																								
Testing and commissioning																								

5.5 Construction workforce

Additional workforce required for tunnelling operations from the Iron Cove tunnelling site would typically range from six to ten people at any one time, made up of supervision, workforce and tunnelling equipment maintenance personnel.

5.6 Construction hours and justification for 24-hour tunnelling

5.6.1 Overview

Construction hours for the proposed modification would be in accordance with the Planning Approval.

Work hours for construction of the ventilation tunnel and caverns and fit out works would be in accordance with the Planning Approval Condition E70 and E73, which allow tunnelling activities (excluding cut and cover tunnelling) and tunnel fit out works to occur 24 hours a day, seven days a week.

Tunnelling is carried out sequentially 24 hours a day, seven days a week. The justification for the out of hours works is twofold:

- Excavation of each round or cycle would take on average 6–12 hours of rock hammering or roadheader excavation. Once completed, temporary support in the form of shotcrete, steel sets and/or rock bolts must be installed immediately to ensure stability of the works and minimise any potential ground movement or settlement
- The duration of construction works under roads and other infrastructure would be less. This would reduce the likelihood and length of time during which excessive ground movement or settlement may occur and result in the need for road closures for repairs or due damage to surface structures.

It is noted that spoil haulage outside standard daytime construction hours specified in Planning Approval Condition E69 is not required for the proposed tunnel support site within the Iron Cove cut and cover.

5.7 Operation of the proposed modification

The ventilation tunnel would operate as the ventilation facilities described in the EIS; that is, the road tunnels would comprise longitudinally ventilated tunnels, which rely on the movement of air through the tunnels in the same direction as the flow of traffic. Air would be extracted from near the Iron Cove Link tunnel exit portal, and conveyed to the ventilation cavern, where the four ventilation fans would push the air towards the ventilation outlet facility (located between the eastbound and westbound carriageways of Victoria Road).

As described in the EIS, the ventilation facilities would be in operation 24 hours a day, seven days a week.

As indicated in section 5.2.1, heavy maintenance vehicles would access the underground ventilation facilities and substation via an approved breakdown bay adjacent to the westbound lanes within the Iron Cove Link tunnel. Access for maintenance personnel to the ventilation tunnels would also be possible from the access stairway structure located near Callan Street.

Access would also be required to the switch room for scheduled meter readings, monitoring of the equipment and in the event of an incident.

The alternative OMCS room is not expected to be frequently used and would only be operated as a backup measure. Maintenance would be undertaken in accordance with the asset management schedule.

The High Voltage regulators would be maintained in accordance with manufacturer's specifications and be replaced about every 25 years. The replacement of the High Voltage regulators would likely involve a road closure on Victoria Road and a crane to lift them from the road over the wall onto a semitrailer.

Personnel attending the site for scheduled maintenance and monitoring would park in the designated parking with access off Clubb Street, and within the switch room site with access off Toelle Street.

5.8 Conditions of approval

The proposed modification would require some of the Conditions of the Project Approval to be amended as some of the proposed changes would not be consistent with the existing project approval. Chapter 8 (Conditions of approval) provides a review of the relevant Conditions in relation to the proposed modification and details the proposed changes.

6 Consultation

This chapter provides an outline of the consultation carried out for the proposed modification to the project.

6.1 Introduction

This chapter provides:

- A summary of the consultation completed to date for the project and the proposed modification
- An outline of the consultation and engagement activities that will occur in the future.

6.2 Consultation during the preparation of the proposed modification

6.2.1 Summary of key consultation activities and consultation tools

The following section details the key consultation activities and tools used to consult on the proposed modification to date. Table 5-3 provides a summary of the community notifications and community engagement that has occurred, and the relevant feedback received.

Table 5-3 Community notification summary for the proposed modification to date

Activity/Tool	Timing	Details
WestConnex Community Reference Group meeting – Rozelle Interchange	7 May 2019	Overview of the tunnel alignment for the proposed modification presented. It was noted that the Iron Cove ventilation building on the surface would be relocated underground and that a shaft is now no longer required for the building. The ventilation outlet location would not change. It was noted that the proposed modification will be placed on public display and the community will be invited to provide formal submissions.
Information session - Iron Cove community	28 May 2019 (2 sessions)	Drop-in information session about Iron Cove construction work. The proposed modification tunnel alignment was discussed and noted as being subject to formal public consultation and Ministerial approval. Residents were keen to be informed regarding when the proposed modification would be on display. Improved visual amenity and operational noise noted by attendees.
WestConnex Community Reference Group meeting – Rozelle Interchange	6 August 2019	An overview of the proposed modification tunnel alignment was presented. The justification for the proposed undergrounding was queried and it was noted that the proposed modification has been designed to minimise the long-term impact on the community. The alignment, depth and size of the proposed tunnel was queried, and details were provided. The need for additional subsurface stratum acquisition was discussed and it was noted that additional acquisition would be required and be completed in accordance with *the Land Acquisition (Just Terms Compensation) Act 199.* It was noted that residences above the proposed ventilation tunnel and cavern alignment would be notified in advance of the public exhibition.
Letter – hand delivered	25 September 2019	Courtesy letter delivered to all properties located directly above the ventilation tunnel and caverns to advise them that the Tunnel Tool would be released the following day, and it would include the final location of the proposed modification.

Activity/Tool	Timing	Details
Online Tunnel Tool	Available from 26 September 2019	An interactive tool showing the alignment of the proposed new Iron Cove ventilation tunnel and caverns, marked as subject to modification approval – https://v2.communityanalytics.com.au/ric/rozelle-interchange
Brochure - Rozelle Interchange tunnel alignment	26 September 2019	Tunnel alignment brochure delivered to 10,000 properties along the alignment including those located above the proposed modification tunnels. A brief section explaining the modification was included in the brochure.
Information session - tunnelling at Iron Cove	3 October 2019	Group discussions with 30 residents and members of the design and construction team. A presentation was provided that included details about the proposed modification including the alignment and structures. Questions from the community were encouraged and were answered by the team. Residents sought further clarification about why the proposed modification is required. It was noted that the surface buildings in the EIS concept design would require the construction of a shaft to connect the ventilation facility building to the ventilation outlet that was not assessed in the EIS. Residents asked if tunnelling from Iron Cove is proposed and it was noted that this is being considered as part of the proposed modification, subject to consultation with DPIE.
Information session - tunnelling at Iron Cove	15 October 2019	Group discussions with 32 residents and members of the design and construction team. A presentation was provided that included details about the proposed modification including the alignment and structures, a site layout for the proposed Iron Cove tunnel support site and discussion of tunnelling from the Iron Cove site. Questions from the community were encouraged and were answered by the team. Attendees requested further justification for the proposed modification to the EIS concept design and confirmation of the tunnel depths as soon as possible. There were no issues raised regarding the proposal to tunnel from Iron Cove. Positive feedback was received regarding the session format and the level of detail provided about tunnel design and construction.
Individual meetings	As requested	Meetings with individual stakeholders impacted by the ventilation tunnels. The contractor has so far met with two stakeholders regarding tunnelling at Iron Cove. Concerns over shallow tunnelling were raised with further information provided about construction methods and monitoring.
Email – Community input to Guide to Modification	18 October 2019	270 local residents were emailed to seek community input as to what topics the community wished to have addressed in the Community Guide to the Modification Brochure
Doorknock	Target 2-3 days prior to exhibition	Doorknock properties located directly above the proposed ventilation tunnels and caverns to ensure they are aware of the proposed modification and understand how to make a submission.

Activity/Tool	Timing	Details
Brochure - Rozelle Interchange Community Guide to Modification	Coincide with modification report exhibition 20 November 2019	A brochure distributed to all properties within 100 metres of the proposed ventilation tunnel and caverns, including properties on the east of Victoria Road (Balmain Shores). The brochure provides a simple summary of the proposed modification including what was in the EIS, what is being changed, the reasons why it is being proposed and concept drawings of final state. The brochure also outlines the consultation process and how to make a submission.
Email – Community Guide to Modification	Coincide with modification report exhibition 20 November 2019	Email to be sent to the stakeholder distribution list for the Rozelle Interchange containing information on the proposed modification and how to make a submission.
Advert - Inner West Courier	Third week of November 2019	A quarter page advert advising that a proposed modification relating to the Rozelle Interchange is now on public exhibition.
Information session – drop-in for Iron Cove work specifically	20 November 2019	Details of the proposed modification and other Iron Cove related construction work, on display for public viewing. Members from the construction and design team available to answer questions from the community.
Information session - Drop-in for all residents interested in Rozelle Interchange tunnelling	23 November 2019	Details of the proposed modification on display for public viewing. Members from the construction and design team available to answer questions from the community.
Email updates – construction lookahead	Every Friday	Sent to everyone subscribed to email updates for Rozelle Interchange and Iron Cove. Currently 270 residents near the Iron Cove site subscribe to the email updates. A reminder that the proposed modification is on public display and information on how to make a submission would be included.

6.2.2 Consultation with local, state and commonwealth government agencies elected representatives and other industry and stakeholder consultation

Table 5-5 provides a summary of the consultation activities undertaken with local, state and Commonwealth Government agencies, elected representatives and other stakeholders prior to the modification going on public display. In addition to these meetings, regular phone and email Correspondence has taken place with these stakeholders.

Table 5-5 Stakeholder engagement summary for the modification to date

Briefing	Timing	Feedback and comments
Inner West Council – Proposed tunnel and cavern alignment	20 June 2019	• Importance of comprehensive community consultation with residents potentially impacted by the new ventilation tunnels • Benefits including improved urban design outcomes • Potential property impacts (condition survey and substratum) • Queried if the proposed modification increases operational energy requirements. It was confirmed that no additional ventilation fans are required and that energy usage during operation would not change

Briefing	Timing	Feedback and comments
Environment Protection Authority	1 July 2019 3 July 2019 (Noise Branch) 21 October 2019 (tunnelling from Iron Cove presented)	• Importance of comprehensive community consultation with residents potentially impacted by the new ventilation tunnels • Need to consider human comfort vibration levels in assessing impacts of additional tunnelling • Need for water quality discharge impact assessment to address total groundwater inflows including those associated with the proposed modification • With respect to operational noise impact assessment, the need to ensure this represents worst case impacts (for example, scenario for fans operating simultaneously)
Department of Primary Industries Water	10 July 2019 22 October 2019 (tunnelling from Iron Cove presented)	• Need for baseline data on groundwater levels; noted that three years of data is available • Noted that alignment of the proposed new ventilation tunnel and caverns was in Hawksbury Sandstone • Noted that the High Voltage regulators are located on the surface and would not impact groundwater

In addition to the meetings noted in Table 5-5, regular phone and email correspondence has taken place with these stakeholders. There have been a number of other meetings with key State government agencies and local council stakeholders and the contractor to discuss post-approval management plans required by Project Approval conditions.

6.3 Consultation during the exhibition of proposed modification

The Modification Report for Iron Cove ventilation underground modification will be exhibited from 20 November 2019 to 17 December 2019. The consultation activities planned during the exhibition period will provide community and stakeholders with an opportunity to find out detailed information about the proposed modification. The community and other stakeholders will also be able to provide feedback on the modification to DPIE as submissions. All feedback will be collated and presented in the Response to Submissions Report for the modification.

Consultation activities that will occur during the exhibition of the modification include:

- Distributing a Community Guide brochure clearly outlining details of the modification, justification, impacts and benefits of the proposal, and visual representation of the final state
- Doorknocking highly impacted residents, businesses and other stakeholders to explain the proposed modification and gathering any feedback
- Sending direct emails to registered stakeholders, including residents, landowners, stakeholders, businesses and community groups
- Providing webpage updates about the modification, which will be published on www.westconnex.com.au and will include information on how to make a submission
- Scheduling meetings and drop-in information sessions to allow the community to have their questions answered about the proposed modification.

All feedback will be collated and presented in the Response to Submissions Report for Iron Cove ventilation underground modification.

6.4 Consultation during and following DPIE assessment

Following exhibition of the proposed modification, Roads and Maritime and the contractor will review the submissions received and respond to the issues raised in a Response to Submissions Report for the modification. This report will be provided to DPIE and will be assessed prior to a determination being made. If during exhibition or during the response to submissions process further changes to the proposed modification are identified, these changes would also be described and assessed.

During DPIE's assessment of the modification and up to and following determination, Roads and Maritime and the contractor would continue to consult with the community and relevant stakeholders in line with the existing and modified (if approved) CoA, the Community Communications Strategy and established communication and complaints processes.

Communication and consultation with stakeholders and the community during construction would focus on providing updates on construction activities and program, responding to enquiries and concerns in a timely manner and minimising potential impacts where possible. Further detail of consultation with stakeholders and the community during construction is provided in section 7.6.2 of the EIS.

6.5 Ongoing consultation

Should the proposed modification be approved, ongoing consultation and communication activities would be undertaken with the surrounding residents and key stakeholders as required in accordance with the Planning Approval.

7 Environmental assessment

This chapter provides an environmental assessment of the proposed modification to Stage 2 of the project. The assessment identifies potential issues and provides a comparison with the impacts assessed in the EIS and the SPIR for the approved project. The assessment has been prepared to address the relevant environmental assessment requirements for the modification as described in Appendix A - Secretary's Environmental Assessment Requirements (SEARs).

7.1 Environmental scoping

A scoping assessment has been completed to identify the likely potential environmental impacts associated with the proposed modification. The proposed modification is described in Chapter 5 (Proposed modification). The relevant SEARs were considered when completing this assessment.

Under the proposed modification, the additional excavation works to underground the electrical substation and ventilation facilities require the construction of new ventilation tunnels and two new caverns that would be supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle tunnelling site (C5).The proposed modification would reduce the extent of permanent surface works required at Iron Cove to construct the MOC4 and in particular avoid the need to construct a shaft connecting the surface facilities to the tunnels.

Potential environmental impacts associated with the proposed modification that require assessment are identified in Table 7-1.

Table 7-1 Scoping summary of the environmental assessment of the proposed modification

Environmental issue	Proposed changes
Construction traffic and transport	See section 7.2.1
Operational traffic and transport	See section 7.2.2
Construction air quality	See section 7.3.1
Operational air quality	See section 7.3.2
Construction noise and vibration	See section 7.4
Operation noise and vibration	See section 7.4
Human health	The identified potential impacts on human health are related to operational air quality and construction noise and vibration. Refer to section 7.3.2 (Operational Air Quality) and section 7.4 (Construction Noise and Vibration) for further assessment.
Groundwater drawdown and potential surface settlement	See section 7.5
Socio-economic, land use and property	See section 7.6
Urban design and visual amenity	See section 7.7
Construction water	See section 7.8.1
Operational water	See section 7.8.2
Contamination	The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS. While the proposed modification would slightly increase the total volume of spoil to be extracted for the project, this spoil would be predominantly sandstone. Contamination impacts expected as a result of the proposed modification are consistent with those presented in the EIS.

Environmental issue	Proposed changes
Flooding and drainage	No additional flooding and drainage impacts are expected a result of the proposed modification. The proposed modification would decrease the surface footprint of the permanent works required for the Iron Cove ventilation facilities and therefore work to increase the extent of permeable surface area. Flooding and drainage impacts are considered consistent with those presented in the EIS.
Biodiversity	The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS. No additional impacts on biodiversity are expected a result of the proposed modification. Biodiversity impacts are considered consistent with those presented in the EIS.
Non-Aboriginal heritage	The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS. No items of non-Aboriginal heritage significance would be impacted by the proposed modification. The proposed changes are considered consistent with the non-Aboriginal impacts assessed in the EIS.
Aboriginal heritage	The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS. No additional impacts are predicted to occur as a result of the proposed modification. The proposed changes are considered consistent with the Aboriginal impacts assessed in the EIS.
Greenhouse gas	The proposed modification would not alter the road tunnels to be provided under the approved project and would not generate additional operational traffic volumes. Construction of the proposed modification would not result in significant changes to emissions generating activities assessed in the EIS. The proposed modification is considered consistent with the greenhouse gas assessment in the EIS.
Resource use and waste minimisation	See section 7.9.
Climate change risk and adaption	The proposed modification would not result in changes to the climate change risk assessment presented in the EIS.
Hazard and risk	See section 7.10.
Cumulative impacts	The proposed modification reduces the extent of surface infrastructure required to the west of Victoria Road adjacent to the tunnel portals at Iron Cove and involves the construction of a new ventilation tunnel and two caverns. The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS. The new ventilation tunnel and caverns would equate to about 425 metres of additional tunnels and caverns. This calculation is based on a length of about 340 metres for the ventilation tunnel alignment and the ventilation fan cavern, 65 metres for the substation cavern and about 20 metres of access tunnel connecting the two caverns. It is important to note that the Rozelle Interchange (stage 2) of the project includes excavation of approximately 22 kilometres of tunnels and that the proposed modification represents a very small increase in the extent of tunnelling. Construction impacts would be minimised through further consideration during detailed design and construction planning and consultation with affected residents and stakeholders.

A number of issues for the proposed modification would be generally consistent with the EIS and do not require further assessment. Impacts that do not require further assessment include:

- Human health risk
- Contamination
- Flooding and drainage
- Biodiversity
- Non-Aboriginal heritage

- Aboriginal heritage
- Greenhouse gases
- Climate change risk and adaption.

7.2 Traffic and transport

7.2.1 Construction Traffic and transport

A detailed construction traffic and transport assessment has been prepared by The Transport Planning Partnership (TTPP) to address the proposed modification and is included in Appendix B.

The EIS indicates that all plant, equipment and materials required to construct the proposed ventilation facilities would be supported from the Iron Cove civil site (C8). The associated environmental impact assessment included in the EIS was limited to key plant and equipment likely to be used for these surface construction works but does not provide detailed traffic information on the construction of this ventilation infrastructure.

Construction of surface works on the western side of the realigned Victoria Road within the Iron Cove civil site (C8) would typically involve five light vehicles per day and fewer than three trucks per day, and a peak of 10 trucks per day is anticipated during peak construction activities for the surface works on the western side of Victoria Road associated with the proposed modification. The traffic volumes associated with surface construction works under the proposed modification would be reduced compared to the approved project due to the extent of the above-ground ventilation infrastructure works required on the western side of Victoria Road being limited to the construction of the switch room, high voltage regulators, alternative Operational Motorway Control System (OMCS) room and separate access stairs. No traffic modelling was undertaken for these surface works due to the reduction to construction traffic volumes associated with the proposed modification.

As noted in section 5.4, excavation of the proposed new ventilation tunnel and cavern works would be supported from the Iron Cove civil site (C8) with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program. As such this assessment has been completed assuming the worst-case impacts of all deliveries and spoil transportation occurring from either:

- Iron Cove civil site (C8) or
- Rozelle civil and tunnel site (C5).

Undertaking the assessment in this manner also considers the impacts of excavating the ventilation tunnel from the Iron Cove civil site (C8) with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program.

The assessment considers the traffic impacts of the proposed modification and provides a comparison with the impacts assessed as part of the approved project.

The proposed new Iron Cove ventilation tunnel and cavern can be easily accessed from within the Iron Cove cut and cover using a single roadheader. Construction traffic would use the approved routes shown in Figure 7-1. North of Iron Cove Bridge, the haulage route continues north along Victoria Road, Church Street, Concord Road and Homebush Bay Drive towards the M4 Motorway.

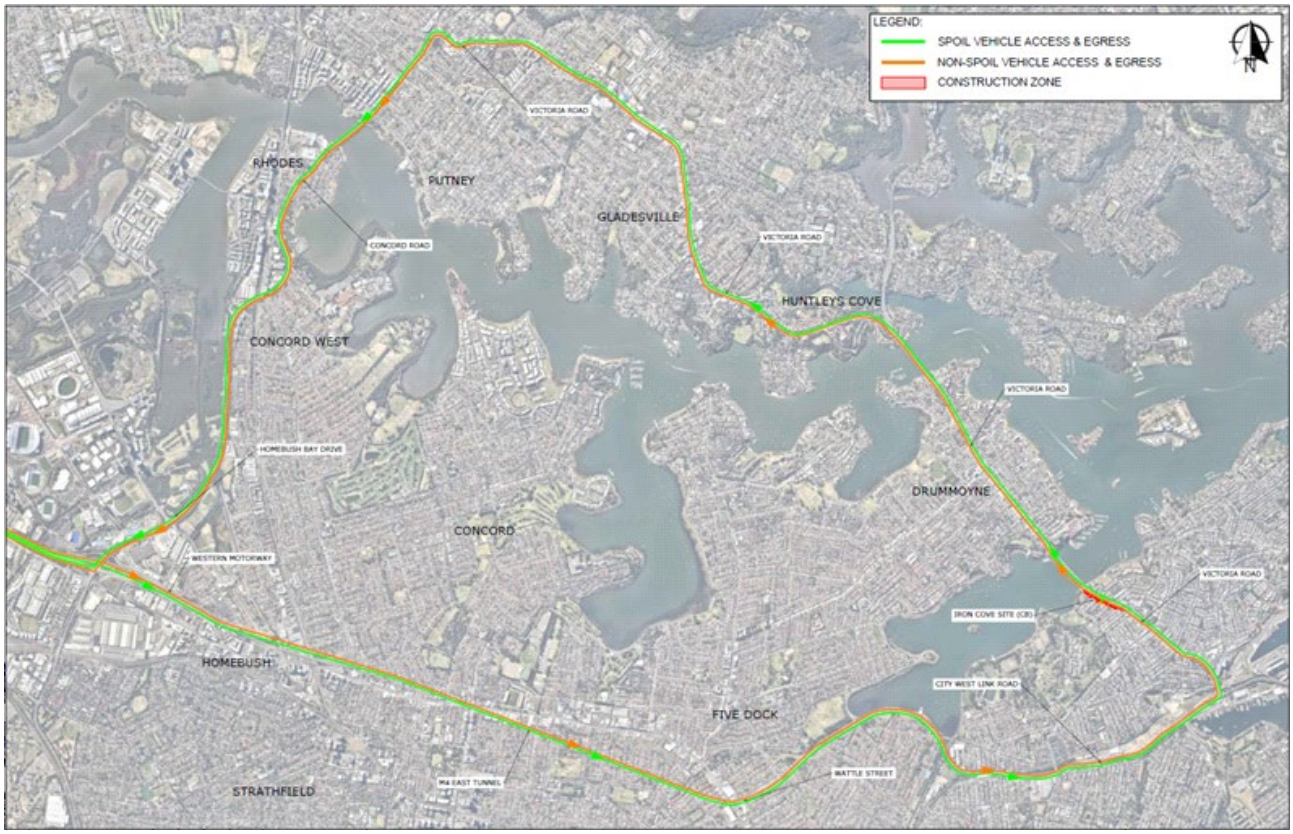

Figure 7-1 Haulage routes via the Iron Cove Civil Site (C8)

Additional workforce required for tunnelling operations from the Iron Cove tunnelling site would typically range from six to 10 people at any one time, made up of supervision, workforce and maintenance personnel.

Additional spoil excavated from the proposed ventilation tunnel and caverns would be transported underground to the Iron Cove cut and cover site. This would involve a total of up to 61,000 bank cubic metres to be removed, resulting in an increase of up to 4800 truck and trailer loads exiting the project from the Iron Cove cut and cover over 15 months.

The daily traffic volumes anticipated during peak construction activities involving spoil load out and concrete works to support tunnelling from Iron Cove would typically be:

- 3 light vehicles per hour
- 3 spoil truck and trailers per hour during standard daytime hours in accordance with Planning Approval Conditions E68 and E69. The EIS identified 145 heavy vehicles per hour use Victoria Rd during the day and evening
- Six shotcrete deliveries by agitator trucks per day, with two concrete deliveries in the evening (6pm to 10pm) with an infrequent maximum of three and typically one truck at night (10pm to 7am) with an infrequent maximum of three
- Six additional heavy vehicles per day.

Tunnelling works using a roadheader launched from Iron Cove would commence once the southern half of the cut and cover structure has been constructed and have been scheduled to occur over about 15 months between about Q3 2020 and the end of 2021. Surface tunnel support from within the Iron Cove cut and cover would therefore overlap with peak construction activities associated with the overall Rozelle Interchange project, which are scheduled to occur in March 2021. Peak truck numbers associated with spoil haulage for the excavation of Iron Cove Link entry ramps at Iron Cove civil site (C8) are forecast to occur around the second quarter of 2021 over a 3 month window. Modelling has been undertaken to represent this peak in conjunction with traffic from the proposed modification. Either side of the short peak forecast truck numbers taper off significantly. Table 7-2 shows a comparison of the approved project and the forecasted construction traffic volumes for the proposed modification during the AM peak hour and PM peak hour.

Table 7-2 Peak Hour Construction Traffic Volumes at the Iron Cove Civil Works Site (C8) for Approved Project and Proposed Modification

Design	Daily		AM Peak Hour (7:30am-8:30am)					PM Peak Hour (4:15pm-5:15pm)				
	Heavy Vehicles	Light Vehicles	Heavy Vehicles		Light Vehicles		Total	Heavy Vehicles		Light Vehicles		Total
	One-way	One-way	In	Out	In	Out	2-Way	In	Out	In	Out	2-Way
Approved project	102[1]	60	13	13	18	0	44	13	13	0	18	44
Approved project plus proposed modification	144[1]	90	18	18	27	0	63	18	18	0	27	63
Difference (proposed modification)	42	30	5	5	9	0	19	5	5	0	9	19

Note: 1 – These peak heavy vehicle numbers represent a short duration at the peak of spoil removal from the Iron Cove Link entry ramps, approximately 3 months, with truck numbers tapering off significantly either side of this peak.

Table 7-2 indicates that the peak hourly traffic volumes associated with the proposed modification would increase by 10 two-way heavy vehicle movements in the AM peak hour and PM peak hour, as compared with the approved project.

To assess the impacts of the increased construction traffic volumes from the approved project, traffic modelling was undertaken to assess the traffic impacts during peak construction activities (March 2021). Roads and Maritime Services provided TTPP with the LinSig models developed as part of the EIS. LinSig is a modelling package that assesses traffic signal intersections individually and in a network of several junctions.

For the purposes of this assessment, TTPP has updated the LinSig models to accommodate the changes in road network and traffic signal phasing, and construction traffic volumes based on detailed construction traffic planning to enable a like-for-like comparison with the approved project modelling results.

The additional construction traffic generated by the proposed modification would not impact the operational performance of Victoria Road intersections with Evans Street, Darling Street and Wellington Street when compared with the performance of the intersections generated by the approved project.

In terms of mid-block traffic volumes, the proposed modification would result in no additional traffic during the AM peak hour and three additional light vehicles (construction workers) during the PM peak hour along Victoria Road in the eastbound direction. The proposed modification would result in an additional five heavy vehicles and four light vehicles in the AM peak hour, and five heavy vehicles in the PM peak hour along Victoria Road in the westbound direction. The additional traffic volumes associated with the proposed modification are minimal and therefore the volume/capacity (V/C) ratio and mid-block Level of Service (LoS) would remain consistent with the approved project.

Any tunnelling of the proposed new ventilation tunnel and caverns supported from the Rozelle civil and tunnelling site (C5) would commence from within the Iron Cove Link Tunnel once it is excavated. Excavation of the ventilation tunnel and caverns would occur from about Q2 2021 if required. The total volume of construction traffic generated by the proposed modification would occur following peak construction activities in March 2021 and be less than the approved project during the peak construction activities. As such, it is concluded that the intersection and mid-block LoS during the construction of the proposed modification would not impact the road network along City West Link.

It is important to note that surface tunnel support for the proposed modification entirely from within the Iron Cove cut and cover or the Rozelle tunnel and civil site (C5) represent two worst case scenarios for haulage route options. However, traffic impacts associated with these worst cases are consistent with the modelling results for the approved project, indicating that either option is acceptable. Notwithstanding this, the additional tunnelling required under the proposed modification would be supported predominantly from the Iron Cove civil site (C8) with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program. Utilising both the Iron Cove civil site (C8) and the Rozelle civil and tunnel site (C5) to support this tunnel excavation would disperse impacts on the road network.

Appropriate measures to reduce the potential for construction traffic impacts, such as limiting heavy vehicles to approved routes, GPS tracking of spoil trucks and driver training, have been included in the project Construction Traffic and Transport and Access Management Plan prepared in accordance with the Planning Approval. The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for construction traffic impacts.

7.2.2 Operational Traffic and transport

As indicated in section 5.7, heavy maintenance vehicles would access the underground ventilation facilities and substation via an approved breakdown bay adjacent to the westbound lanes within the Iron Cove Link tunnel.

Access would be required to the switch room for scheduled meter readings, monitoring of the equipment and in the event of an incident. The alternative Operational Motorway Control System (OMCS) room is not expected to be frequently used and would only be operated as a backup measure. Maintenance would be undertaken in accordance with the asset management schedule. Access for maintenance personnel to the ventilation tunnels would also be possible from the access stairway structure located near Callan Street.

EIS Table 5-7 indicates that parking would be provided at MOC4 but the location and extent of parking is not shown. Under the proposed modification, personnel attending the surface site at Iron Cove for scheduled maintenance and monitoring would park in the designated parking with access off Clubb Street and within the switch room site with access off Toelle Street.

The High Voltage regulator would be maintained in accordance with manufacturer's specifications and be replaced about every 25 years. The replacement of the High Voltage regulators would likely involve removal by skating them out onto Toelle Street and loading them onto a truck using a small crane. The proposed modification would reduce the extent of operational traffic impacts in Callan, Toelle and Springside Streets as the majority of maintenance operations for the underground ventilation fans and substation would be accessed from within the tunnel. The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for operational traffic impacts.

7.3 Air quality

7.3.1 Construction air quality

Construction air quality impacts of the proposed modification have been reviewed by EMM Consulting Pty Ltd (EMM) and their assessment is included in Appendix C.

The EIS identified that the main air quality risks during construction would be associated with dust soiling and the effects of airborne particles on human health and amenity. Several 'high risk' activities were identified including demolition and earth works.

The proposed modification does not require any demolition works. Construction of surface works on the western side of the realigned Victoria Road within the Iron Cove civil site (C8) are limited to the construction of the switch room, high voltage regulators, alternative Operational Motorway Control System (OMCS) room and access stairs and the construction of extensive building foundations and an access shaft are no longer required. As such, potential construction air quality impacts in the location are substantially reduced in the proposed modification.

As noted in section 5.3.2, excavation of the proposed new ventilation tunnel and caverns would be completed using the methodology presented in the EIS and require the excavation of an additional 61,000 bank cubic metres of spoil. Tunnelling works using a roadheader launched from Iron Cove would commence once the southern half of the cut and cover structure has been constructed and the chamber beneath the roof of the cut and cover structure would be temporarily converted into a shed that would assist in minimising dust. Any tunnelling of the proposed new ventilation tunnel and caverns supported from the Rozelle civil and tunnelling site (C5) would be commenced from within the Iron Cove Link Tunnel once it is excavated. This would not require the installation of any additional temporary surface support infrastructure at the Rozelle civil and tunnelling site (C5). Tunnel support works required for the proposed modification would occur within enclosed areas that would work to minimise potential dust impacts on surrounding land uses. The proposed modification would not alter the construction phase vehicle emission and dust impacts assessed in the EIS and would not require any changes or additions to the Planning Approval or environmental management measures for construction air quality impacts.

7.3.2 Operational air quality

Operational air quality impacts of the proposed modification have been reviewed by EMM and their assessment is included in Appendix C.

The proposed modification would relocate the MOC4 underground within caverns housing the electrical substation and ventilation facilities and a ventilation tunnel connecting to the ventilation outlet, which would remain above ground in the same location illustrated in the EIS.

The proposed new ventilation tunnel and fan and substation caverns would operate as the ventilation facilities are described in the EIS. That is, the road tunnels would comprise longitudinally ventilated tunnels, which rely on the movement of air through the tunnels in the same direction as the flow of traffic. Air would be extracted from near the Iron Cove Link tunnel exit portal, and conveyed to the ventilation cavern, where the four ventilation fans would push the air towards the ventilation outlet facility (located between the eastbound and westbound carriageways of Victoria Road). As described in the EIS, the ventilation outlet facility would be in operation 24 hours a day, seven days a week.

Assessment of operational air quality impacts in Section 9.7.1 of the EIS confirmed that the tunnel ventilation system would be able to maintain in-tunnel air quality well within operational limits for all scenarios assessed, including congestion and incidents within the tunnel.

The proposed modification would not alter the potential air quality impacts reported in the EIS. The proposed modification would be designed to operate to meet the relevant Planning Approval or environmental management measures. The position of air quality monitoring equipment would also remain unchanged, so the measure of performance of the ventilation system would also remain unchanged.

During detailed design, dispersion modelling will be undertaken to confirm the ventilation system is designed to meet operational limits. The dispersion modelling being completed for the MOC4 outlet uses the exit ventilation flow rate, traffic pollution emission rates, air temperature and ventilation outlet dimensions (release height and exit diameter) as input into the model.

The change from an above-ground facility to a subterranean facility would have no tangible effects on the emissions to be released from the outlet. In both cases, the tunnel ventilation system is required to capture all of the vehicle emissions generated within the entire tunnel carriageway area. The factors that impact the in-tunnel pollutant concentrations (e.g. traffic volumes, tunnel grades, flow rates, vehicle pollutant generation rates, etc) would be the same for either facility configuration.

There would be no change to the likely traffic pollution emission rates, or the ventilation flow rates due to the modification. Further, the proposed modification would not alter the shape, size (release height or exit diameter) or location of the MOC4 ventilation outlet. The proposed modification would therefore not alter any of the parameters used in the dispersion modelling for the MOC4 ventilation outlet (dimensions or emission characteristics).

It is therefore concluded that the proposed modification would have no material effect on the dispersion performance of the MOC4 ventilation outlet and would not alter the potential air quality impacts. The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for air quality impacts.

7.4 Noise and vibration

7.4.1 Overview

A detailed noise and vibration assessment has been prepared by Renzo Tonin and Associates to address the proposed modification and is included in Appendix D.

The noise and vibration assessment was undertaken to assess the proposed change to the ventilation ancillary facility at Iron Cove Link during the construction and operational phases.

As stated in the EIS, appropriate measures to reduce the potential for ground-borne noise, ground-borne vibration and airborne noise impacts have been included in the project Construction Noise and Vibration Management Plan. All feasible and reasonable mitigation and management measures would be considered and implemented to minimise and manage potential noise and vibration impacts.

7.4.2 Assessment methodology

The technical assessment was undertaken in accordance with the assessment process documented in the EIS.

For the construction ground-borne noise and vibration assessment, it is noted that Appendix J of the EIS does not consider ventilation tunnels at Iron Cove, therefore a direct comparison could not be undertaken to compare impacts with the EIS design.

The methodology used to assess the ground-borne noise and vibration impacts of the modification proposal was the same as the assessment process used in the EIS. Ground-borne noise predictions were based on the empirical algorithm presented in the M4-M5 Link EIS, APPENDIX J, Figure 4-2 and the ventilation tunnel alignment. The assessment of potential construction vibration impacts during roadheader tunnelling excavation was based on the minimum working distances established for cosmetic damage presented in M4-M5 Link EIS, Appendix J, Table 4-12.

All plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns would be supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the program. The noise and vibration assessment compares the predicted noise levels in each of the NCAs from the tunnel support activities at the Iron Cove cut and cover site with the predicted noise levels from the EIS Iron Cove civil works site (C8) based on the EIS construction noise assessment scenario ICL-11 and ICL-12. Impacts of the peak construction support have been already included in the assessment of the operation of the Rozelle Rail Yard civil and tunnel site (C5) and suitable mitigation measures have been identified such as acoustic enclosures and limiting activities at night.

The assessment includes a comparison of potential construction airborne noise impacts associated with the MOC4. The airborne noise assessment for the construction of the facility (scenario ICL-14) was based on the three typical items of plant (mobile crane, concrete trucks/agitator and concrete pump) that would likely be used for construction. The proposed modification substantially reduces the extent of permanent surface works required at Iron Cove.

For the operational noise and vibration assessment, it is noted that the EIS used a sound power level of 105dB(A) at the top of the ventilation outlet, which assumes attenuators have been included on the outlet side of the fans. Based on this noise source level the EIS predicted non-compliances at receivers in NCA 33 by up to 12dB(A). The modification assessment is based on further development of the detailed design and has determined appropriate attenuator requirements to meet the noise criteria at all relevant NCAs.

Operational noise from the High Voltage regulators has been considered by modelling regulator noise and considering noise reduction from the blockwork walls around the regulators. The total noise from the ventilation outlet plus the High Voltage regulators should not exceed the controlling intrusive noise criteria of 48dB(A) at the nearest receivers. The design will include noise mitigations to meet the requirements of the NSW Industrial Noise Policy 2000.

Operational noise mitigation measures would be confirmed in the Operational Noise and Vibration Review to be prepared in accordance with Planning Approval Condition E92.

7.4.3 Construction noise and vibration

Construction ground-borne noise from tunnelling

The EIS predicted that, during the excavation of the mainline tunnels, up to 29 receivers in NCA 32 and NCA 33 may experience noise levels above the GBNML criteria in the vicinity of the Iron Cove Link tunnel portals (south of Victoria Road between Toelle Street and Cambridge Street), where the mainline tunnel ramps climb to meet Victoria Road. Noise levels are predicted to exceed the night-time GBNML of 35dB(A) over of a period of about 17 days for each roadheader pass at the most noise affected receivers. Typically, 2 passes will be required to excavate the ventilation tunnel, with a gap of 3-5 weeks between each pass. Ground-borne noise (GBN) levels were predicted up to 42dB(A) $L_{Aeq(15\ minute)}$ when tunnelling equipment is located at the shortest distance to the receiver.

Assessment of construction ground-borne noise for the proposed modification found up to 78 residential properties may be above the night-time GBNML as a result of ventilation tunnel excavation in NCA32 and NCA33, as shown in Figure 7-2. Ground-borne noise levels greater than 45 dB(A) $L_{Aeq(15\ minute)}$ are predicted when tunnelling equipment is located at the shortest distance to the receiver.

Consistent with the EIS, this impact would be relatively short term in duration (i.e. approximately 2-3 weeks for each roadheader pass) due to the progression rate of the road header works (proposed to be around 20-25 metres per week). In accordance with CoA E82, mitigation measures would be implemented when predicted GBN levels are above relevant GBN management levels.

Table 7-3 and Figure 7-2 present the residential receivers where predicted ground-borne noise levels are above the night-time GBNML in each Noise Catchment Area (NCA) ground-borne noise affected as a result of the ventilation tunnel excavation works.

Table 7-3 Worst predicted ground-borne noise levels during excavation of the proposed ventilation tunnel and caverns

NCA	Worst-case ground-borne noise level at a residential receiver (dB(A) LAeq,15min)	Number of residential receivers predicted to be within		
		35-40 dB(A)	40-45dB(A)	>45 dB(A)
NCA31	<35	0	0	0
NCA32	39	21	0	0
NCA33	47	40	14	3
NCA34	<35	0	0	0
NCA35	<35	0	0	0
NCA36	<35	0	0	0
Total number per GBN intervals		61	14	3
Total number		78		
Percentage (%) over total		78%	18%	4%

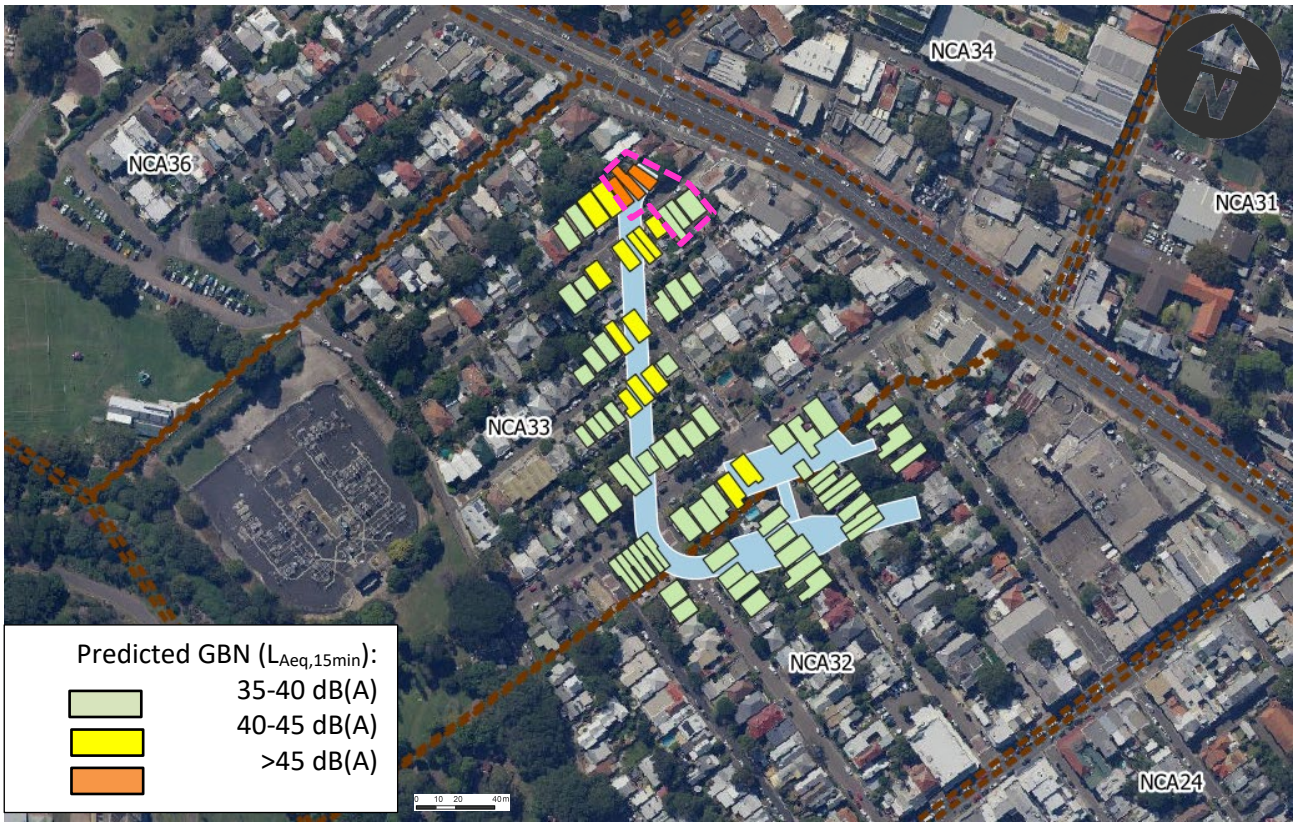

Figure 7-2 Maximum predicted GBN levels (ventilation tunnel and caverns in light blue). Properties within dashed pink area will also receive GBN from Iron Cove link tunnel excavation.

Note that GBN from excavation of the ventilation tunnel and cavern would be the same whether the tunnels are excavated from the Iron Cove cut and cover site (C8) or the Rozelle Rail Yard civil and tunnel site (C5).

As noted from Table 7-3 and Figure 7-2, there are 78 residential receivers along the ventilation tunnel alignment who are expected to experience maximum GBN levels above the night-time ground-borne noise management levels (GBNML) of 35dB(A) during roadheader excavation works. These properties are coloured green, yellow and orange. Residential properties where GBN levels are expected to be above the evening GBNML of 40 dB(A) are also shown as properties coloured yellow and orange. Properties not highlighted are not affected by ground-borne noise in the modification.

More than two thirds of the receivers affected by ground-borne noise (i.e. 78 per cent) are predicted to be exposed to maximum GBN levels between 35 and 40 dB(A). Only a small portion of these receivers (i.e. 18 per cent) is expected to be between 40 and 45 dB(A). Three receivers in NCA33 are predicted to be more than 45 dB(A). The maximum GBN level is predicted to be 47 dB(A).

The six properties identified within the pink dotted line in Figure 7-2 above may also be impacted by ground-borne noise between 35-40 dB(A) from the mainline tunnel excavation, based on information provided in the M4-M5 Link EIS Annexure I.

Construction ground-borne vibration from tunnelling

There were no sensitive receivers identified in the EIS located within the minimum working distances for road-headers during tunnelling works for the mainline tunnel alignment. As such, vibration impacts associated with tunnelling works are expected to be negligible.

Consistent with the EIS, assessment of construction ground-vibration for the proposed modification did not identify any sensitive receivers located within the minimum working distances established for cosmetic damage or human annoyance during roadheader tunnelling excavation of the proposed modification.

It is noted that ground-borne vibration levels from tunnelling works at or below the threshold of human perception would generally result in noise levels above the GBNML for residential and commercial premises. Therefore, management and mitigation measures triggered by the exceedance of GBNMLs would appropriately address and manage potential vibration impacts.

Construction airborne noise – tunnel support works from Iron Cove cut and cover

All plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns would be supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the program. Plant and equipment required to support tunnelling from the Iron Cove cut and cover site (C8) would access the tunnel from the cut and cover structure, which would be temporarily converted into a spoil shed. Noise mitigation has been incorporated into the proposed Iron Cove tunnel support site design following standard construction features, in accordance with the M4-M5 Link EIS and Planning Approval.

The noise assessment presents a comparison of noise impacts from the tunnel support activities at the ICL cut and cover site with impacts from the EIS Iron Cove civil works site (C8) based on the EIS construction noise assessment scenario ICL-11 and ICL-12.

Table 7-4 presents a summary of the predicted impacts by comparing the number of receivers above night-time EIS noise management levels (NMLs) for the EIS Iron Cove civil works site (EIS C8) and the contractor's ICL tunnel support site, with noise mitigation measures in place.

Table 7-4 EIS and JHCPB comparison – number of receivers above EIS NMLs for ICL cut and cover

Activity ID (from EIS)	Activity	Time period	Number of receivers above EIS NMLs (with mitigation*)					
			EIS1			Contractor		
			1 to 10 dB(A)	11 to 20 dB(A)	>20 dB(A)	1 to 10 dB(A)	11 to 20 dB(A)	>20 dB(A)
ICL-11	Earthworks general and drainage	Day	119	38	3	-	-	-
ICL-12	Concrete works	Day	92	17	4	-	-	-
ICL-12	Concrete works	Night	158	149	87	-	-	-
N/A	Cut and cover tunnel support	Day	-	-	-	0	0	0
N/A	Cut and cover tunnel support (single skin	Night	-	-	-	0	0	0

Activity ID (from EIS)	Activity	Time period	Number of receivers above EIS NMLs (with mitigation*)					
			EIS1			Contractor		
			1 to 10 dB(A)	11 to 20 dB(A)	>20 dB(A)	1 to 10 dB(A)	11 to 20 dB(A)	>20 dB(A)
	Wavebar wall)							

Notes: Source: M4-M5 Link EIS, APPENDIX J, Table 5-98

* Mitigation includes at-property treatments identified in PPA Condition E87 (see Appendix D**).**

Predicted noise levels from the tunnel support works at the ICL cut and cover site would be below NMLs at all receivers during the day. At night-time, with a single skin Wavebar shed wall construction at the end of the cut and cover structure, no receivers are predicted to be above the NML at night. Furthermore, the assessment found cumulative noise from the addition of noise generated by the tunnel support site to the noise from civil works would be negligible. The likelihood of sleep disturbance impact is assessed as low as the site would be mitigated and managed to comply with the NMLs at night.

Construction airborne noise – tunnel support works from Rozelle civil and tunnel site

Plant and equipment required to construct the ventilation tunnel would access the tunnel from the Rozelle Rail Yard civil and tunnel site (C5) and progress towards Iron Cove. If required, the additional tunnelling to construct the underground ventilation facilities would result in a minor increase in spoil trucks and deliveries at Rozelle Rail Yard civil and tunnel site (C5). This has been included in the assessment of the operation of the Rozelle Rail Yard civil and tunnel site (C5).

No additional mitigation measures are proposed beyond those required in the Planning Approval, including the approved Construction Environmental Management Plan (CEMP) and associated sub-Plans, to manage the slight increase of spoil trucks and deliveries from the construction of the proposed new ventilation tunnel and caverns.

Construction airborne noise – permanent surface works

The EIS described an electrical substation and ventilation exhaust facility located in separate buildings on the surface that together would comprise the MOC4. The associated construction activities were presented in M4-M5 Link EIS, Appendix J, Table 5-89 under the work activity ICL-14 (i.e. ventilation station and substation) with a total duration of 144 weeks.

The proposed modification would only require the construction of a switch room, High Voltage regulator bays, an alternative Operational Motorway Control System (OMCS) room and a stair access on the surface, substantially reducing the extent and duration of permanent surface works required at Iron Cove compared to the EIS. This would result in a reduced construction program (see section 5.4) and a reduction in construction personnel (see section 5.5) and construction traffic (see section 7.2.1) at the Iron Cove site. Due to the substantially reduced extent of the permanent surface works, there are fewer potentially noise affected receivers compared to the EIS. Furthermore, the proposed modification would reduce the duration of airborne noise impact from construction of the permanent surface works from 144 weeks down to about 40 weeks. The outcomes are summarised in the table below.

Table 7-5 EIS and contractor comparison – number of receivers above EIS NMLs for ICL-14 (daytime)

Activity ID (from EIS)	Activity	Estimated duration		Number of receivers above EIS NMLs (with mitigation)					
				EIS1			Contractor		
		EIS1	JHCPB	1 to 10 dB(A)	11 to 20 dB(A)	>20 dB(A)	1 to 10 dB(A)	11 to 20 dB(A)	>20 dB(A)
ICL-14	Ventilation station and substation	144 weeks	40 weeks	24	4	-	11	-	-
Notes:	1. Source: M4-M5 Link EIS, Appendix J, Table 5-98								

7.4.4 Operational noise and vibration

Operational airborne noise

Noise emissions from fixed facilities in the Iron Cove area were predicted to exceed the criteria by up to 12dB(A) based on the EIS design at the most-affected receivers either side of Callan Street.

During development of the proposed modification design, consideration was given to a selection of fans and attenuators to ensure compliance with operational noise criteria.

A comparison of the predicted operational noise levels for Iron Cove ventilation facilities in the EIS against the proposed modification is shown in Table 7-6. The criteria of 45dB(A) is consistent with the EIS and was established according to the NSW Industrial Noise Policy (INP), based on the night-time amenity criteria for residences in urban areas. The assessment assumes a conservative ventilation fan sound power level of 123dB(A) and three fans in operation.

Table 7-6 Operational noise levels at the closet residential receivers – Iron Cove fixed facilities

Receiver	NCA	Criteria	EIS predicted operational noise levels, dB(A)	Proposed modification predicted operational noise levels, dB(A)
Closest residential receivers	NCA33	45	57	44
	NCA34	45	40	40
	NCA35	45	42	38
	NCA36	45	39	41

The proposed attenuator on the outlet side of the fans has been selected such that the predicted non-compliance at NCA33 from the EIS has been mitigated. Compliance is now predicted at all surrounding NCAs. Although noise levels at the closest receiver in NCA36 are expected to be 2dB higher than in the EIS, compliance with the noise criteria of 45dB(A) is still achieved. Therefore, noise impacts at the closest receivers associated with the operation of the Iron Cove fixed facilities are consistent with or less than the EIS.

Locating equipment underground also reduces potential noise impacts as noise breakout through ventilation building walls, roof and doors is no longer an issue. Similarly, for the substation, transformer noise and building services noise impact is reduced as the substation is located underground.

Under the proposed modification, a switch room, high voltage regulators, an alternative Operational Motorway Control System (OMCS) room and a separate stair access leading down to the ventilation tunnel would be required on the surface. The only element of this surface infrastructure which requires noise assessment are the High Voltage regulators, as the other elements are contained within buildings and do not generate noise.

The high voltage regulators are electrical transformers and would be surrounded by core-filled blockwork on all sides. The operational noise levels of the High Voltage regulators, including the On Load Tap Changers (OLTC) attached to the regulators, are expected to be approximately 66dB(A) at one metre, assuming the OLTC operation occurred for 15 seconds within a 15 minute assessment period. The aim is to mitigate High Voltage regulator noise to 45dB(A), so that the combination of high voltage regulator noise and ventilation outlet noise would not exceed 48dB(A) at any nearby property. A range of mitigation measures would be considered during the detailed design so that the combination of high voltage regulator noise and ventilation outlet noise would comply at nearby properties, including:

- During the procurement process for the high voltage regulators, the aim would be to procure equipment less than 65dB(A) at full load, and less than 62dB(A) at typical night-time loads
- Blockwork walls around the transformers would be as high as practical (minimum four metres high), particularly on southern and eastern sides to maximise noise reductions
- If additional noise reduction is required, installing a partial pitched roof would be investigated. A full roof is not practical due to cooling requirements
- If further reduction is required, the underside of the pitched roof and the inner face of the walls would be lined with acoustic absorption material where practical.

Operational noise mitigation measures would be confirmed in the Operational Noise and Vibration Review to be prepared in accordance with Planning Approval Condition E92.

Operational vibration

Operational vibration impacts are predicted to be negligible for the following reasons:

- Operational sources are relocated underground as part of this proposed modification and there are relatively large distances to buildings at the surface
- Ventilation fans would be installed with appropriate vibration isolation mounts such that vibration is not transmitted from the fan cavern to the surrounds
- The substation is also relocated underground, and substations do not generally contain plant or machinery that generates significant levels of vibration.

Change in traffic noise levels

Modelling for traffic noise levels in the EIS did not include the ventilation facility between Springside Street and Callan Street or the substation between Callan Street and Toelle Street. This conservative approach to traffic noise modelling reflects the uncertainty related to the detailed design of operational infrastructure. As these surface operational buildings did not influence the EIS traffic noise model the proposed removal of the ventilation facility will have no impact on the traffic noise predictions. The proposed construction of operational buildings between Callan Street and Toelle Street will provide some traffic noise shielding to residents adjacent to these structures, potentially improving operational traffic noise relative to the EIS predictions.

All properties impacted by traffic noise would be mitigated in accordance with the RMS Noise Mitigation Guideline as part of the operation noise and vibration review required by the PPA.

Sleep disturbance from operation

The operational noise sources are generally fairly constant noise sources and are unlikely to cause sleep disturbance as they would be mitigated to meet the INP criteria. The item that has the most potential to cause sleep disturbance is the OLTC, which is attached to the High voltage regulator and located inside the concrete blockwork walls. The OLTC operates for periods of 10 -15 seconds at a time. This operation generates noise levels of approximately 72dB(A) at one metre. Taking into consideration the noise reduction from the blockwork walls, maximum noise levels from this operation could be up to 54dB(A) at the nearest receivers.

The INP does not contain sleep disturbance criteria. Taking guidance from the Noise Policy for Industry (EPA, 2017), sleep disturbance screening criteria is either LAFmax 52dB(A), or the prevailing RBL plus 15dB, whichever is the greater. Based on a night-time RBL of 43dB(A), the sleep disturbance screening criteria is 43 + 15 = 58dB(A). As the predicted maximum noise level of 54dB(A) is below the screening criteria of 58dB(A), sleep disturbance impacts are unlikely.

7.4.5 Conclusions

Based on the noise and vibrations assessment conducted for the proposed modification, the following conclusions can be made:

- Up to 78 residential properties may exceed night-time ground-borne noise management levels in NCA33 and NCA32 during construction of the ventilation tunnel and caverns. However, more than two thirds of these receivers (i.e. 78 per cent) are predicted to be exposed to maximum GBN levels between 35 and 40 dB(A). Only a small portion of these receivers (i.e. 18 per cent) are expected to be exposed to GBN levels of between 40 and 45 dB(A). Finally, only three receivers in NCA33 are predicted to be exposed to GBN levels of more than 45 dB(A). The maximum GBN level is predicted to be 47dB(A). Due to the advance rate of roadheader works, this impact is expected to be relatively short-term in duration (i.e. approximately 2-3 weeks per roadheader pass). In accordance with MCoA 82, mitigation measures would be implemented when predicted ground-borne noise levels are above relevant management levels in accordance with the approved NVMP
- There are no sensitive receivers located within the minimum working distances for roadheaders during tunnelling works for the proposed ventilation tunnels, therefore the risk of disturbance due to vibration from roadheader excavation works is considered low
- Tunnel support from within the cut and cover at the Iron Cove civil works site (C8) would result in no properties affected by construction noise associated with the tunnel support site operation. As tunnel support would be a 24-hour operation, noise impacts at night were also predicted and found to be below the NML at receivers nearby the worksite. A detailed construction noise and vibration assessment will be prepared for the proposed activities at the proposed Iron Cove tunnel support site in accordance with the

approved Construction Noise and Vibration Management Plan to document the outputs of detailed noise and vibration modelling and confirm the optimum suite of noise and vibration mitigation measures

- Should any tunnelling be supported from Rozelle Rail Yard civil and tunnel site (C5) there would be a slight increase in spoil trucks and deliveries at worksite, however this would occur outside the peak construction activities associated with the overall Rozelle Interchange project and would not require additional mitigation measures
- The proposed modification would result in a shorter duration of surface works to the west of Victoria Road than the EIS concept design and greatly reduce the scope of works at Iron Cove as only a switch room, High voltage regulator bays, alternative Operational Motorway Control System (OMCS) room and stair access need to be built
- Potential construction noise and vibration impacts would be managed in accordance with the processes set out in the Construction Noise and Vibration Management Plan prepared in accordance with Planning Approval Condition C4(b)
- The proposed relocation of the ventilation fans and substation underground would have a long-term acoustic benefit by reducing the operational noise impacts compared to the EIS. The predicted noise exceedance at NCA33 identified in the EIS would be avoided through selection of appropriate noise attenuators and noise compliance would be achieved at all surrounding NCAs. The High voltage regulators would comply with the required noise criteria, subject to the implementation of mitigation measures, which would be confirmed during detailed design so that the combination of High voltage regulator noise and ventilation outlet noise would comply at nearby properties
- Noise impacts from the operation of the Iron Cove fixed facilities are consistent with or less than the potential impacts identified in the EIS. Operational noise mitigation measures would be confirmed in the Operational Noise and Vibration Review to be prepared in accordance with Planning Approval Condition E92.

7.5 Potential groundwater drawdown and surface settlement

An assessment of potential settlement impact on existing buildings and structures has been prepared by the contractor to address the proposed modification and is included in Appendix E.

The EIS identifies two causes of potential ground movement associated with the construction of the project, namely:

- Tunnel-excavation-induced ground movement, which is the slight movement of the soil and rock around the tunnel as a result of the tunnel excavation removing material; this is a short-term effect, which happens as soon as the tunnel is excavated and can cause heave and/or settlement
- Soil consolidation (soil shrinkage) and rock compression due to the groundwater draw down due to inflow into underlying tunnels; this is a longer-term effect, which may take some time to occur and causes settlement only.

The EIS noted that cumulative settlement impacts include the combined impacts of settlement from tunnel-excavation-induced ground movement and groundwater drawdown. The EIS identified that risks associated with groundwater drawdown and induced settlement within Hawkesbury Sandstone are considered low because of the geotechnical properties of the rock.

The new ventilation tunnel and caverns would equate to a total length of about 425 metres and would be excavated below residences not identified in the EIS as being near the tunnel alignment. This calculation is based on a length of about 340 metres for the ventilation tunnel alignment and the ventilation fan cavern, 65 metres for the substation cavern and about 20 metres of access tunnel connecting the two caverns. It is important to note that Rozelle Interchange (Stage 2 of the M4-M5 Link Project) includes excavation of approximately 22 kilometres of tunnels and that the proposed modification represents a very small increase in the extent of tunnelling.

Areas most likely to be affected by settlement are where tunnelling is closest to the ground surface (shallowest), and where soils are more likely to be compressible because they have more voids that can compress. In Iron Cove, the depth to Hawksbury Sandstone is very shallow, with overlaying soils generally less than two metres in depth.

The depth of the proposed new ventilation tunnel and caverns would vary from about eight metres (from ground level to tunnel crown) at its shallowest to about 25 metres (from ground level to tunnel crown) at its deepest (see Figure 5-3).

The proposed new ventilation tunnel and caverns would be located within Hawksbury Sandstone, which is a highly competent bedrock. A cross-section of the geotechnical profile in Iron Cove which illustrates the proposed tunnel and ventilation cavern is provided in Figure 7-3. The crown (top) of the tunnel and ventilation cavern is marked in orange and the base is marked in blue.

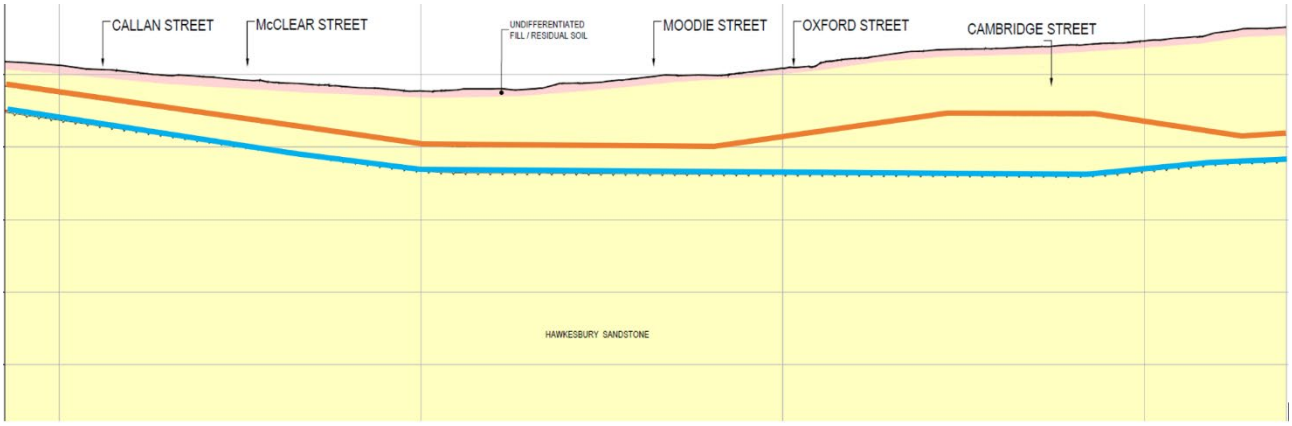

Figure 7-3 Iron Cove ventilation tunnel geological cross-section. Orange represents the top of the tunnel and blue represents the base of the tunnel.

The shallowest section of the proposed new tunnel would have substantial rock cover above the crown of the tunnel. It is noted that the wider cavern excavations are generally located at depths greater than 15 metres. The ventilation tunnel and caverns connect to the Iron Cove Link road tunnel alignment and are therefore located at similar depths.

Consistent with the EIS findings, tunnel-excavation-induced ground movement is anticipated to be the prevalent mechanism causing ground movement. Risks associated with groundwater drawdown and associated induced settlement within Hawkesbury Sandstone is considered low because of the geotechnical properties of the rock. As groundwater is removed from this rock type the structural integrity and strength of the rock remains due to its competent nature. As a result, the cumulative settlement impacts are not anticipated to be an issue for tunnels excavated in the Hawkesbury Sandstone, which would include the proposed new ventilation tunnel and caverns at Iron Cove.

The findings of the EIS described in Chapter 19 regarding groundwater would be consistent with the implementation of the proposed modification. Tunnel groundwater inflow criteria would not be altered. The proposed new ventilation tunnel and caverns, as noted above, are located in Hawksbury Sandstone. Hawksbury Sandstone has low permeability and predicted groundwater inflows and groundwater induced settlement associated with the proposed modification would be minimal.

Planning Approval Condition E190 of the Planning Approval requires all practicable measures be undertaken to limit operational groundwater inflows into each tunnel to no greater than one litre per second per km length of tunnel. Based on the preliminary analysis completed to date on the concept design, the total groundwater inflow that would be expected for the proposed modification in steady state would be about 0.4 litre per second per kilometre length. During construction this may increase by about 0.1 litre per second to about 0.5 litres per second per kilometre length.

With respect to potential impacts on existing groundwater users, there are no registered bores within two kilometres of the footprint of the proposed modification and no impacts are therefore anticipated for existing groundwater users as a result of the proposed modification.

The preliminary settlement analysis completed to date, which combines both predicted excavation induced, and short and long-term groundwater drawdown settlement, is shown in Figure 7-4. This assessment is based on the concept design and the predicted ground settlement ranges from 0 to 20 millimetres, which is consistent with settlement screening criteria set out in Planning Approval Condition E103 (see Table 7-7).

Table 7-7 Comparison of preliminary settlement analysis against the screening criteria in MCoA E103

Surface and Sub-Surface Structures	Maximum Settlement	Maximum Angular Distortion	Limiting Tensile Strain (percent)*	Compliance
Buildings – Low or non-sensitive properties (ie ≤ 2 levels and carparks)	30 mm	1 in 350	0.1	✓
Buildings and pools – High or sensitive properties (ie ≥ 3 levels and heritage items)	20 mm	1 in 500	0.1	✓
Roads and parking areas	40 mm	1 in 250	n/a	✓
Parks	50 mm	1 in 250	n/a	✓

* As defined in Burland et al. 'Building response to tunnelling – Case studies from construction of the Jubilee Link Extension', London, Thomas Telford (2001)

Based on the preliminary settlement analysis and building and structure impact assessment undertaken to date that has taken into consideration rock type, tunnel depth and building types (number of storeys and basement and foundation extents), it is not anticipated that the settlement screening criteria set out in Planning Approval Condition E103 would be triggered during excavation of the proposed new ventilation tunnel and caverns at Iron Cove.

As a result of the proposed modification, the subsurface stratum acquisition requirements and areas potentially subject to surface settlement would alter accordingly. The potential excavation-induced and groundwater-drawdown impacts of the proposed ventilation tunnel and caverns would be consistent with those already identified in the EIS as:

- The proposed ventilation tunnels and caverns would be excavated in Hawkesbury Sandstone
- The proposed ventilation tunnels and caverns are being constructed at a similar depth to the main road tunnel alignment for the Iron Cove Link
- The same tunnelling methodology is proposed for the construction of the proposed ventilation tunnel and caverns.

Potential settlement along the alignment associated with the proposed modification would continue to be assessed as part of the project-wide settlement modelling and impact assessment processes and will be finalised during detailed design.

The Planning Approval sets in place comprehensive requirements to ensure the potential impacts of the detailed design and construction methodology of the project, including the proposed modification, are assessed and potential impacts on property are minimised.

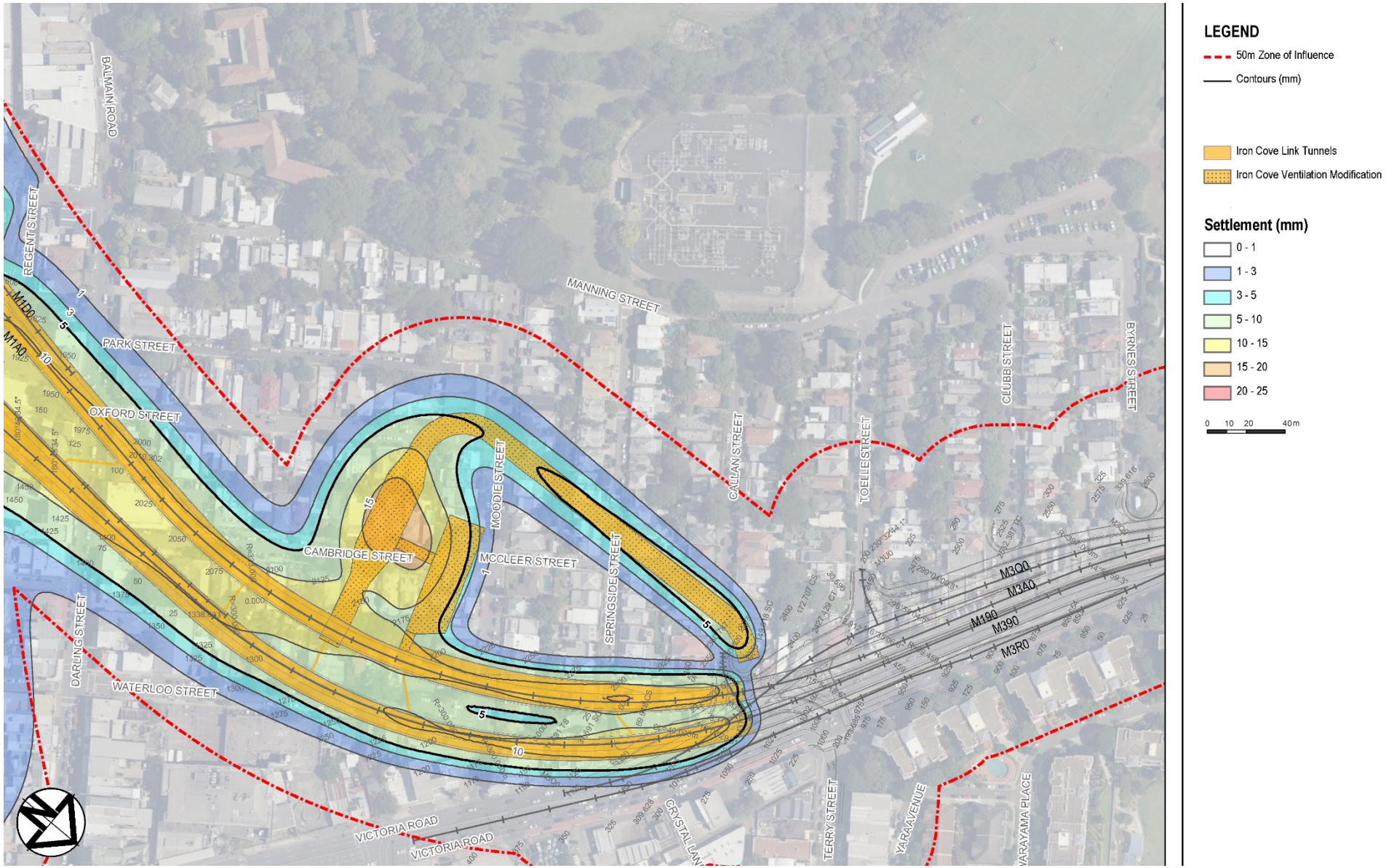

Figure 7-4 Preliminary settlement analysis of proposed modification (note this is subject to design development)

The settlement criteria adopted for the project and the assessment and monitoring processes are in accordance with the Conditions of Approval and include:

- Review of ground conditions and natural ground water parameters
- Calculation of predicted ground movement as a result of the tunnel construction
- Development of a detailed ground settlement model which addresses the short-term and long-term settlement expected
- Identification of buildings and infrastructure that may be considered as sensitive and potentially at risk, based on the expected settlement.

The design will be reviewed as it is developed and approved by the Independent Certifier prior to construction.

Comprehensive ground movement predictions that consider the cumulative impacts of potential excavation-induced ground movements and groundwater-drawdown will be undertaken during design development in accordance with the Planning Approval. The findings of this modelling will be used to identify and assess buildings adopting a risk based approach as required under the Planning Approval.

The settlement monitoring program will identify trigger values to ensure that if the monitoring data indicates changes in what was predicted, then processes will be put in place to ensure review of the data is undertaken. For each aspect being monitored the trigger level would vary, but a common approach ensures that any changes to expected ground behaviour is captured early with an appropriate level of response implemented. This will include review by appropriately qualified specialists. Contingency actions may include additional monitoring, assessment of potential causes and if required design and/or construction methodology refinement.

Combined with other Planning Approval requirements including building condition surveys and the Independent Property Impact Assessment Panel, the Planning Approval sets in place comprehensive requirements to ensure the potential impacts of the detailed design and construction methodology are assessed and impacts on property are minimised. The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures to successfully manage potential settlement or groundwater drawdown impacts.

7.6 Socio-economic, land use and property

Socio-economic impacts associated with the proposed ventilation tunnel alignment changes relate to construction noise, land use and subsurface acquisition. Construction noise is discussed in section 7.4. Potential land use and property impacts are further discussed below.

The existing land use adjacent to the proposed surface infrastructure and above the alignment of the proposed new ventilation tunnel and caverns consists of residential dwellings of varying densities, comprising primarily detached dwellings. There are also commercial land uses (e.g. car dealership and retail stores) along Victoria Road.

Surface activities for the construction of the proposed modification including tunnelling support would be carried out within the footprint assessed in the EIS. Therefore, as no additional land is required, the surface land use and property impacts during construction of the proposed changes are consistent with the EIS.

As noted in section 7.5 the proposed modification would add to the subsurface stratum acquisition requirements of the project. RMS will acquire a subsurface stratum to provide for the proposed modification under the *Land Acquisition (Just Terms Compensation) Act, 1991*.

With respect to future development, Chapter 12.3.3 of the EIS states that in most cases, subsurface acquisition would not affect the future use of property at the surface. The EIS concludes that, subject to council regulations and approvals, landowners would generally be able to:

- Carry out improvements, such as installing a swimming pool
- Dig deeper foundations for a new building or second storey additions
- Undertake property development.

Consistent with the EIS, the proposed modification would not affect the future use of property at the surface.

The proposed modification would decrease the surface footprint of the permanent works associated with the Iron Cove ventilation facilities. This has the potential to increase the amount of residual land available following

the completion of the project. The final use of this land will be subject to the finalisation of the Residual Land Management Plan (RLMP) required under Planning Approval Condition E112 in consultation with Inner West Council.

Impacts on land use and property under the proposed modification are considered consistent with the EIS and would not require any changes or additions to the Planning Approval or environmental management measures.

7.7 Urban design and visual amenity

7.7.1 Impacts during construction

Chapter 13 of the EIS includes a landscape character and visual impact assessment undertaken in accordance with *Environmental Impact Assessment Practice Note – Guidelines for Landscape Character and Visual Impact Assessment* (NSW Roads and Maritime Services 2013). The existing landscape character and visual setting around the Iron Cove civil site (C8):

- Victoria Road corridor east of Iron Cove Bridge
- Single storey residential buildings on small lots to the south of Victoria Road
- Areas of open space including active and passive recreation facilities such as King George Park along the foreshore area south of Iron Cove Bridge.

The EIS notes that receivers with views of construction ancillary facilities and construction activities could include:

- Residents who adjoin and/or have views of the project
- Workers in commercial properties that adjoin and/or have views of the project
- Road users and pedestrians
- Users of recreation areas/reserves with views of the project.

As noted in section 5.3.3, all plant, equipment and materials required to construct the proposed new ventilation tunnel and caverns would be supported from the Iron Cove civil site (C8), with the potential for some tunnelling to be supported from the Rozelle civil and tunnel site (C5) later in the construction program.

The establishment and operation of the tunnel support site within the Iron Cove cut and cover under the proposed modification would not alter the layout of the Iron Cove civil works site (C8) or require any additions to temporary ancillary facilities located to the west of Victoria Road to be jointly used by the tunnelling personnel. The tunnel support site would be established within the cut and cover, with the majority of plant and equipment being located under the completed concrete structure. The plant and equipment located within the dive area would also be shielded from view by this cutting. As such, the establishment and operation of this tunnel support site would not contribute to or alter the overall visual impact of this worksite.

Any tunnelling of the proposed new ventilation tunnel and caverns supported from the Rozelle civil and tunnelling site (C5) would not require the installation of any additional temporary surface support infrastructure and as such the proposed modification would not alter temporary visual impacts at this worksite.

The EIS concluded that the overall impact rating for construction visual impacts on sensitive receivers surrounding the Iron Cove civil works site (C8) ranged from moderate-low through to moderate, with a high rating for residents in Callan Street, Springside Street, Toelle Street and Clubb Street.

The proposed modification would decrease the surface footprint of the permanent works required for the Iron Cove ventilation facilities. Reducing surface infrastructure would also have improved temporary visual impacts to some receivers during construction compared to the EIS, however the residents on Toelle and Callan Streets close to the switch room, high voltage regulators, alternative Operational Motorway Control System (OMCS) room and the separate stair access would still experience a high impact consistent with the EIS assessment.

Temporary visual impacts during construction of the proposed modification would not require any changes or additions to the Planning Approval or environmental management measures.

7.7.2 Permanent urban and landscape concept

A visual assessment and concept urban design has been prepared to address the proposed modification and is included in Appendix F.

The proposed modification aligns with the aspirations and objectives of the WestConnex Urban Design Framework, specifically:

'The WestConnex Motorway will be a sustainable, high quality and transformational project for the people of Sydney and NSW. Exhibiting design excellence as a whole and in all constituent parts, it shall be sensitively integrated into the built and natural environments and help build local communities. It will enhance the form, function, character and liveability and contribute to the future liveability of the city.'

The proposed modification would decrease the surface footprint of the permanent works required for the Iron Cove ventilation facilities. An indicative layout is shown in Figure 5-4. This has the potential to increase the amount of residual land available following the completion of the project (see section 6.7). The landscape character impact of the proposed modification would be the same as compared to the landscape character associated with the concept design as assessed in the EIS.

As was undertaken in the EIS, landscape character impacts were assessed, including ratings for sensitivity and magnitude at each nominated Landscape Character Zone (LCZ) related to the proposed modification. These LCZs are shown in Appendix F in the EIS.

Although the proposed modification would provide a reduction in operational facilities located above ground, the assessment results did not change to such a degree that would alter these overall LCZ conditions as assessed in the EIS.

The proposed modification would improve amenity adjacent to the new shared path located next to Victoria Road westbound due to increased areas offered with the reduction in operation facilities located above ground.

In regard to visual impact, the overall impact of the proposed modification would be slightly improved with the reduction in visible facilities, compared to comparable visual impacts as assessed in the EIS.

The major visual change from what was assessed at the EIS is the removal of the MOC4 facility from the corner of Springside Street and Victoria Road. This results in residents that were to be impacted under the EIS concept design no longer being impacted under the proposed modification in this location.

The ventilation facility building and substation shown in the EIS is now proposed to be underground, with a new switch room, high voltage regulators, and an alternative Operational Motorway Control System (OMCS) located at the corner of Victoria Road and Toelle Street.

This residual infrastructure which cannot be located underground is required to support the fans and substations underground. This infrastructure has been placed on the southwestern side of Victoria Road between Toelle and Callan Streets as this is the location closest to which the ventilation tunnel will pass and can fit the structures. At this point above and below ground infrastructure can be connected. No buildings are proposed to remain on Victoria Rd between Springside St and Callan St as there is no connectivity to the tunnel at this location.

A separate small above ground structure in the vicinity of Callan Street would contain an access door and a stairway to the ventilation tunnel. The visible mass of this new building is noticeably smaller than the EIS assessed MOC4 ventilation facility.

Although the location and form of the visible structures at Iron Cove Link is reduced, there is still a number of structures adjacent to Victoria Road when compared to the existing condition, and what was assessed at EIS. Figure 7-5, Figure 7-6 and Appendix F provides artists' impressions and photomontages of the proposed modification combined with the residual elements of the approved project looking from Toelle Street eastward and Victoria Road median looking south.

Figure 7-5 Artist's impression at 10 years of operation, looking east along Toelle Street toward the proposed ancillary facilities. Note: Operation infrastructure subject to detailed design. This modification does not alter the ventilation outlet from the approved project. Exterior design of the ventilation outlet is subject to the Urban Design and Landscape Plan. Pedestrian traffic lights on Victoria Rd will be included in detailed design.

Figure 7-6 3D Artist's impression at 10 years of operation looking south along Victoria Road toward the proposed ancillary facilities. Note: Pedestrian traffic lights will be included in detailed design.

Overall, the visual impact is generally similar, while the overall visible scale and size of the structure has been reduced from what was assessed in the EIS.

As undertaken in the EIS, visual impacts on receivers were assessed, including ratings for sensitivity and magnitude at each nominated viewpoint related to the proposed modification.

Artists' impressions, photomontages and cross-sections of the relevant viewpoints to the Iron Cove Link, including MOC4, were prepared to reflect the proposed modification and are included in Appendix F. A typical cross-section of the proposed modification is shown in Figure 7-7.

Impacts were re-assessed for the proposed modification using the method outlined in the EIS, including the production of updated photomontages. The assessment resulted in the same visual impacts as recorded in the EIS and shown in the EIS Table 13-17 (see Appendix F), as the slight improvement associated with the proposed modification does not alter the overall rating category.

Figure 7-7 Typical cross-section AA location of proposed modification

Figure 7-8 Iron Cove Link - Typical section AA

Given the minor change in visual impacts, and that the size and form of the facilities and locations at Iron Cove Link assessed during the EIS are generally consistent with those shown in the proposed modification, the environmental management measures included in the EIS and SPIR are adequate to achieve the overall project outcomes.

With reference to LV8 visible elements of operational facilities will be designed to satisfy functional requirements and adopt the design principles detailed in the M4-M5 Link Urban Design Report. The proposed designs will be documented in the relevant Urban Design and Landscape Plan for the project.

REMM LV19 will be complied with through the use of vegetation to reduce the visual impact associated with the ventilation outlet, where possible. Through detailed design, the design of Iron Cove Link facilities will consider the height, bulk, scale and landscape setting in accordance with the design principles detailed in the M4-M5 Link Urban Design Report to satisfy REMM LV22.

The detailed design of the Iron Cove Link will be managed under the existing Planning Approval Conditions. The Urban Design and Landscape Plan(s) will be prepared under Planning Approval Conditions E133 to E137. Overshadowing will be assessed with a Solar Access and Overshadowing Report under Planning Approval Condition E138. Indicative overshadowing modelling is shown in Figure 7-9 and Figure 7-10 for 21 June when the sun is low in the sky and shadows cast the furthest. Review of the proposed concept design shows the shadowing from operational buildings affects less properties and to a smaller extent than the EIS design as the height of the proposed structures is lower than the EIS ventilation facility. As a result of relocating structures relative to the EIS different properties are affected. The Urban Design and Landscape Plan(s) and Overshadowing will be reviewed by the Design Review Panel and the Urban Design and Landscape Plan(s) will be approved by the Secretary of the Department of Planning, Industry and Environment.

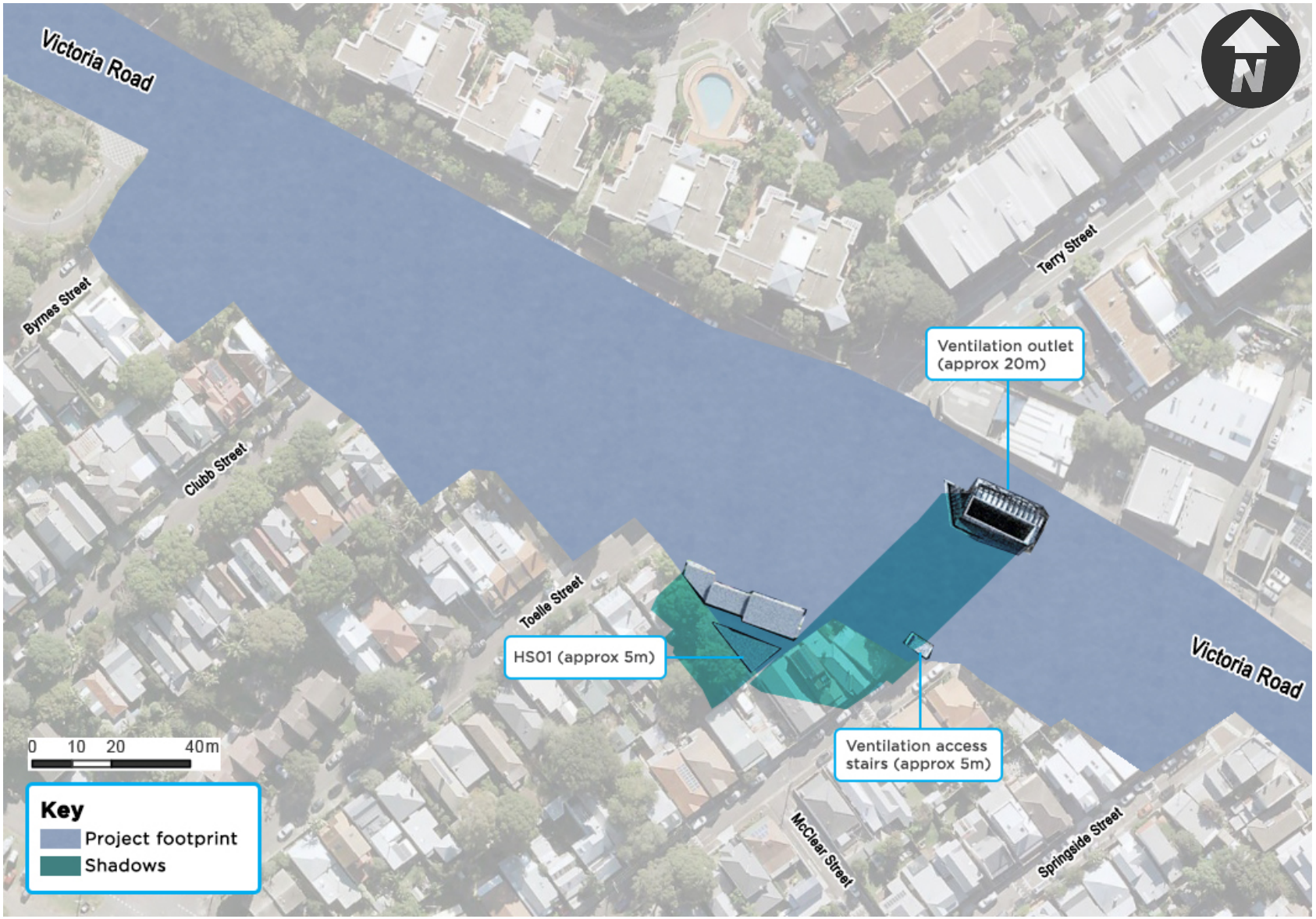

Figure 7-9 Indicative Overshadowing diagram 9am 21 June. Note: No change is proposed to the ventilation outlet in the approved project.

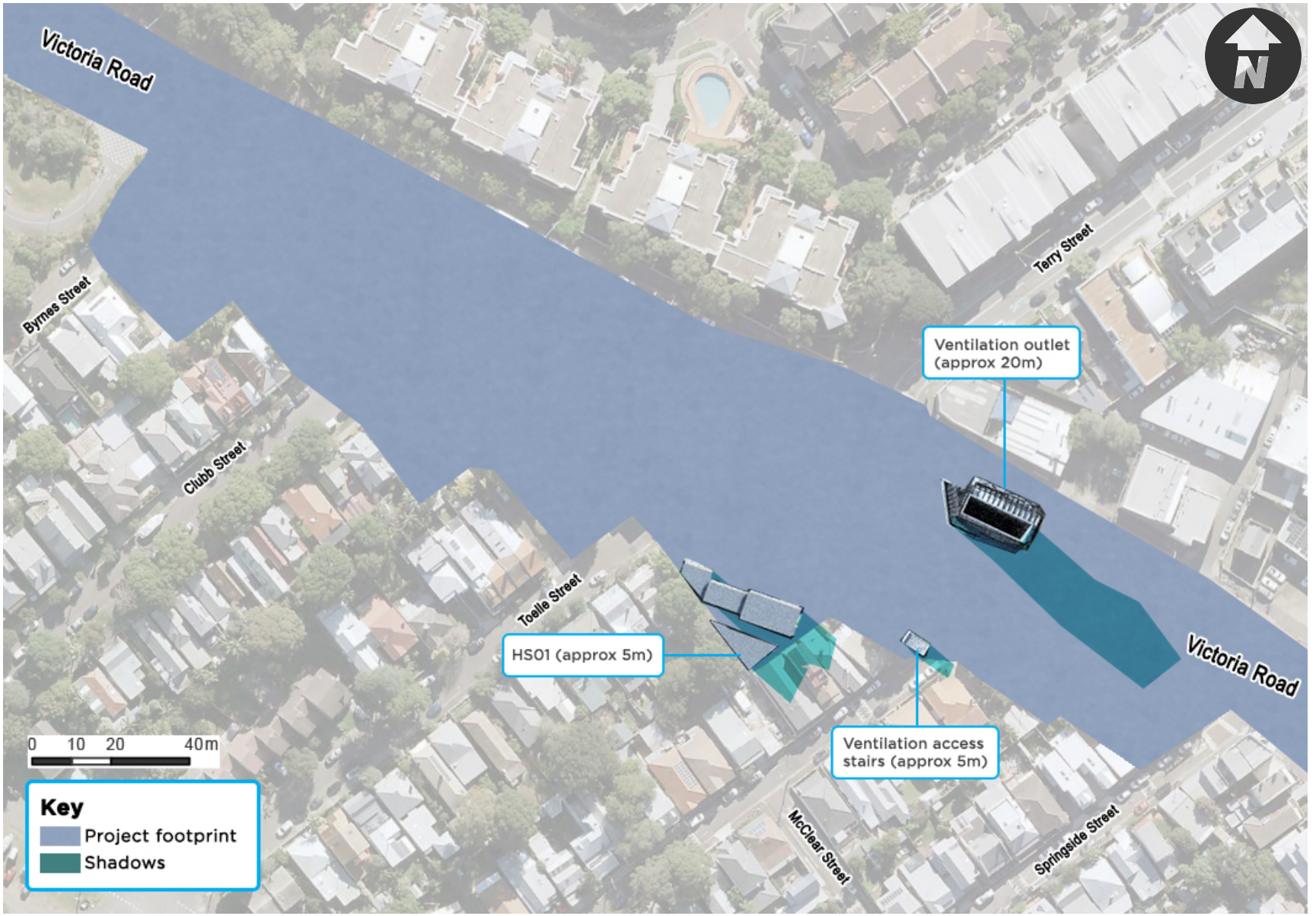

Figure 7-10 Indicative Overshadowing diagram 3pm 21 June. Note: No change is proposed to the ventilation outlet in the approved project.

7.8 Water management

7.8.1 Construction water management

The project is located within the Sydney Harbour and Parramatta River and Cooks River catchments. Existing water quality in all waterways is generally poor, indicative of a highly urbanised catchment. However, a number of waterways are considered to be sensitive receiving environments, including Iron Cove at Rozelle.

The EIS notes that the short-term groundwater inflow during construction would depend on a number of factors including tunnelling progress, tunnelling construction methodology, fractured zones intersected, localised groundwater gradients and storability (the volume of water released from storage per unit decline in hydraulic head in the aquifer, per unit area of the aquifer).

The EIS states that initial groundwater inflows to tunnels can be large, because of the large hydraulic gradients that initially develop near the tunnel walls; however, these gradients would be reduced in time as drawdown impacts extend to greater distances from the tunnels and inflows approach steady state conditions. The EIS identifies that higher inflow rates are likely from zones of higher permeability, where saturated geological structural features are intersected by the tunnels.

Initial groundwater inflows to the tunnels during construction are estimated in the EIS to range between 0.45 megalitres per day and 2.87 megalitres per day. As noted in section 7.5, the proposed ventilation tunnel and caverns are located within Hawksbury Sandstone, which has low permeability and inflows of about 0.1 litre per second to about 0.5 litres per second per kilometre length have been predicted. During construction, high permeability zones that are likely to have higher inflows over the longer term would be grouted to reduce the inflow rate. Grouting is the process of pumping grout into the rock mass by drilling and injecting cement to reduce the permeability of the rock.

The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS. The proposed modification would:

- Reduce the extent of earthworks required to construct surface infrastructure on the south-western side of Victoria Road near the Iron Cove Link portals
- Require the establishment and operation of a surface tunnel support site within the Iron Cove civil site (C8) within the southern half of the cut and cover once the concrete structure has been constructed.

The EIS identified that a Water Treatment Plant (WTP) would be provided at Iron Cove civil site (C8) in Table 6-5 but noted that facilities may change when the contractor is engaged, and detailed construction methodologies are developed.

Appropriate measures to reduce the potential for construction water impacts have been included in the project Construction Soil and Surface Water Management Plan and the Construction Groundwater Management Plan prepared in accordance with the Planning Approval. In accordance with these plans the contractor is currently assessing water management requirements including:

- Maximising water re-use on site
- The need for a WTP, considering the very low predicted groundwater inflow rate (note space for a WTP is shown on the indicative site layout on Figure 5-5)
- Discharge to sewer under a Trade Waste Agreement
- If required, a discharge impact assessment for tunnel support from Iron Cove would be prepared during detailed construction planning.

The type, arrangement and performance of construction water treatment facilities would be further refined during detailed design. The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for construction water quality impacts.

7.8.2 Operational water management

The proposed ventilation tunnel and caverns would be drained, and a sprayed shotcrete lining would generally be used, consistent with the other ventilation tunnels and caverns to be constructed as part of the approved project (see section 7.5). Any groundwater seeping into the tunnel would drain towards the Iron Cove Link tunnel drainage system, where it would be pumped to the operational water treatment plant at Rozelle Rail Yards, as described in Section 5.9.1 of the EIS.

The new ventilation tunnel and caverns would be about 425 metres in length which represents a very small increase in the extent of tunnelling. This calculation is based on a length of about 340 metres for the ventilation tunnel alignment and the ventilation fan cavern, 65 metres for the substation cavern and about 20 metres of access tunnel connecting the two caverns.

As noted in section 7.5, Planning Approval Condition E190 requires all practicable measures to be undertaken to limit operational groundwater inflows into each tunnel to no greater than one litre per second per km length of tunnel across any given kilometre. Based the preliminary on analysis completed to date on the concept design, the total groundwater inflow that would be expected for the proposed modification in steady state would be about 0.4 litre per second per kilometre length which is well within the requirements of Planning Approval Condition E190. As such, the proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for operational water quality impacts.

7.9 Resource use and waste minimisation

7.9.1 Spoil volumes and classification

As stated in section 5.3.2, about 61,000 bank cubic metres of spoil would be excavated to construct the ventilation tunnel at Iron Cove. This increase in spoil volume is negligible in the context of the entire project.

The majority of excavated spoil material would be uncontaminated crushed sandstone, classified as virgin excavated natural material (VENM). This would consist of mixed size crushed rock ranging from shale and sand to lumps of rock. As noted in section 7.1, while the proposed modification would increase the total volume of spoil to be extracted for the Project, there would be no additional contamination impacts expected as a result of the proposed modification as the surface activities required to construct the proposed modification are located within the footprint assessed in the EIS.

The classification of spoil will be undertaken in accordance with the Waste Classification Guidelines, Part 1: Classifying Waste (NSW EPA November 2014)

In accordance with the EIS, the project aims to re-use or recycle around 95 per cent of uncontaminated spoil, either within the project or at other locations. Where feasible and reasonable, spoil would be managed according to the following hierarchy:

- Minimisation of spoil generation through design and management
- Re-use of spoil within the project
- Beneficial reuse of spoil outside the project
- Where reuse is not possible, disposal of spoil would be the last resort.

Potential spoil removal impacts including traffic impacts are assessed in section 7.2.1, construction air quality impacts are assessed in section 7.3.1 and construction noise impacts are assessed in 7.4.3. The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for spoil management.

7.9.2 Waste minimisation and management

Construction of the proposed modification would generate a number of waste streams that would require management and disposal in accordance with relevant legislation and government policies. All wastes generated onsite will be classified in accordance with *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW EPA November 2014).

Waste would be managed in accordance with the waste hierarchy established under the *Waste Avoidance and Resource Recovery Act 2001*. Avoiding the generation of waste would be the first preference. Waste re-use and recycling strategies would be considered and implemented, where practical and cost-effective. Onsite reuse opportunities would be maximised, with efforts made to implement re-use and recycling initiatives onsite. The contractor would reduce waste and ensure efficient resource use where practicable by:

- Using water-efficient fixtures and fittings to reduce water usage from the demand side and increase self-sufficiency from non-potable water supplies
- Using recycled or re-used steel
- Using standardised modular construction methods where practicable
- Re-using formwork

- Using recycled material or waste materials, e.g. recycled aggregate and cement replacement materials (ie fly ash) where relevant technical requirements can be achieved.

Waste generated during construction of the proposed modification would be managed in accordance with the project Construction Waste Sub Plan.

The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for waste management.

7.10 Hazard and risk

Chapter 25 of the EIS identifies potential hazards associated with the project, assesses risks and confirms mitigation measures to be implemented. The proposed modification involves a small increase in the extent of tunnelling to be undertaken as part of the project and would reduce the extent of surface construction works required to the west of Victoria Road adjacent to the tunnel portals at Iron Cove. The hazards and risks associated with the proposed modification are consistent with those addressed in the EIS.

The additional High voltage regulators to be installed as part of the proposed modification are electrical transformers and are required for the project as a whole to maintain the voltage fluctuations from the high voltage source of supply to prevent damage to equipment and injury to personnel. Transformers suitable in terms of capacity for Rozelle Interchange are only available in oil filled type – they are not available in encapsulated dry type configuration. Transformers must comply with the Electricity Supply Authority requirements AS 2374 and AS 60076. There would be a bund, oil separator and a flame trap within the transformer bay to contain any leaks. The transformer walls would be rated to a 4-hour fire rating.

The proposed modification has been designed to minimise the likelihood of incidents and risks to public safety. The storage, transportation, handling and use of dangerous goods and hazardous substances would be undertaken in accordance with the *Work Health and Safety Act 2011* (NSW), the Storage and Handling of Dangerous Goods Code of Practice (Workcover NSW 2005), the Dangerous Goods (Road and Rail Transport) Regulation 2014 (NSW) and relevant Australian Standards and codes.

The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for hazard and risk.

8 Conditions of Approval

This chapter outlines the conditions of approval relevant to the project, as described in Chapter 1 (Introduction), that would need to be amended as a result of the proposed modification.

A review of the conditions of approval for the project was undertaken to identify the conditions that would require either amendment or deletion as part of the proposed modification.

8.1 Conditions to be amended or removed

Table 7-1 presents the proposed changes to the conditions of approval for the project. These changes are required to Schedule 1 (description of critical State Significant Infrastructure (CSSI)) and Schedule 2 (conditions of approval). Proposed amendments are shown in bold text and deletions shown as strikethrough text.

The proposed changes would ensure that the conditions of approval are consistent with the proposed modification.

Table 8-1 Conditions of approval to be amended or removed

No.	Description of CSSI or condition of approval	Action and reason
A1	The CSSI must be carried out in accordance with the terms of this approval and generally in accordance with the description of the CSSI in the WestConnex M4-M5 Link Environmental Impact Statement – Volumes 1A-C and 2A-J (dated August 2017) (the EIS) as amended by: (a) the WestConnex M4-M5 Link Submissions and Preferred Infrastructure Report (dated January 2018) (the SPIR); and (b) the WestConnex M4-M5 Link Mainline Tunnel Modification Report (dated September 2018) (Modification 1 Report) as amended by the WestConnex M4-M5 Link Mainline Tunnel Modification Response to Submissions (dated November 2018) (Modification 1 RtS); (c) **the WestConnex M4-M5 Link Rozelle Interchange Iron Cove Ventilation Underground Modification Report (dated November 2019) as amended by the WestConnex M5-M5 Link Rozelle Interchange Modification Response to Submissions (dated Month 2020**)	Add this proposed modification to condition A1.
A2	The CSSI must be carried out in accordance with all procedures, commitments, preventative actions, performance criteria and mitigation measures set out in the EIS **or any document listed in A1**, SPIR, Modification 1 Report and Modification 1 RtS unless otherwise specified in, or required under, this approval.	Add reference to Condition A1 rather than re-listing the environmental documents.

9 Environmental management measures

Chapter 29 of the EIS for the project summarised the identified environmental management measures that would be adopted to avoid or reduce potential environmental impacts. These measures were revised in Part E of the SPIR after consideration of the issues raised during the EIS public Exhibition period.

Chapter 7 (Environmental assessment) indicated that potential impacts for the following environmental issues would be effectively managed through the implementation of the approved environmental management measures for the project as summarised in the SPIR:

- Traffic and transport
- Operational air quality
- Noise and vibration
- Groundwater drawdown and settlement
- Socio-economic, land use and property
- Urban design and visual amenity
- Water management
- Resource use and waste.

As such the proposed modification would not require any changes or additions to the environmental management measures.

10 Justification and conclusions

10.1 Need for the proposed modification

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). The approved project allows construction and operation of the M4-M5 Link in two stages. The proposed modification relates to Stage 2 of the project, the Rozelle Interchange and Iron Cove Link.

The EIS assessed an indicative concept design that would continue to be refined where relevant to improve road network and safety performance, minimise impacts on receivers and the environment, and in response to feedback from stakeholders.

The undergrounding of the Iron Cove ventilation facilities would result in benefits for the community and improved environmental outcomes.

The only remaining surface infrastructure would be a switch room, high voltage regulators, an alternative Operational Motorway Control System (OMCS) room and access staircase. The proposed modification aligns with the aspirations and objectives of the WestConnex Urban Design Framework.

The proposed modification would decrease the surface footprint of the permanent works required for the Iron Cove ventilation facilities. This has the potential to increase the amount of residual land available following the completion of the project (see section 6.7).

Reducing surface infrastructure would also have improved visual impacts compared to the EIS, particularly a reduction in overshadowing due to the much smaller scale of permanent infrastructure (see section 6.8).

There would be improvements to operational noise impacts by placing the ventilation facilities and substation underground. Operation of the proposed modification would comply with relevant noise criteria in all noise catchment areas, compared to the EIS which predicted exceedances of up to 12dB (see section 6.5.4).

The proposed modification would require an additional tunnel support site to be established within the Iron Cove Link cut and cover. This would provide additional access and egress for tunnel workers, plant, deliveries, ventilation and spoil and work to improve safety during construction. Housing the ventilation facilities underground means that the majority of construction would also be underground. It reduces the need for construction of buildings to house the equipment and associated connections on the surface.

Commissioning of the entire project would begin at Iron Cove Link. Tunnelling of the proposed new ventilation tunnel and caverns from Iron Cove would work to potentially allow the project to commence commissioning two to three months early. Starting commissioning earlier would give the project more opportunity to finish early and more certainty that it would finish on time.

10.2 Environmental assessment

Chapter 7 (Environmental assessment) assessed the potential environmental impacts associated with the proposed modification and provides a comparison of the potential environmental impacts for the proposed modification and the approved project.

The proposed modification would result in the following:

Traffic and transport

- Construction of surface works on the western side of the realigned Victoria Road within the Iron Cove civil site (C8) would be reduced compared to the approved project due to the extent of the above-ground ventilation infrastructure works required on the western side of Victoria Road reducing substantially
- The additional tunnelling required under the proposed modification would be supported predominantly from the Iron Cove civil site (C8) with some tunnelling also supported from the Rozelle civil and tunnel site (C5) later in the construction program. The additional construction traffic generated by the proposed modification would not impact the operational performance of intersections when compared the performance of the intersections generated by the approved project. Utilising both the Iron Cove civil site (C8) and the Rozelle civil and tunnel site (C5) to support this tunnel excavation would disperse impacts on the road network

- The proposed modification would reduce the extent of operational traffic impacts in Callan, Toelle and Springside Streets as the majority of maintenance operations for the underground ventilation fans and substation would be accessed from within the tunnel
- Appropriate measures to reduce the potential for construction traffic impacts have been included in the project Construction Traffic and Transport and Access Management Plan prepared in accordance with the Planning Approval.

Air quality

- The proposed modification does not significantly alter the scope and nature of construction works proposed would not alter the construction phase vehicle emission and dust impacts assessed in the EIS
- The proposed modification would relocate the MOC4 underground within caverns housing the electrical substation and ventilation facilities and a ventilation tunnel connecting to the ventilation outlet, which would remain above ground in the same location shown in the EIS. The proposed new ventilation tunnel and fan and substation caverns would operate as the ventilation facilities are described in the EIS and would not alter the potential air quality impacts reported in the EIS.

Noise and vibration

- The excavation of the new ventilation tunnel and caverns would result in relatively short-term ground-borne noise impacts on residences not identified in the EIS as being near the tunnel alignment. The extent of predicted impact is consistent with that associated with the approved ventilation tunnels and cavern. Mitigation measures would be implemented when predicted ground-borne noise levels are above relevant management levels
- During establishment of the new tunnel support from within the cut and cover at Iron Cove, a temporary shed wall and roller door would be installed at the western end of the cut and cover structure. This wall combined with the concrete roof of the cut and cover structure would assist with minimising ambient noise and dust impacts during tunnelling and would result in no properties being affected by construction noise associated with the tunnel support site operation during the day, evening or night
- The proposed modification would result in a shorter duration of surface works to the west of Victoria Road than the EIS concept design and greatly reduce the scope of works at Iron Cove, as only a switch room, High voltage regulator bays, alternative OMCS) room and stair access need to be built
- A detailed construction noise and vibration assessment will be prepared for the proposed activities at the proposed Iron Cove tunnel support site in accordance with the approved Construction Noise and Vibration Management Plan to document the outputs of detailed noise and vibration modelling and confirm the optimum suite of noise and vibration mitigation measures
- The proposed relocation of the ventilation fans and substation underground would have a long-term acoustic benefit by reducing the operational noise impacts compared to the EIS. The predicted noise exceedance at Noise Catchment Areas 33 identified in the EIS would be avoided through selection of appropriate noise attenuators and noise compliance would be achieved at all surrounding NCAs. The High voltage regulators would comply with the required noise criteria, subject to the implementation of mitigation measures, which would be confirmed during detailed design. Operational noise mitigation measures would be confirmed in the Operational Noise and Vibration Review to be prepared in accordance with Planning Approval.

Potential groundwater drawdown and surface settlement

- As a result of the proposed modification, the areas potentially subject to surface settlement would be altered accordingly, however the tunnel and cavern excavation methodology would be in accordance with the EIS
- The preliminary settlement analysis completed to date on the concept design, which combines both excavation induced, and short and long-term groundwater drawdown predicts settlement impacts ranging from 0 to 20 millimetres, which is consistent with the settlement screening criteria set out in Planning Approval Condition E103
- Potential settlement associated with the proposed modification would continue to be assessed as part of the project-wide settlement modelling and impact assessment processes and will be finalised during detailed design

- The Planning Approval sets in place comprehensive requirements to ensure the potential impacts of the detailed design and construction methodology of the Project, including the proposed modification, are assessed and potential impacts on property are minimised.

Socio-economic, land use and property

- The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS and no additional land is required
- As a result of the proposed modification, the subsurface stratum acquisition requirements would be altered and consistent with the EIS, the proposed modification would not affect the future use of property at the surface
- The proposed modification would decrease the surface footprint of the permanent works associated with the Iron Cove ventilation facilities. This has the potential to increase the amount of residual land available following the completion of the project. The final use of this land will be subject to the finalisation of the Residual Land Management Plan (RLMP) required under Planning Approval Condition E112 in consultation with Inner West Council.

Urban design and visual amenity

- The proposed modification would decrease the surface footprint of the permanent works required for the Iron Cove ventilation facilities. Reducing surface infrastructure would also have improved temporary visual impacts on some receivers during construction compared to the EIS, however the residents on Toelle and Callan Streets close to the switch room, high voltage regulators, alternative Operational Motorway Control System (OMCS) room and the separate stair access would still experience a high impact consistent with the EIS assessment
- The proposed modification aligns with the aspirations and objectives of the WestConnex Urban Design Framework. The proposed modification would decrease the surface footprint of the permanent works required for the Iron Cove ventilation facilities. Reducing surface infrastructure would also have improved visual impacts compared to the EIS, particularly a reduction in overshadowing due to the much smaller scale of permanent infrastructure
- The Urban Design and Landscape Plan(s) will be prepared under E133 to E137. Overshadowing will be assessed with a Solar Access and Overshadowing Report under E138. The Urban Design and Landscape Plan(s) and Overshadowing will be reviewed by the Design Review Panel and the Urban Design and Landscape Plan(s) will be approved by the Secretary of the Department of Planning, Industry and Environment.

Water management

- The surface activities required to construct the proposed modification are located within the footprint assessed in the EIS and groundwater inflows to the tunnel and caverns is predicted to be minimal. Appropriate measures to reduce the potential for construction water impacts have been included in the project Construction Soil and Surface Water Management Plan and the Construction Groundwater Management Plan prepared in accordance with the Planning Approval
- The type, arrangement and performance of construction water treatment facilities would be further refined during detailed design. The proposed modification would not require any changes or additions to the Planning Approval or environmental management measures for construction water quality impacts.

Resource use and waste minimisation

- About 61,000 bank cubic metres (BCM) of spoil would be excavated to construct the ventilation tunnel at Iron Cove. This increase in spoil volume is negligible in the context of the project in its entirety. Spoil would be reused beneficially where feasible and reasonable
- Construction of the proposed modification would generate a number of waste streams that would require management and disposal in accordance with the waste hierarchy established under *the Waste Avoidance and Resource Recovery Act 2001*. Avoiding the generation of waste would be the first preference.

Hazard and risk

- The additional High voltage regulators to be installed as part of the proposed modification are electrical transformers and are required for the project as a whole to maintain the voltage fluctuations from the high voltage source of supply to prevent damage to equipment and injury to personnel. There would be a

bund, oil separator and a flame trap within the transformer bay to contain any leaks. The transformer walls would be rated to a 4-hour fire rating. The proposed modification has been designed to minimise the likelihood of incidents and risks to public safety.

The proposed new ventilation tunnel and caverns would equate to a total length of about 425 metres. This calculation is based on a length of about 340 metres for the ventilation tunnel alignment and the ventilation fan cavern, 65 metres for the substation cavern and about 20 metres of access tunnel connecting the two caverns. It is important to note that Rozelle Interchange (i.e. Stage 2 of the M4-M5 Link Project) includes excavation of approximately 23 kilometres of tunnels and that the proposed modification is limited to the construction of about 425 metres of additional tunnels and caverns, which represents a very small increase in the extent of tunnelling and associated construction noise and vibration and traffic impacts.

10.3 Planning Approval and environmental management measures

No changes to the Planning Approval or the environmental management measures have been proposed to accommodate the proposed modification, other than to include reference to this assessment in Planning Approval Conditions A1 and A2.

10.4 Community and stakeholder consultation

Consultation has been carried out with the community, local councils, government agencies and other stakeholders during the preparation of the modification as outlined in Chapter 6 (Consultation). This modification report will be exhibited for 28 days from 20 November to 17 December. Following exhibition of the modification, Roads and Maritime will review the submissions received and respond to the issues raised in a Response to Submissions Report.

11 References

AECOM Australia Pty Ltd, WestConnex M4-M5 Link: Environmental Impact Statement, prepared for NSW Roads and Maritime Services, August 2017
http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7485

AECOM Australia Pty Ltd, WestConnex M4-M5 Link: Submissions and preferred infrastructure report, prepared for NSW Roads and Maritime Services, January 2018
http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=7485

AECOM Australia Pty Ltd, WestConnex M4-M5 Link: Mainline Tunnel – Modification report, prepared for NSW Roads and Maritime Services, September 2018
http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=9612.

State Significant Infrastructure Assessment Report (SSIAR) was lodged in January 2016, with SSIAR addendums following in September 2016 and March 2017

Roads and Maritime Services, Secretary's Environmental Assessment Requirements (SEARs) for Modification , May 2019

WestConnex M4-M5 Link
Rozelle Interchange – Modification:
Iron Cove ventilation underground
Modification report


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