



# Planning Approval Consistency Assessment Form

SM ES-FT-414

Sydney Metro Integrated Management System (IMS)

<b>Assessment Name:</b>	Hunter Street Station undercut and turnback tunnels
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## 1. Existing Approved Project

Planning approval reference details (Application/Document No. (including modifications)):

SSI-19238057: Sydney Metro West – Major civil construction between The Bays to Sydney CBD (Stage 2 of the planning approval process for Sydney Metro West)

Date of determination:	24 August 2022	Type of planning approval:	Critical State Significant Infrastructure (CSSI) (Division 5.2)
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Relevant background information (including EA, REF, Submissions Report, Director General’s Report, MCoA):

*Sydney Metro West Environmental Impact Statement – Major civil construction between The Bays and Sydney CBD* (Sydney Metro, November 2021) (referred to throughout this document as ‘the EIS’)

*Sydney Metro West Submissions Report – Major civil construction work between The Bays and Sydney CBD* (Sydney Metro, April 2022)

*Sydney Metro West Stage 2 - Assessment Report (SSI 19238057) (24 August 2022)*

*Sydney Metro West Stage 2 – Instrument of Approval - Conditions of approval (CoA) (24 August 2022)*

All proposed work identified in the assessment would be carried out in accordance with the mitigation measures identified in the Environmental Impact Statement (EIS), Submissions Report and the Conditions of Approval (CoA).

Description of existing Approved Project you are assessing for consistency:

### Sydney Metro West (the Concept)

Sydney Metro West (the Concept) would involve the construction and operation of a metro rail line around 24 kilometres long between Westmead and Hunter Street in the Sydney central business district (CBD). The key components are expected to include (as described in Chapter 6 of the Environmental Impact Statement (EIS)):

- Construction and operation of new passenger rail infrastructure between Westmead and the CBD of Sydney, including:
  - Tunnels, stations (including surrounding areas) and associated rail facilities
  - Stabling and maintenance facilities (including associated underground and overground connections to tunnels)
- Modification of existing rail infrastructure (including stations and surrounding areas)
- Ancillary development.

**Sydney Metro West - all major civil construction work between Westmead and The Bays (Stage 1)**

Sydney Metro West – Concept and Stage 1 (major civil construction between Westmead and The Bays), including station excavation and tunnelling, was determined on 11 March 2021.

It is noted that this consistency assessment does not relate to any aspects of Stage 1.

**Sydney Metro West - all major civil construction work and tunnelling between The Bays and Sydney CBD (Stage 2, the Approved Project)**

The major civil construction work between The Bays and Sydney CBD was determined on 24 August 2022. The scope of the Approved Project is described in Chapter 5 of the EIS and would include:

- Enabling work such as demolition, utility supply to construction sites, utility adjustments, and modifications to the existing transport network
- Tunnel excavation including tunnel support activities
- Station excavation for new metro stations at Pyrmont and at Hunter Street, in the Sydney CBD.

**Tunnel construction methodology for the Approved Project**

The work for the Approved Project was described in the *Sydney Metro West Environmental Impact Statement – Sydney Metro West – The Bays to Sydney CBD* (Sydney Metro, 2021) (Stage 2 of the planning approvals process).

Shafts would be excavated within the Hunter Street Station (Sydney CBD) construction sites to provide access to the station cavern during construction. Tunnel boring machines would be used to excavate the majority of the twin underground tunnels between The Bays and Sydney CBD. The two bored tunnels would have a circular cross-section with an internal lined diameter of about six metres and an excavated diameter of about seven metres.

The centre lines of the two tracks would typically be about 14 metres apart. This would depend, however, on specific geological constraints and the need to avoid building basements. The tunnels would be lined with precast concrete segments to ensure the long-term life of the asset and minimise groundwater inflow into the tunnel.

Based on the long section presented in the EIS, the depth of the tunnels to rail level would vary from about 27 to 52 metres due to changes in topography, with depths to the top of the tunnel typically measuring about 7 metres less than this. The shallower tunnel sections would generally be near the stations, with the deeper sections generally under the major water bodies of Johnstons Bay and Cockle Bay.

The following tunnel features would be excavated using roadheaders and rock hammers:

- Crossover cavern east of The Bays tunnel launch and support site
- Cross passages between the two tunnels to allow for emergency access
- Tunnel turnback at the end of the line, east of the eastern Hunter Street Station (Sydney CBD) construction site, to allow for the future operational ability to turn trains around for services travelling from the Hunter Street Station (Sydney CBD) west towards Westmead
- Stub tunnels to safeguard a potential future extension to the Metro network.

The total tunnel length between The Bays and Sydney CBD is about 3.5 kilometres, of which about 2.3 kilometres would be excavated by tunnel boring machines.

## 2. Description of proposed change which is the subject of this assessment

The purpose of this consistency assessment is to assess the following proposed changes to the Approved Project:

- Hunter Street Station (Sydney CBD) construction site undercut – An additional substratum excavation adjoining the Hunter Street Station (Sydney CBD) eastern construction site shaft that would be located partially outside the Approved Project corridor, under the Hunter Street road reserve, as shown in Figure 1. This undercut would remain as a permanent excavation required to support operation of the future Hunter Street Station (CBD).
- Revised alignment of the turnback tunnels from Hunter Street Station (Sydney CBD) to The Domain. The proposed change in tunnel alignment is located entirely underground and the depths of the realigned tunnels would be similar to the relevant sections of the approved tunnel alignment as shown in Figure 2. The proposed realignment of the turnback tunnels would generally be within the Approved Project corridor, with the end of the tunnels extending past the approved corridor under The Domain. The realigned tunnels would not be located under any private properties that were not previously identified within the EIS.

These proposed changes are shown in Appendix A.

This consistency assessment considers the potential construction impacts of these proposed changes. The proposed revised tunnel alignment subject to this consistency assessment has implications to the operational aspects assessed in Sydney Metro West - Rail infrastructure, stations, precincts and operations (SSI-22765520). Operational impacts associated with the proposed revised tunnel alignment will be assessed through a separate consistency assessment following approval of SSI-22765520.

Table 1: Comparison of the proposed change with relevant elements of the Approved Project

Relevant elements of the Approved Project	Proposed change
<p><b>Project description</b></p> <p>Chapter 5 (Project description) of the EIS describes the key construction work for the Approved Project, including excavation of the tunnel and stations. It notes that the tunnel alignment is indicative and subject to design development and construction planning. Further details and an indicative alignment and long section are shown on Figure 5-2 and Figure 5-3 of the EIS.</p> <p>The location and indicative layout of the Hunter Street Station (Sydney CBD) construction sites is illustrated in Figure 5-12 of the EIS.</p> <p>Section 5.4 of the EIS notes that wherever possible, construction sites would be contained within the future operational station footprints for Hunter Street Station (Sydney CBD). Section 5.4.5 of the EIS provides a detailed description of the Hunter Street Station (Sydney CBD) eastern construction site bounded by O’Connell Street, Hunter Street and Bligh Street. The purpose and need for the station cavern and shaft excavations are also described in Section 5.4.5 of the EIS.</p>	<p>The proposed additional permanent shaft undercut within and adjoining the Hunter Street Station (Sydney CBD) eastern construction site; as well as the revised alignment of turnback tunnels from Hunter Street, are shown in Appendix A.</p> <p>The proposed additional shaft undercut extends outside the approved Hunter Street Station (Sydney CBD) construction site, and partially outside the Approved Project corridor. The proposed change would be substratum, and the surface level footprint of the approved construction site would not change. This undercut would remain as a permanent excavation required to support the future planned operation of the station.</p> <p>The proposed revised alignment of the turnback tunnels is shown in Appendix A. The stub tunnels would be reduced in size, with the turnback tunnel continuing past the stub tunnels as shown in Appendix A.</p> <p>The length and depth of the revised tunnels would be generally consistent with the Approved Project. The purpose of the proposed revised turnback tunnel alignment is to allow for the future operational ability to turn trains around and to safeguard a potential future extension to the Metro network.</p>
<p><b>Construction sites</b></p> <p>Sections 5.4 of the EIS describes the construction sites for the Approved Project. Section 5.4.5 of the EIS provides a detailed description of the Hunter Street Station (Sydney CBD) eastern construction site bounded by O’Connell Street, Hunter Street and Bligh Street.</p>	<p>The proposed permanent shaft undercut would extend marginally outside the approved Hunter Street Station (Sydney CBD) eastern construction site. The proposed change would be substratum and the surface level footprint of the approved construction site would not change.</p>
<p><b>Spoil generation</b></p> <p>Indicative spoil generation of the Approved Project is outlined in Section 5.6.1 of the EIS. Further detail on the impacts associated with spoil generation and management is provided in the relevant chapters of the EIS, including Chapter 6 (Transport and traffic), Chapter 19 (Air quality) and Chapter 20 (Spoil, waste management and resource use).</p>	<p>There would be no substantial change to the estimated volume of spoil generated by the proposed changes compared with that for the Approved Project.</p>
<p><b>Construction traffic</b></p> <p>Information relating to haulage routes, the daily profile of construction traffic movements for each site, construction traffic impacts and mitigation is provided in Chapter 6 (Transport and traffic) and Technical Paper 1 (Transport and traffic) of the EIS.</p>	<p>There would be no material change to the estimated construction traffic volumes as a result of the proposed changes, compared with that for the Approved Project.</p>



Figure 1 Location of proposed permanent undercut relative to the Approved Project



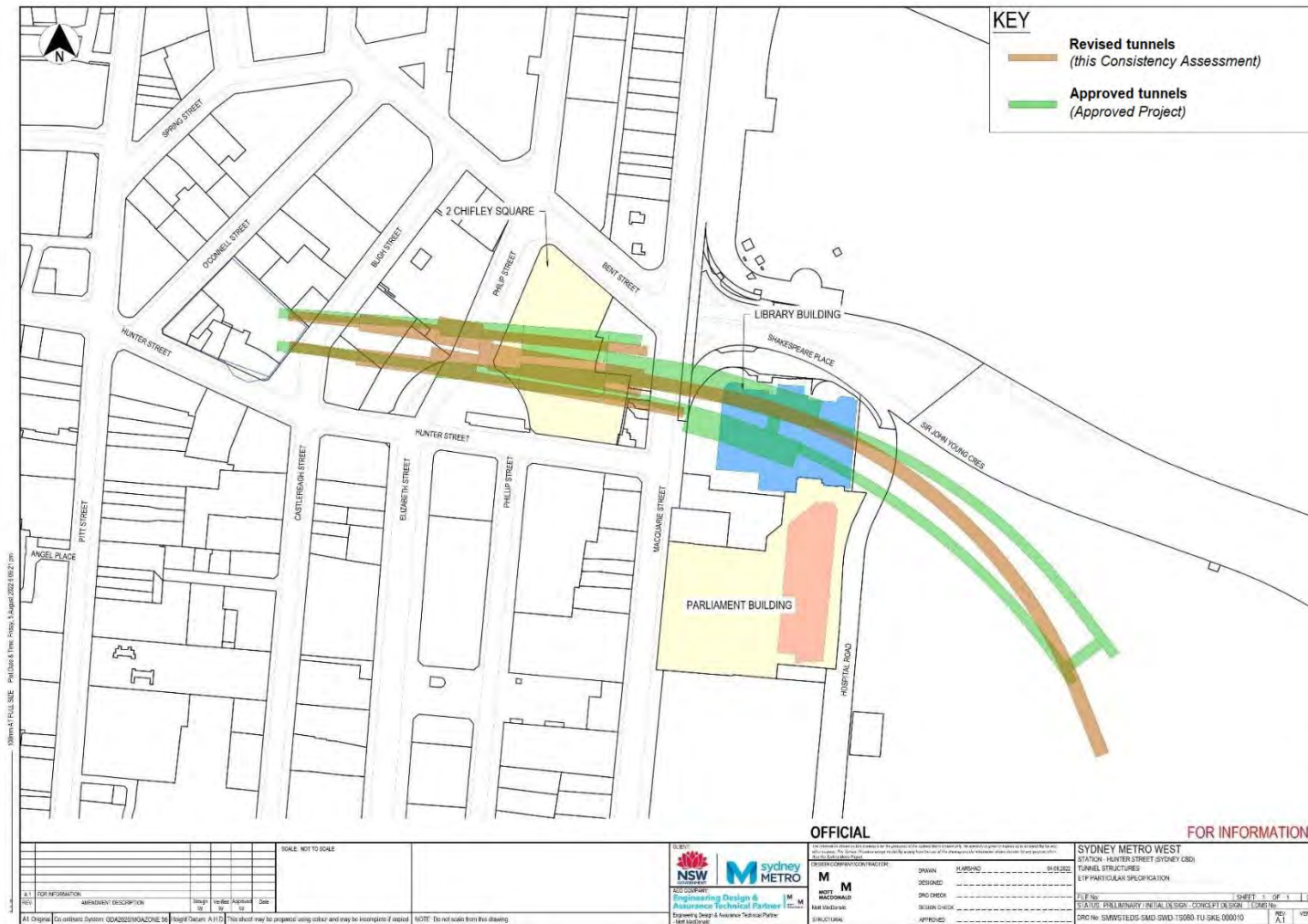


Figure 2 Location of proposed realigned turnback tunnels relative to the Approved Project



### 3. Timeframe

An indicative construction program for the major civil construction work between The Bays and Sydney CBD is shown in Figure 5-6 of the EIS. Section 5.3 of the EIS notes that the actual program and commencement of the civil work at each construction site may vary and is subject to ongoing design development and construction planning to be agreed with the successful contractor for each work package.

The proposed changes would fit within the indicative construction program described in the EIS for the Approved Project and would not require any change to the Approved Project indicative construction program.

### 4. Site description

The Hunter Street (Sydney CBD) eastern construction site is comprised of:

- 20-26 O'Connell Street Sydney 2000 (DP626651)
- 28-34 O'Connell Street Sydney 2000 (DP1107981, DP217112, DP536538)
- 44-48 Hunter Street Sydney 2000 (DP59871, DP217112)
- 50-58 Hunter Street Sydney 2000 (SP87437).

These properties have been acquired by Sydney Metro and are expected to be demolished as part of the work in the Approved Project as described in Chapter 5 (Project Description) of the EIS. The site is situated in a dense, established urban area with no threatened flora present. The presence of threatened fauna is considered unlikely. Surrounding land uses are predominantly commercial with no sensitive residential receivers located proximal to the site.

Section 5.4.5 of the EIS provides a detailed description of the Hunter Street Station (Sydney CBD) eastern construction site bounded by O'Connell Street, Hunter Street and Bligh Street. The proposed changes would be substratum and the surface level footprint of the approved Hunter Street Station (Sydney CBD) eastern construction site would not change.

As described in Section 10.5.1 of the EIS, it would be necessary to acquire land below the surface of properties for the construction of the tunnels, adits, cross passages and caverns (substratum acquisition). Figure 10-1 of the EIS shows an indicative example of the extent of the substratum to be acquired around the tunnels. The indicative depth of the tunnel alignment is shown in Figure 5-2 of the EIS. There would be no additional substratum acquisition under private properties required as a result of the proposed changes. As such, the process of substratum acquisition for the proposed changes would be consistent with that for the Approved Project as described in the EIS.

### 5. Site Environmental Characteristics

The proposed changes would be substratum and would not have any effect at ground surface level. The proposed permanent undercut and the realigned turnback tunnels would be excavated in geology that is consistent with the adjoining areas of the Approved Project (Hawkesbury Sandstone) and using the same methods as described in Section 5.5.3 of the EIS.

## 6. Justification for the proposed change

The proposed changes are the result of further design development and construction planning that has occurred since the exhibition of the EIS. The purpose of the proposed permanent shaft undercut is to facilitate pedestrian and escalator vertical transport movements through the operational station when complete. The proposed revised alignment and turnback tunnels would safeguard opportunities for future extensions of the Sydney Metro network and would more efficiently cater for the ability of trains to turn around while not resulting in any additional impacts to non-Aboriginal heritage items from those assessed in the EIS, including Chifley Square and the State Library of NSW. The revised alignment includes a simplified tunnel and turnback design. The simplification of design which reduces the number of turnback tunnels from two to one reduces the tunnel excavation from that in the Approved Project, while also ensuring that possible future extensions of the alignment are safeguarded.

## 7. Environmental Benefit

The environmental benefits of the proposed changes are anticipated to be consistent with the environmental benefits of the Approved Project.

## 8. Control Measures

Will a project and site specific EMP be prepared?	<input checked="" type="checkbox"/> Yes	Are appropriate control measures already identified in an existing EMP?  A project and site specific EMP will be prepared upon the appointment of the successful contractor. The EMP will be prepared in accordance with the relevant conditions of approval and project mitigation measures and include the appropriate control measures for the activities described within this consistency assessment. All work will be undertaken in accordance with the control measures outline in the project and site specific EMP.	<input type="checkbox"/> Yes
	<input type="checkbox"/> No		<input checked="" type="checkbox"/> No

## 9. Conditions of approval

Will the proposal be consistent with the conditions of approval?	<input checked="" type="checkbox"/> Yes
	<input type="checkbox"/> No

## 9. Impact Assessment – Construction

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project CoA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Traffic and transport	<p>There would be no material change to the estimated construction traffic volumes as a result of the proposed changes, given that the volume of spoil and construction methodology would be consistent with that described in the EIS.</p> <p>Given that there would be no changes to the layout of the approved Hunter Street (Sydney CBD) construction site, there would be no changes to the active transport, public transport, parking and property access impacts of the Approved Project.</p>	No additional control measures proposed.	Y	Y	

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<p>Noise and vibration</p>	<p>An updated noise and vibration assessment has been prepared and is presented as Appendix B. The proposed construction methods required for the proposed changes, including plant and equipment and construction hours, is principally unchanged compared with that for the Approved Project. As a result, and given that all changes would be substratum, there would be no substantial change to predicted air-borne noise impacts from those assessed in the Approved Project.</p> <p>There would be no substantial change to the indicative construction traffic volumes as a result of the proposed changes, given that the volume of spoil and construction methodology would be consistent with that described in the EIS. As a result, there would be no substantial change to predicted construction traffic noise.</p> <p>The revised turnback alignment is shown in Appendix A. The length and depth of the revised tunnels would be generally consistent with the Approved Project. As a result, the revised alignment would generally result in vibration impacts that are consistent with that of the Approved Project.</p> <p>The updated noise and vibration assessment found that no additional impacts are predicted at receivers due to the proposed changes. As a result, the proposed changes are not predicted to result in any additional ground-borne noise or vibration impacts to the surrounding receivers.</p> <p>In summary, the proposed changes are not predicted to result in any additional noise or vibration impacts.</p>	<p>No additional control measures proposed.</p>	<p>Y</p>	<p>Y</p>	
<p>Non-Aboriginal heritage</p>	<p>An updated heritage assessment has been prepared and is presented as Appendix C. That assessment found that the heritage impacts of the proposed changes would be generally minor in</p>	<p>No additional control measures proposed.</p>	<p>Y</p>	<p>Y</p>	

(Uncontrolled when printed)

Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project CoA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
	nature and would be consistent with the impacts identified for the Approved Project as described in the EIS. As a result, the direct and indirect non-Aboriginal heritage impacts associated with the proposed changes would be consistent with those described in Chapter 8 (Non-Aboriginal heritage) of the EIS.				
Water	As the proposed changes would be located underground and the surface level approved Hunter Street Station (Sydney CBD) eastern construction site would not change, the proposed changes would not result in any changes to the flooding or surface water quality impacts described in the EIS for the Approved Project. The proposed realigned turnback tunnel would be progressively lined to minimise groundwater inflow as per the approved tunnel excavation methodology described in the EIS. As a result, the proposed changes would not have substantial groundwater impacts relative to the impact of the Approved Project.	No additional control measures proposed.	Y	Y	

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Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project CoA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Ground movement	<p>Preliminary settlement contours were developed for the Approved Project to identify the expected zone of influence and magnitude of induced settlement from construction, as described in Section 14.6.1 of the EIS. The identified buildings, infrastructure and utilities currently fall within risk category 1 or 2 where the damage is negligible or slight.</p> <p>Based on the proposed permanent shaft undercut and realigned turnback tunnel being at comparable or deeper depths as the Approved Project, maximum estimated ground movement is anticipated to be substantially unchanged.</p>	No additional control measures proposed.	Y	Y	
Soils and contamination	<p>Assessment of potential acid sulfate soils, saline soils and contamination was carried out in the EIS for the approved footprint and surrounding areas. This addressed actual/potential contamination sources adjacent to the Approved Project footprint. This includes potential contamination sources above and adjacent to the proposed changes. In addition, the construction activities for the proposed are consistent with those for the Approved Project.</p> <p>As a result, the proposed changes are not expected to encounter significantly different conditions or result in significantly different impacts to those already identified (and managed as required) for the Approved Project.</p>	No additional controls are proposed.	Y	Y	



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Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project CoA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Aboriginal heritage	<p>As the proposed changes would be located underground and the surface level approved Hunter Street Station (Sydney CBD) eastern construction site would not change, the proposed changes would not result in any Aboriginal heritage impacts not described for the Approved Project.</p> <p>Consistent with the Approved Project, the proposed realigned turnback tunnels would be at a depth where no Aboriginal heritage objects or sites would be encountered.</p>	No additional control measures proposed.	Y	Y	
Land use and property	<p>As the proposed changes would be located underground and the surface level approved Hunter Street Station (Sydney CBD) eastern construction site would not change, the proposed changes would not result in any changed land use and surface property impacts not described for the Approved Project. There would be no additional private property acquisitions as a result of the proposed changes, as the shaft undercut would be located within a roadway</p> <p>The process of substratum acquisition for the proposed changes would be consistent with that for the Approved Project as described in the EIS.</p>	No additional control measures proposed.	Y	Y	

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Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project CoA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Waste and resource management	<p>There would be no substantial change to the estimated volume of spoil or other waste generated by the proposed changes compared with that for the Approved Project. The consolidation of the revised tunnel alignment to include one turnback tunnel compared to the previous two turnback tunnels (Figure A-1) in the Approved Project would result a minor reduction in the generation of spoil.</p> <p>Comparatively, the construction of the permanent shaft undercut would result in a minor increase of spoil generation. Noting the above design change to the tunnel alignment, however, it is expected that the cumulative spoil generation as a result of the proposed changes would be consistent with the Approved Project.</p> <p>There would be no substantial changes to resources used for the proposed changes compared with that for the Approved Project.</p>	No additional control measures proposed.	Y	Y	
Landscape and visual amenity	As the proposed changes would be located underground, there would be no additional landscape and visual amenity impacts from those described for the Approved Project.	No additional control measures proposed.	Y	Y	
Flora and fauna	As the proposed changes would be located underground, there would be no additional flora and fauna impacts from those described for the Approved Project.	No additional control measures proposed.	Y	Y	

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Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project CoA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Air quality	Given that the proposed changes would be located underground and that there would be no substantial changes to plant and equipment, there would be no substantial changes to the air quality impacts of the proposed changes compared with that for the Approved Project.	No additional control measures proposed.	Y	Y	
Community and socio-economic	As described above, there would be no receivers with additional predicted noise or vibration impacts from the Approved Project as a result of the proposed changes. The overall impact associated with the proposed changes on receivers would be minimal.  As described above, there would also be no substantial changes to traffic, land use and property, landscape and visual amenity and air quality as a result of the proposed changes.  As a result, there would be no substantial changes to the community and socio-economic impacts of the proposed changes compared with that for the Approved Project.	No additional control measures proposed.	Y	Y	
Hazard and risk	Given that the proposed changes would be located underground and that there would be no substantial changes to traffic volumes and plant and equipment, there would be no substantial changes to the hazard and risk impacts of the proposed changes compared with that for the Approved Project.	No additional control measures proposed.	Y	Y	

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Aspect	Nature and extent of impacts (negative and positive) during construction (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project CoA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Other	<p><b>Business impacts</b></p> <p>As described above, there would be no substantial changes to traffic, noise, land use and property, landscape and visual amenity and air quality as a result of the proposed changes. As a result, there would be no substantial impacts to businesses from reduced amenity.</p> <p>Given that the proposed changes would be located underground and that there would be no additional businesses impacted, there would be no substantial changes to the business impacts of the proposed changes compared with that for the Approved Project. Business property acquisitions would be unchanged from the Approved Project.</p> <p><b>Sustainability, climate change and greenhouse gas</b></p> <p>As described above, there would be no changes to traffic volumes, spoil generated, and equipment used as a result of the proposed changes. As a result, there would be no substantial changes to the sustainability, climate change and greenhouse gas impacts of the proposed changes compared to the Approved Project.</p> <p>Sydney Metro West would continue to be managed in accordance with the Sydney Metro West Sustainability Plan.</p>	No additional control measures proposed.	Y	Y	

## 10. Impact Assessment – Operation

Aspect	Nature and extent of impacts (negative and positive) during operation (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Flora and fauna	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Water	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Soils and contamination	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Air quality	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	

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Aspect	Nature and extent of impacts (negative and positive) during operation (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Noise and vibration	<p>The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.</p> <p>Given that the revised tunnel alignment is within the proposed corridor of the Approved Project, it is anticipated that operational noise impacts can be appropriately managed to achieve compliance with the applicable guidelines.</p>	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Aboriginal heritage	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Non-Aboriginal heritage	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Community and socio-economic	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Traffic and transport	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	



(Uncontrolled when printed)

Aspect	Nature and extent of impacts (negative and positive) during operation (if control measures implemented) of the proposed change, relative to the relevant impact in the Approved Project	Proposed Control Measures in addition to project COA and REMMs	Minimal Impact Y/N	Endorsed	
				Y/N	Comments
Waste and resource management	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Visual and urban design	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Land use and property	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Hazard and risk	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	
Other	The Approved Project covers the major civil construction between The Bays and Sydney CBD. This consistency assessment relates to the potential construction impacts of these proposed changes only.	Where relevant, proposed control measures would be assessed through a separate consistency assessment following approval of SSI-22765520.	N/A	Y	

## 11. Consistency with the Approved Project

Question	Consider the following:
Is the project as changed consistent with the conditions of approval?	Yes. The proposed changes are consistent with the conditions of approval.
Is the project (including the proposed changes) consistent with the objectives and functions of elements of the approved project?	Yes. The changes identified in this assessment are consistent with the objectives and functions of the relevant elements of the Approved Project. The purpose of the proposed revised alignment of turnback tunnels is to improve the future operational ability to turn trains around and to safeguard a potential future extension to the Metro network, and is considered consistent with the objectives and functions of the Approved Project.
Are the environmental impacts of the proposed change consistent with the impacts of the Approved Project?	Yes. The proposed changes would not result in any changes to environmental impacts as assessed for the Approved Project as described throughout the EIS.
Is the change within the envelope of what has been approved?	<p>The proposed changes would be located underground, and the surface level approved Hunter Street Station (Sydney CBD) eastern construction site would not change. The proposed additional shaft undercut extends outside the approved Hunter Street Station (Sydney CBD) construction site and operational station footprint, and partially outside the Approved Project corridor. This undercut would remain as a permanent excavation required to support operation of the station.</p> <p>The proposed revised alignment is shown in Appendix A. The length and depth of the revised tunnels would be generally consistent with the Approved Project. The proposed realignment of the turnback tunnels would be generally within the Approved Project corridor, with the end of the tunnels extending past the approved corridor under The Domain.</p> <p>Chapter 5 of the EIS notes that the tunnel alignment is indicative and subject to design development and construction planning. Section 5.4 of the EIS notes that construction sites would be contained within the future operational station footprints wherever possible. The proposed changes are therefore considered to be consistent with the project approval.</p>
Are there any new environmental impacts as a result of the proposed works/project changes?	<p>The proposed works would not result in any new environmental impacts beyond those considered in the Approved Project.</p> <p>The proposed changes would have negligible or minor environmental impacts relative to the impact of the Approved Project as described in Section 9 above. All impacts identified for the proposed change would be adequately mitigated through the application of the mitigation measures provided in the EIS, Submissions Report and conditions of approval.</p>
Are the impacts of the proposed activity/works known and understood?	Yes. The potential impacts of the proposed changes are understood and assessed as outlined in Section 9 above.
Are the impacts of the proposed activity/works able to be managed so as not to have an adverse impact?	Yes. Potential impacts of the proposed changes would be adequately mitigated through the application of the mitigation measures provided in the EIS, Submissions Report and conditions of approval for the Approved Project, including the Sydney Metro Overarching Community Communications Strategy and the Sydney Metro Construction Noise and Vibration Standard.
Is the proposed change/s consistent with the approval (having regard to the above assessment)?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

## 12. Other Environmental Approvals

Identify all other approvals required for the proposed works:

No other environmental approvals are required.

## 14. Recommendation

Based on the above impact assessment, and with reference to the *Sydney Metro West Environmental Impact Statement – Major civil construction between The Bays and Sydney CBD* (Sydney Metro, November 2021), Submissions Report (April 2022) and the conditions of approval, it is recommended that:

Tick relevant box	
The proposed changes have negligible or more than negligible impacts on the environment or community, however, is consistent with the approval, including the conditions of approval. The proposed impacts are consistent with those assessed for the Approved Project (i.e. does not trigger a change to the conditions of approval).	X
The proposed changes are not consistent with the Approved Project including the conditions of approval and would be subject to a separate modification application.	
The proposed changes are not substantially the same as the Approved Project and is considered a radical transformation. A new planning pathway should be considered.	

## Author certification

I certify that to the best of my knowledge this Consistency Checklist:

- Examines and takes into account the fullest extent possible all matters affecting or likely to affect the environment as a result of activities associated with the proposed change; and
- Examines the consistency of the proposed change with the Approved Project; is accurate in all material respects and does not omit any material information.

Name:	Charlotte Brogan	Signature:	<i>Charlotte Brogan</i>
Title:	Planning Approvals Officer		
Company:	Sydney Metro	Date:	21/09/2022

## Assessment Supporting Signature

Application supported and submitted by

Name:	Yvette Buchli	Date:	23/09/2022
Title:	Associate Director Planning Approvals	Comments:	
Signature:	<i>Yvette Buchli</i>		

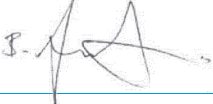
## Assessment Endorsement

Based on the above assessment, are the impacts and scope of the proposed change consistent with the existing Approved Project?

Yes  The proposed change is consistent with the Approved Project and no further assessment is required.

No  The proposed change is not consistent with the Approved Project.

A modification or a new activity approval/ consent is required. Advise Senior Project Manager of appropriate alternative planning approvals pathway to be undertaken.

Endorsed by			
Name:	Ben Armstrong	Date:	24/09/2022
Title:	Director Environment, Sustainability, and Planning, West	Comments:	
Signature:			



## **Appendix A – Proposed changes – drawings**



Hunter Street Station  
construction sites

Eastern  
construction site

- Undercut
- Metro tunnels (final alignment  
to be confirmed)
- Interim corridor  
(Stage 2 EIS)

0 30 m

Figure A-1: Location of proposed permanent undercut relative to the Approved Project

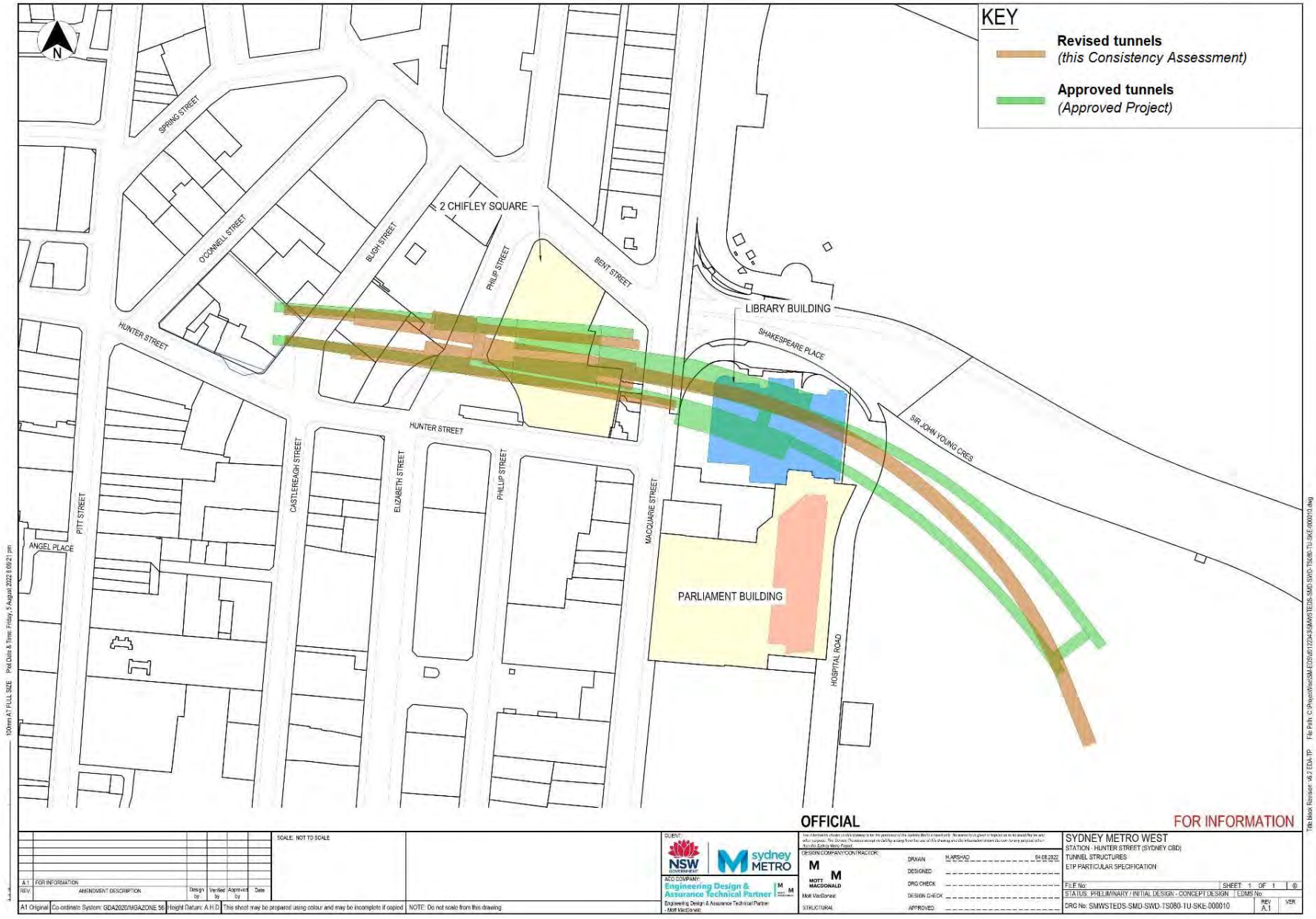


Figure A-2: Location of proposed realigned turnback tunnels relative to the Approved Project

## **Appendix B – Noise and vibration technical memo**

**To:** Lauren Clear  
**From:** Jordan McMahon  
**Date:** 21 September 2022  
**Subject:** Sydney Metro West Stage 2  
Hunter Street Tunnelling Consistency Assessment  
Noise and Vibration

**At:** Jacobs Group (Australia) Pty Ltd  
**At:** SLR Consulting Australia Pty Ltd  
**Ref:** 610.18331-M17-v2.1-20220921.docx

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## 1 Introduction

### 1.1 Overview

The proposed major civil construction work between The Bays and Sydney CBD (the approved project) was determined on 24 August 2022. The scope of the approved project is described in Chapter 5 of *Sydney Metro West Environmental Impact Statement – Major civil construction between The Bays and Sydney CBD* (the EIS) and would include the following:

- Enabling work such as demolition, utility supply to construction sites, utility adjustments, and modifications to the existing transport network
- Tunnel excavation including tunnel support activities
- Station excavation for new metro stations at Pyrmont and at Hunter Street, in the Sydney CBD.

The potential noise and vibration impacts from the proposal were assessed in Technical Paper 2 (Noise and Vibration).

### 1.2 The Proposal

The proposed changes include:

- The inclusion of an additional substratum excavation adjoining the Hunter Street (Sydney CBD) east shaft. This undercut would remain as a permanent excavation required to support the operation of the station.
- Revised alignment of the turnback and stub tunnels from Hunter Street Station (Sydney CBD) to The Domain. The proposed change in tunnel alignment is located entirely underground and the depths of the realigned tunnels would be similar to the relevant sections of the approved tunnel alignment. The southern stub tunnel would be shortened by around 300 metres and all tunnel elements are generally more distant from sensitive receivers compared to the approved project alignment.

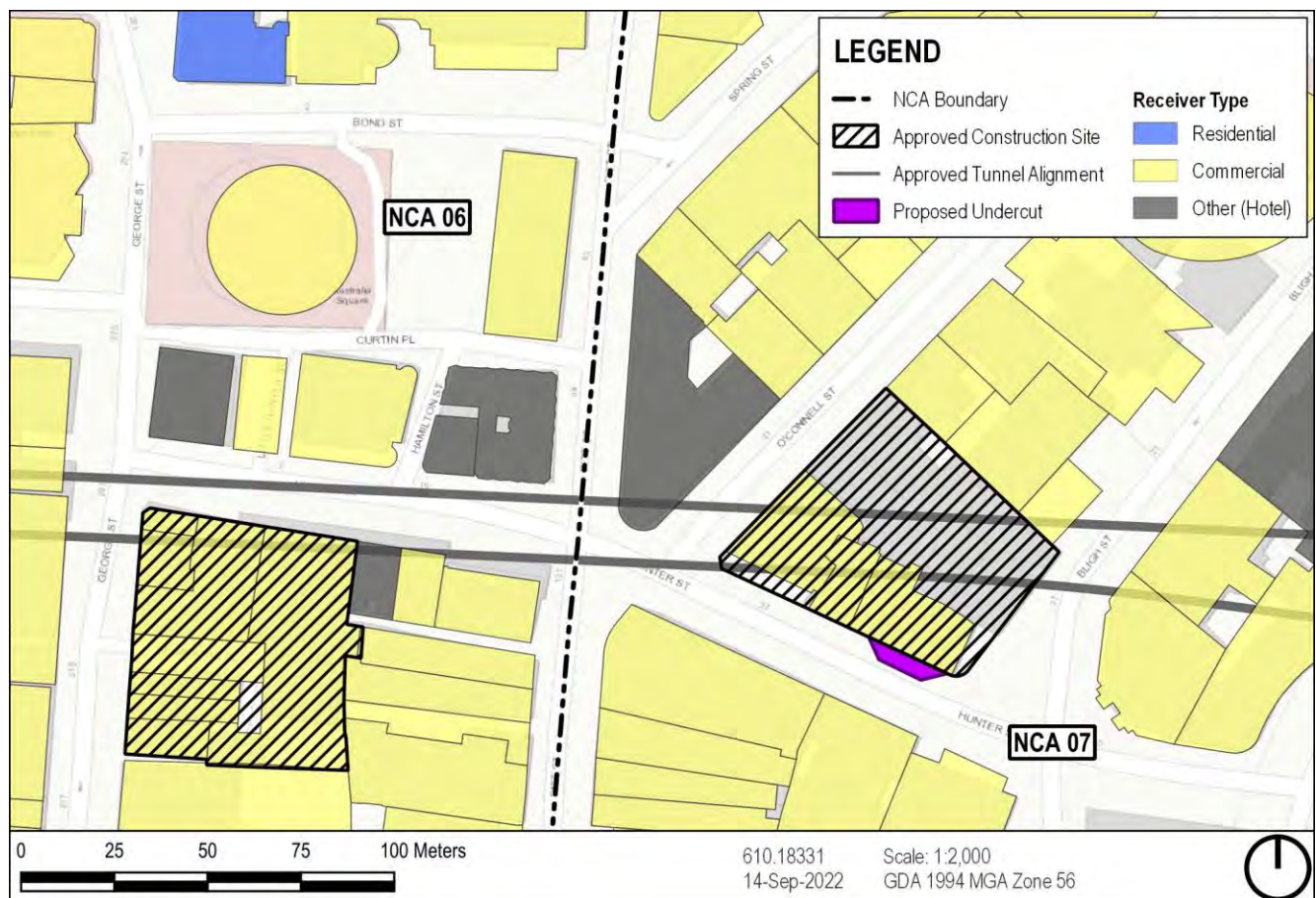


The following aspects are generally unchanged from the approved project and are not expected to change the predicted noise and vibration impacts from the approved project:

- Spoil volumes and truck numbers.
- The construction methodology (including construction plant and equipment, working hours and duration of work).
- Excavation activity times reduced proportionally to the reduction in excavation volume, but no change to the overall program.

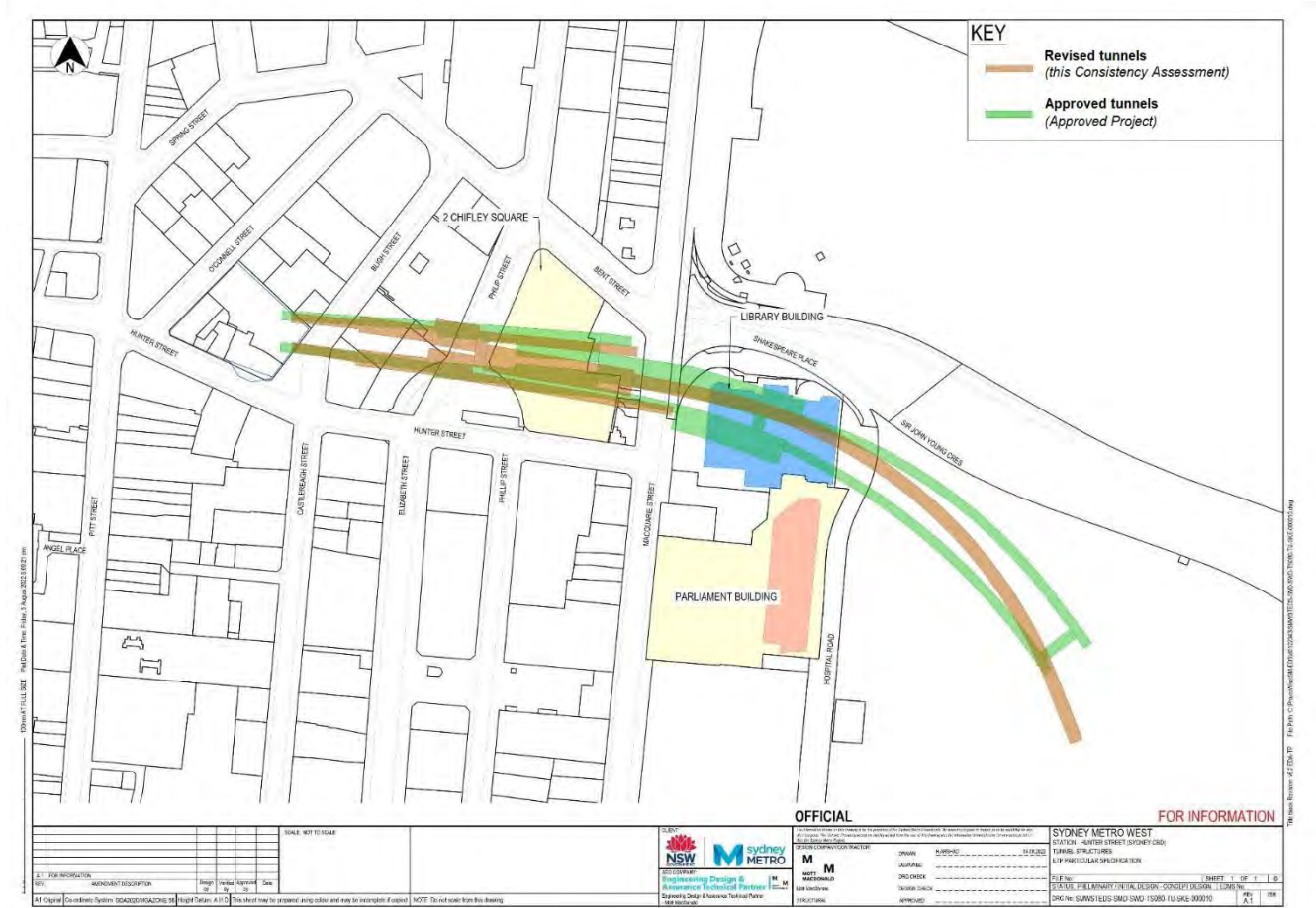
This memorandum provides a technical review of the potential noise and vibration impacts associated with the proposed changes. The location of the additional tunnelling activity at the Hunter Street Station (Sydney CBD) eastern construction site is shown in **Figure 1**.

**Figure 1 Revised Tunnelling – Hunter Street Station (Sydney CBD) Construction Site**



The revised tunnel alignment east of Hunter Street Station (Sydney CBD) to The Domain is shown in **Figure 2** and compared to the approved tunnel alignment.

**Figure 2 Revised Tunnelling – Hunter Street Station (Sydney CBD) to The Domain**



## 2 Construction Guidelines

This assessment applies the same guidelines and criteria as the assessment of the approved project. The guidelines are detailed in Technical Paper 2 (Noise and Vibration) of the *Sydney Metro West Stage 2 Environmental Impact Statement –Major civil construction between The Bays and Sydney CBD*, and are reproduced in the following sections.

### 2.1 Construction Ground-borne Noise Guidelines

Construction work can cause ground-borne (or regenerated) noise impacts in nearby buildings when vibration intensive equipment is in use, such as during tunnelling or excavation work using tunnel boring machines, roadheaders and rockbreakers. Vibration can be transmitted through the ground and into nearby buildings, which can then create audible noise impacts inside the building.

Ground-borne Noise Management Levels (NMLs) are applicable where ground-borne noise levels are likely to be higher than airborne noise levels, which can occur where work is underground or where surface work is shielded by noise barriers or other structures.

## Residential and Commercial Receivers

The internal ground-borne noise NMLs used in the assessment for residential and commercial receivers are shown in **Table 1**.

**Table 1 Construction Ground-borne NMLs**

Period	Residential	Commercial
Daytime <sup>1</sup>	45 dBA LAeq(15minute)	50 dBA LAeq(15minute)
Evening	40 dBA LAeq(15minute) <sup>2</sup>	n/a
Night-time	35 dBA LAeq(15minute) <sup>2</sup>	n/a

Note 1: Daytime ground-borne noise NMLs taken from preceding Sydney Metro planning applications for consistency. Daytime ground-borne noise NMLs are not specified in the ICNG or Sydney Metro CNVS.

Note 2: Specified in the Sydney Metro CNVS.

## Other Sensitive Land Uses

The NSW *Interim Construction Noise Guideline (ICNG)* and *Sydney Metro Construction Noise and Vibration Standard (CNVS)* do not provide ground-borne noise NMLs for 'other sensitive' receivers. For these receivers, the ICNG internal airborne noise NMLs have been used to identify potential ground-borne noise impacts from the proposal.

## 2.2 Construction Vibration Guidelines

The effects of vibration from construction work can be divided into three categories:

- Those in which the occupants of buildings are disturbed (human comfort)
- Those where building contents may be affected (building contents)
- Those where the integrity of the building may be compromised (structural or cosmetic damage).

The criteria for these categories are taken from a number of guidelines and are discussed in the following sections.

### 2.2.1 Human Comfort Vibration

People can sometimes perceive vibration impacts when vibration generating construction work is located close to occupied buildings.

Vibration from construction work tends to be intermittent in nature and the EPA's *Assessing Vibration: a technical guideline* (2006) provides criteria for intermittent vibration based on the Vibration Dose Value (VDV). The 'preferred' and 'maximum' VDV's for human comfort impacts are shown in **Table 2**.



**Table 2 Vibration Dose Values for Intermittent Vibration**

Building Type	Assessment Period	Vibration Dose Value <sup>1</sup> (m/s <sup>1.75</sup> )	
		Preferred	Maximum
Critical Working Areas (e.g. operating theatres or laboratories)	Day or night-time	0.10	0.20
Residential	Daytime	0.20	0.40
	Night-time	0.13	0.26
Offices, schools, educational institutions and places of worship	Day or night-time	0.40	0.80
Workshops	Day or night-time	0.80	1.60

Note 1: The VDV accumulates vibration energy over the daytime and night-time assessment periods, and is dependent on the level of vibration as well as the duration.

### 2.2.2 Effects on Building Contents

People perceive vibration at levels well below those likely to cause damage to building contents. For most receivers, the human comfort vibration criteria are the most stringent and it is generally not necessary to set separate criteria for vibration effects on typical building contents.

Exceptions to this can occur when vibration sensitive equipment, such as electron microscopes, is located in buildings near to construction work. Criteria for vibration sensitive equipment are discussed in **Section 2.2.4**

### 2.2.3 Cosmetic Damage Vibration

If vibration from construction work is sufficiently high it can cause cosmetic damage to elements of affected buildings. Examples of damage that can occur includes cracking or loosening of drywall surfaces, cracks in supporting columns and loosening of joints. The levels of vibration required to cause cosmetic damage tends to be at least an order of magnitude (10 times) higher than those at which people can perceive vibration.

Industry standard cosmetic damage vibration limits are specified in Australian Standard AS 2187-2, British Standard BS 7385 and German Standard DIN 4150, which are referenced in the Sydney Metro CNVS. Cosmetic damage vibration limits for residential and commercial buildings, heritage structures, and utilities are provided below.

#### 2.2.3.1 General Cosmetic Damage Vibration Screening Criterion

The Sydney Metro CNVS recommends the following conservative cosmetic damage screening limits shown in **Table 3**.

**Table 3 Transient Vibration Values for Minimal Risk of Cosmetic Damage**

Type of Building	Peak Particle Velocity <sup>1</sup>
Reinforced or framed structures. Industrial and heavy commercial buildings	25 mm/s
Unreinforced or light framed structures. Residential or light commercial type buildings	7.5 mm/s

Note 1: Cosmetic damage vibration limits are reduced by 50 per cent to account for dynamic loading caused by continuous vibration dynamic magnification due to resonance.

The CNVS recommends that a more detailed analysis of the potential vibration impacts should be completed where the predicted and/or measured vibration levels are greater than the screening values.

### 2.2.3.2 Utilities and Other Vibration Sensitive Assets

Construction of the proposal could potentially affect other utilities and assets which may be sensitive to vibration. Examples include pipelines, tunnels, fibre optic cable routes and high pressure gas pipelines.

German Standard DIN 4150 provides the guideline vibration limits for buried pipework shown in **Table 4**.

**Table 4** DIN 4150 Guideline Values for Short-term Vibration on Buried Pipework

Line	Pipe Material	Guideline Values Vibration Velocity at the Pipe (mm/s)
1	Steel, welded	100
2	Vitrified clay, concrete, reinforced concrete, pre-stressed concrete, metal (with or without flange)	80
3	Masonry, plastics	50

For other potentially affected assets, specific vibration limits should be determined on a case-by-case basis in consultation with the asset owner.

### 2.2.3.3 Heritage Buildings and Structures

The Sydney Metro CNVS states that heritage buildings and structures should be assessed using the cosmetic damage screening criteria in **Table 3** and should not be assumed to be more sensitive to vibration unless found to be structurally unsound.

Where heritage buildings and/or structures are found to be structurally unsound a more conservative cosmetic damage objective of 2.5 mm/s Peak Particle Velocity (PPV) (from DIN 4150) should be considered. No heritage buildings or structures were identified within the Hunter Street (Sydney CBD) study area to require consideration of the 2.5 mm/s cosmetic damage screening criterion.

### 2.2.4 Sensitive Scientific Equipment

Some scientific equipment, such as electron microscopes and microelectronics manufacturing equipment, can require more stringent vibration objectives. Other sensitive equipment used for various business requirements, such as medical equipment, may also have specific vibration goals. Vibration sensitive equipment is, however, often housed in buildings/rooms specifically designed and constructed for that purpose, which can help mitigate any potential impacts.

The only receivers in the Hunter Street (Sydney CBD) study area identified to potentially have vibration sensitive equipment are at the Sydney Hospital. These receivers were identified to potentially exceed the sensitive equipment screening criteria in the assessment of the approved project. The impacts at these receivers are expected to be consistent with the approved project.

Vibration limits for the operation of sensitive scientific and medical equipment should be taken from manufacturer's data. Where this is not available the Vibration Criterion (VC) curves shown in **Table 5** can be used.

**Table 5 VC Curves for Vibration Sensitive Equipment**

Criterion Curve	Max Level (µm/sec, RMS)	Detail Size (microns)	Description of Use
VC-A	50	8	Adequate in most instances for optical microscopes to 400X, microbalances, optical balances, proximity and projection aligners, etc.
VC-B	25	3	An appropriate standard for optical microscopes to 1000X, inspection and lithography equipment (including steppers) to 3 micron line widths.
VC-C	12.5	1	A good standard for most lithography and inspection equipment to 1 micron detail size.
VC-D	6	0.3	Suitable in most instances for the most demanding equipment including electron microscopes (TEMs and SEMs) and E-Beam systems, operating to the limits of their capability.
VC-E	3	0.1	A difficult criterion to achieve in most instances. Assumed to be adequate for the most demanding of sensitive systems including long path, laser-based, small target systems and other systems requiring extraordinary dynamic stability.

Note: Vibration Criterion curves as published by the Society of Photo-Optical Instrumentation Engineers (Colin G. Gordon – 28 September 1999).

Where the criteria are exceeded all appropriate feasible and reasonable mitigation and management measures would be considered to minimise the impacts.

### 3 Methodology

The assessment includes either quantitative or qualitative analysis of each of the proposed changes. **Table 6** describes the different assessment types and where they are applied.

**Table 6 Assessment Types**

Assessment Type	Applied to	Description
Quantitative	The Hunter Street Station (Sydney CBD) eastern construction site undercut	This assessment follows the same methodology as the approved project. The methodology is detailed in Technical Paper 2 (Noise and Vibration) of the <i>Sydney Metro West Stage 2 Environmental Impact Statement – Major civil construction between The Bays and Sydney CBD</i> , which should be referenced where further information is required. This includes modelling of the assessed items relative to the sensitive receivers and produces numerical outputs which are compared to the relevant guideline values.
Qualitative	Revised alignment of the turnback and stub tunnels from Hunter Street Station (Sydney CBD) to The Domain	This assessment is a high-level comparison of the proposed tunnel alignment to the approved tunnel alignment. The comparison is based on the description and figures of the proposed change, and does not include detailed modelling. Discussion of the expected change to the ground-borne noise and vibration impacts is provided. This assessment type is suitable for changes which are considered to have a low risk of causing increased or additional impacts.

## 4 Ground-borne Noise and Vibration Impacts from Undercut Tunnelling

### 4.1 Ground-borne Noise Impacts

The assessment in this section shows the predicted ground-borne noise impacts based on the exceedance of the management levels, as per the categories in **Table 7**.

**Table 7 Exceedance Bands and Impact Colouring**

Exceedance of Management Level	Subjective Classification <sup>1</sup>	Impact Colouring
No exceedance	Negligible	
1 to 10 dB	Low impact	
11 dB to 20 dB	Moderate impact	
>20 dB	High impact	

Note 1: This subjective classification is indicative and follows the approach outlined in the Sydney Metro CNVS for reporting of construction impacts in Detailed Noise and Vibration Impact Statements. The subjective response would vary and depends on the period in which the impacts occur (i.e. people are generally more sensitive to impacts during the evening and night-time).

The ground-borne noise assessment is based on the worst-case predicted internal ground-borne noise levels for sensitive receivers above the proposed tunnel alignment and undercut. The predictions represent the likely highest noise levels when the tunnelling work is directly below each receiver.

A summary of the predicted ground-borne noise levels from work in each NCA is shown in **Table 8**. The predicted impacts are consistent with the approved project as assessed in the EIS.

**Table 8 Overview of Tunnelling Ground-borne NML Exceedances – All Receiver Types**

NCA	Number of Receivers									
	Total	With NML Exceedance <sup>1</sup>								
		Daytime			Evening			Night-time		
		1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB	1-10 dB	11-20 dB	>20 dB
NCA06	399	4	6	-	1	3	-	2	1	3
NCA07	250	1	1	-	-	1	-	1	-	1

Note 1: Based on worst-case predicted noise levels in each NCA.

The above assessment during the worst-case impacts shows that:

- The ground-borne noise impacts during tunnelling work are predicted to comply with the daytime NMLs at most receivers. A small number of the nearest receivers at the Hunter Street Station (Sydney CBD) eastern construction site are predicted to have ‘moderate’ or ‘low’ impacts. This is consistent with the approved project.
- The worst-case impacts are predicted to be consistent with the assessment of the approved project during all periods. This is due to the relatively small footprint of the proposed undercut and because it is separated from the nearest sensitive receivers by Hunter Street.

The ground-borne noise predictions are based on the nearest receivers within each building at ground floor. The impacts would reduce for sensitive receivers which are further away from the alignment or for receivers on high floors in multistorey buildings.

## 4.2 Vibration Impacts

The ground-borne vibration assessment is based on the worst-case predicted ground-borne vibration level for sensitive receivers above the proposed tunnel alignment and undercut. The predictions represent the likely highest vibration level when the tunnelling work are directly below each receiver.

A summary of the predicted ground-borne vibration levels from work in each NCA is shown in **Table 9**. The predicted impacts are consistent with the approved project as assessed in the EIS.

**Table 9 Overview of Vibration Criteria Exceedances – All Receiver Types**

NCA	Number of Receivers					
	Total	With Vibration Criteria Exceedance <sup>1</sup>				
		Cosmetic Damage		Human Comfort		Sensitive Equipment
		Day / Night	Day	Night	Day / Night	
NCA06	399	-	7	3	-	
NCA07	250	-	1	1	3	

Note 1: Based on worst-case predicted vibration levels.

The above assessment during the worst-case impacts shows that:

- Potential exceedances of the human comfort criteria are likely at the nearest receivers, meaning perceptible levels of vibration may occur when tunnelling work is below these areas. These impacts are at the closest receivers which surround the construction sites, as this is where the tunnel depth is shallowest. This is consistent with the approved project.
- The worst-case impacts are predicted to be consistent with the assessment of the approved project during all periods. This is due to the relatively small footprint of the proposed undercut and because it is separated from the nearest sensitive receivers by Hunter Street.
- No receivers in the Hunter Street (Sydney CBD) study area are predicted to be subject to vibration levels which exceed the cosmetic damage screening criteria during tunnelling. This is consistent with the approved project.

## 5 Ground-borne Noise and Vibration Impacts from Turnback and Stub Tunnelling

A qualitative assessment of the potential ground-borne noise and vibration impacts the proposed changes to the revised alignment of the turnback and stub tunnels from Hunter Street Station (Sydney CBD) construction site to The Domain has been completed.

The closest section of the revised tunnels is generally more distant from sensitive receivers compared to the approved tunnels, as shown in **Figure 2**. The depths of the realigned tunnels would be consistent with the approved tunnel alignment, such that the total 3D slant distance between the proposed tunnels and the sensitive receivers is also generally more distant compared to the approved project.

The eastern extent of the proposed tunnel alignment would extend around 50 m further to the southeast under The Domain and is closer to some receivers on Hospital Road compared to the approved project. These receivers are, however, over 200 m from the proposed alignment and are not expected to result in any exceedances of the vibration screening criteria.

The ground-borne noise and vibration impacts associated with the proposed tunnelling of the turnback and stub tunnels are expected to be equivalent to or less than the impacts presented in the assessment of the approved project.

## 6 Change from Approved Project

Technical Paper 2 (Noise and Vibration) of the *Sydney Metro West Stage 2 Environmental Impact Statement – Major civil construction between The Bays and Sydney CBD* assessed ground-borne noise and vibration from the project separately in the following categories:

- Ground-borne Noise and Vibration from Construction Sites – Demolition and surface excavation
- Ground-borne Noise and Vibration from Tunnelling – Main tunnels, excavating stations, crossover caverns, cross passages, turnback cavern, stub tunnels and adits.

The proposed changes relate only to ground-borne noise and vibration from tunnelling. Accordingly, the results in **Table 8** and **Table 9** are equivalent to the results from the assessment of the approved project (Technical Paper 2 Section 5.3).

The proposed changes are not predicted to result in any additional ground-borne noise or vibration impacts at the surrounding receivers.

## 7 Management of Impacts

Mitigation and management measures to minimise noise and vibration impacts from the approved project are identified in Section 6 of Technical Paper 2 (Noise and vibration) of the *Sydney Metro West Stage 2 Environmental Impact Statement – Major civil construction between The Bays and Sydney CBD*.

Checked/  
Authorised by: AMcK

## **Appendix C – Heritage technical memo**



artefact

## Memo: Sydney Metro West Stage 2: Non-Aboriginal Heritage Impact Consistency Assessment

<b>Project:</b> Sydney Metro West Stage 2	<b>Date:</b> 15 September 2022
<b>To:</b> Lauren Clear – Senior Environmental Scientists, Jacobs	<b>From:</b> Sarah-Jane Zammit – Senior Heritage Consultant (Built Heritage), Artefact Heritage

### Introduction – Sydney Metro West

The major civil construction work between The Bays and Sydney CBD (the approved project) was determined on 24 August 2022. The scope of the approved project is described in Chapter 5 of the *Sydney Metro West Environmental Impact Statement – Major civil construction between The Bays and Sydney CBD* (the EIS) and will include the following:

- Enabling work such as demolition, utility supply to construction sites, utility adjustments, and modifications to the existing transport network
- Tunnel excavation including tunnel support activities
- Station excavation for new metro stations at Pyrmont and at Hunter Street, in the Sydney CBD.

Stage 2 of the planning approval process includes all major civil construction between The Bays and Sydney CBD. The Environmental Impact Statement (EIS) for major civil construction between The Bays and Sydney CBD was exhibited between 3 November 2021 and 15 December 2021.

### Proposed Changes

The proposed change includes:

- Hunter Street Station construction site undercut – An additional substratum excavation adjoining the Hunter Street Station eastern construction site shaft that would be located partially outside the approved project corridor. This undercut would remain as a permanent excavation required to support operation of the future Hunter Street Station.
- Revised alignment of the turnback tunnels from Hunter Street station to The Domain. The proposed change in tunnel alignment would be located entirely underground and the depths of the realigned tunnels would be similar to the relevant sections of the approved tunnel alignment. The proposed realignment of the turnback tunnels would be generally within the approved project corridor, with the end of the tunnels extending past the approved corridor into The Domain.



The proposed changes to the scope would be limited to the subterranean tunnelling and below ground spaces.

The non-Aboriginal heritage items which have the potential to be impacted by the proposed changes to the Hunter Street eastern construction site include the following:

- Former Wales House (SHR item no. 00586)
- Public Trust Office (SHR item no. 01019)
- Former Bank 'Delfin House' (SLEP item no. I1903)
- NSW Club House Building (SHR item no. 00145)
- Bennelong Stormwater channel No. 29A (Sydney Water s170 item no. 4570854)

Heritage items which have potential to be impacted by the proposed changes to the turnback tunnel alignment from Hunter Street to the Domain include the following:

- Former 'Qantas House' (SHR item no. 01512)
- Wentworth Hotel (SLEP item no. I1674)
- Chifley Square (SHR item no. 01512)
- Terrace house 'Horbury House' (SLEP item no. I1877)
- Shakespeare Place (SLEP item no. I1949)
- State Library of NSW (SHR item no. 01071)
- Royal Botanical Gardens and Domain (including Governor's Domain and Civic Precinct) (NHL Place ID: National 106103, SHR item no. 01070)

The following memo provides an assessment of the potential heritage impacts as a result of the proposed change and the consistency of those potential impacts against those assessed in the EIS. The proposed changes to the Hunter Street eastern construction site and tunnel alignment are shown in Figure 1 and Figure 2 below.



Figure 1: Proposed change to Hunter Street eastern construction site (Source: Sydney Metro)

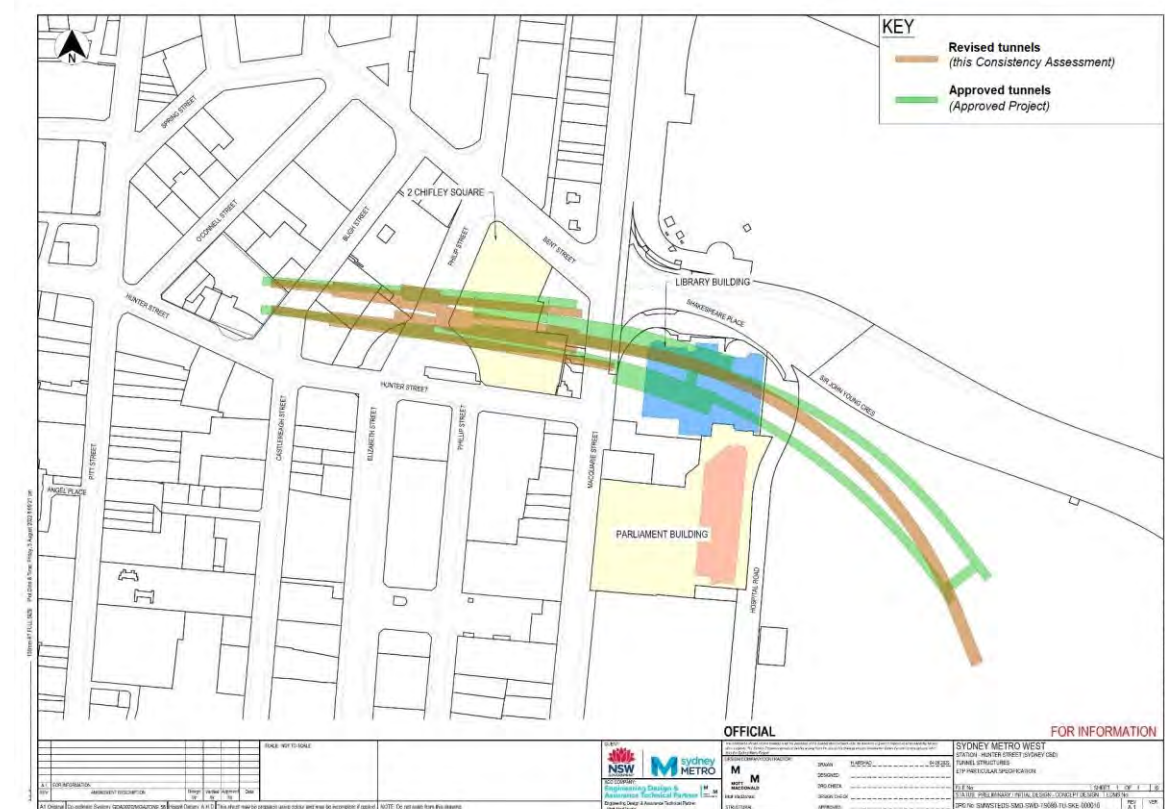


Figure 2: Proposed change to tunnel alignment (Source: Sydney Metro)

## Assessment of methodology

The following methodology for vibration and ground movement impacts is consistent with the approved project.

### Vibration impacts

Vibration arising from construction or excavation work has the potential to impact on the fabric of heritage items, potentially affecting structural integrity.

It is noted that assessments of vibration impacts are predicted probable impacts. As the extent of vibration impacts is uncertain, and is heavily influenced by construction method, these impacts have been separated from other direct impacts to provide clarity in management response.

A conservative vibration damage screening level of 7.5 millimetres per second peak particle velocity has been adopted for the assessment. This screening level has been established with reference to the minor cosmetic damage criteria in *British Standard BS 7385:2-1993*. The vibration levels specified in this standard are designed to minimise the risk of threshold or cosmetic surface cracks and are set well below the levels that have potential to cause damage to the main structure.

The recommended screening level of 7.5 millimetres per second peak particle velocity is also applicable to heritage items unless it is known that the item is structurally unsound – in which case, a lower screening level may be applicable.

During main tunnelling work, it is anticipated that ground-borne vibration associated with tunnel boring machine would be much lower than 7.5 millimetres per second peak particle velocity screening level. As such the study area for assessment of potential impacts to heritage items does not extend to areas above the tunnel alignment that are outside the nominated study area for each construction site.

### Settlement impacts

Settlement caused by groundwater drawdown and ground movement from tunnelling and excavation activities can also potentially cause damage to structures. This would involve differential settlement of the ground surface below buildings which could potentially affect the structural integrity of those buildings.

A high level assessment of potential ground movement along the proposal alignment was carried out, as described in Chapter 14 (Groundwater and ground movement) of the EIS. Preliminary settlement contours were developed for the proposal to identify the expected zone of influence and magnitude of induced settlement from construction. Ground surface settlement contour intervals at five millimetres were developed to estimate the range of ground movement. The one millimetre settlement contour was also included to indicate the likely extent of ground movement. For the purposes of undertaking preliminary impact assessments, the five millimetres ground surface vertical settlement contour has been defined as the likely zone of influence. Any existing buildings, infrastructure and utilities located within the likely zone of influence have been assessed within the primary impact assessment. Where items are outside the likely zone of influence, no further assessment is required. Within the likely zone of influence, buildings have been assessed using a different approach to infrastructure and utilities.

For assessment of potential settlement in relation to listed heritage buildings, risk based criteria (refer to Table 1) were used. These criteria are outlined by the Construction Industry Research and Information Association (1996) and were used to assist with preliminary ground movement risk levels. The criteria in the table specify the maximum settlement of the building and the maximum slope of the ground below building foundations for each risk level.

Based on a preliminary assessment using a conservative approach, the identified existing buildings, infrastructure and utilities currently fall within risk category 1 or 2 where the damage is negligible or slight. Further assessments at later design stages and during detailed construction planning would be undertaken to check the preliminary findings and are likely to include more sophisticated methods of assessing ground movement, investigating the existing structural condition of the asset, calculating building and infrastructure strain, undertaking structural assessments, and developing mitigation measures to address potential impacts supported by detailed instrumentation and monitoring.

**Table 1: Ground movement risk levels**

Risk	Description	Potential maximum slope of building	Potential maximum settlement (millimetres)
1	Negligible: Superficial damage unlikely	<1:500	<10
2	Slight: Possible superficial damage that is unlikely to have a structural significance	1:500 to 1:200	10 to 50
3	Moderate: Expected superficial damage and possible structural damage to buildings, possible damage to rigid pipelines	1:200 to 1:50	50 to 75
4	High: Expected structural damage to buildings. Expected damage to rigid pipelines, possible damage to other pipelines	>1:50	>75

## Impacts of the approved project

The impacts of the approved project to heritage items located within the 25m buffer of the Hunter Street Station eastern construction site were summarised in EIS Chapter 8 Non-Aboriginal Heritage, with an in depth assessment located in EIS Technical Paper 3 Non-Aboriginal Heritage.

## Impacts of the proposed change

Sydney Metro engaged SLR Consulting in August 2022 to undertake analysis of noise and vibration impacts associated with the proposed changes at Hunter Street (Sydney CBD) eastern construction site.

SLR Consulting findings are as follows in relation to noise and vibration:

*The Sydney Metro CNVS states that heritage buildings and structures should be assessed using the cosmetic damage screening criteria and should not be assumed to be more sensitive to vibration unless found to be structurally unsound.*

*Where heritage buildings or and structures are found to be structurally unsound a more conservative cosmetic damage objective of 2.5 mm/s Peak Particle Velocity (PPV) (from DIN 4150) should be considered. There are no heritage buildings or structures identified to require consideration of the 2.5 mm/s cosmetic damage screening criterion within the vicinity of the Hunter Street Station eastern construction site.<sup>1</sup>*

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The noise and vibration analysis did not identify any exceedances of the 7.5 mm/s PPV criteria at any heritage buildings in the vicinity of the Hunter Street Station eastern construction site.

The proposed changes are not predicted to result in any additional ground-borne noise and vibration impacts at the neighbouring properties at the Hunter Street (Sydney CBD) eastern construction site.

No neighbouring properties at the Hunter Street (Sydney CBD) eastern construction site would exceed the cosmetic damage screening vibration criteria during tunnelling. This is consistent with the approved project.

In light of these findings the following has been assessed as the potential adverse impacts to the heritage items within the 25m buffer zone of the Hunter Street Station eastern construction site (Table 2).

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<sup>1</sup> SLR Consulting, Sydney Metro West Hunter Street Tunnelling Consistency Assessment Noise and Vibration assessment, September 2022

**Table 2: Summary of heritage impacts to items in or near the Hunter Street Station (Sydney CBD) eastern construction site**

Item	Address	Listing	Significance	Approved SMW Stage 2 potential impact	Potential impact as a result of proposed change	Summary of Consistency Assessment Impacts
<b>Bennelong Stormwater Channel No 29A</b>	Various locations across Sydney	<ul style="list-style-type: none"> <li>• Sydney Water s170 Item no. 4570854</li> </ul>	Local	<p>Direct impact: Neutral</p> <p>Potential direct impact: Moderate (vibration), Further assessment required (settlement)</p> <p>Indirect impact: Neutral</p> <p>Overall impact: Moderate</p>	<p>Direct impact: Neutral</p> <p>Potential direct impact: Moderate (vibration), Further assessment required (settlement)</p> <p>Indirect impact: Neutral</p> <p>Overall impact: Moderate</p>	Unchanged
<b>NSW Club House Building</b>	31 Bligh Street, Sydney	<ul style="list-style-type: none"> <li>• SHR Item no. 00145</li> <li>• SLEP 2012 Item no. I1676</li> <li>• RNE Place Id 2206</li> <li>• NTR no. 6092</li> </ul>	State	<p>Direct impact: Negligible</p> <p>Potential direct impact: Moderate (vibration), Minor (settlement)</p> <p>Indirect Impact: Negligible (views and vistas)</p> <p>Overall impact: Minor</p>	<p>Direct impact: Negligible</p> <p>Potential direct impact: Moderate (vibration), Minor (settlement)</p> <p>Indirect Impact: Negligible (views and vistas)</p> <p>Overall impact: Minor</p>	Unchanged

Item	Address	Listing	Significance	Approved SMW Stage 2 potential impact	Potential impact as a result of proposed change	Summary of Consistency Assessment Impacts
<b>Former Bank – Delfin House</b>	16 O'Connell Street, Sydney	<ul style="list-style-type: none"> <li>SLEP 2012 Item no. I1903</li> <li>RNE Place ID 2206</li> <li>NTR no. 6403</li> </ul>	Local	<p>Direct impact: Negligible</p> <p>Potential direct impact: Moderate (vibration), Minor (settlement)</p> <p>Indirect impact: Negligible (views and vistas)</p> <p>Overall impact: Moderate</p>	<p>Direct impact: Negligible</p> <p>Potential direct impact: Moderate (vibration), Minor (settlement)</p> <p>Indirect impact: Negligible (views and vistas)</p> <p>Overall impact: Moderate</p>	Unchanged
<b>Public Trust Office</b>	19-21 O'Connell Street, Sydney	<ul style="list-style-type: none"> <li>SHR item no. 01019</li> <li>Department of Justice and Attorney General s170 Register (2011) [no item no. provided]</li> <li>SLEP 2012 item no. I1904</li> </ul>	State	<p>Direct impact: Neutral</p> <p>Potential direct impact: Neutral (vibration), Negligible (settlement)</p> <p>Indirect Impact: Negligible (views and vistas)</p> <p>Overall impact: Negligible</p>	<p>Direct impact: Neutral</p> <p>Potential direct impact: Neutral (vibration), Negligible (settlement)</p> <p>Indirect Impact: Negligible (views and vistas)</p> <p>Overall impact: Negligible</p>	Unchanged

Item	Address	Listing	Significance	Approved SMW Stage 2 potential impact	Potential impact as a result of proposed change	Summary of Consistency Assessment Impacts
<b>Former Wales House</b>	64-66 Pitt Street, Sydney	<ul style="list-style-type: none"> <li>• SHR item no. 00586</li> <li>• SLEP 2012 item no. 11915</li> <li>• RNE Place ID 1841</li> <li>• NTR no. 6543</li> <li>• AIA listing no. 4700660</li> </ul>	State	<p>Direct impact: Neutral</p> <p>Potential direct impact: Neutral (vibration), Minor (settlement)</p> <p>Indirect Impact: Minor (views and vistas)</p> <p>Overall impact: Minor</p>	<p>Direct impact: Neutral</p> <p>Potential direct impact: Neutral (vibration), Minor (settlement)</p> <p>Indirect Impact: Minor (views and vistas)</p> <p>Overall impact: Minor</p>	Unchanged



The following has been assessed for the potential adverse impacts to the heritage items above the proposed revised tunnel alignment (Table 3).

**Table 3: Summary of heritage impacts to items in or near the Hunter Street Station (Sydney CBD) eastern construction site as a result of the proposed changes**

Item	Address	Listing	Significance	Approved SMW Stage 2 potential impact	Potential impact as a result of proposed change	Summary of Consistency Assessment Impacts
<b>Former 'Qantas House'</b>	68-96 Hunter Street, Sydney	<ul style="list-style-type: none"> <li>• SHR item no. 01512</li> <li>• SLEP 2012 item no. I1811</li> </ul>	State	Neutral (Vibration)	Neutral (Vibration)	Unchanged
				Negligible (settlement)	Negligible (settlement)	
				Overall impact: Negligible	Overall impact: Negligible	
<b>Wentworth Hotel</b>	2 Bligh Street (and 61-101 Phillip Street), Sydney	<ul style="list-style-type: none"> <li>• SLEP 2012 item no. I1674</li> </ul>	Local	Neutral (Vibration)	Neutral (Vibration)	Unchanged
				Negligible (settlement)	Negligible (settlement)	
				Overall impact: Negligible	Overall impact: Negligible	
<b>Chifley Square</b>	Chifley Square, Sydney	<ul style="list-style-type: none"> <li>• SHR item no. 01512</li> <li>• SLEP 2012 item no. I1708</li> </ul>	State	Neutral (Vibration)	Neutral (Vibration)	Unchanged
				Outside the zone of influence for potential settlement impacts and unlikely to be impacted	Outside the zone of influence for potential settlement impacts and unlikely to be impacted	
				Overall impact: Negligible	Overall impact: Negligible	

Item	Address	Listing	Significance	Approved SMW Stage 2 potential impact	Potential impact as a result of proposed change	Summary of Consistency Assessment Impacts
<b>Terrace house 'Horbury House'</b>	171-173 Macquarie Street, Sydney	<ul style="list-style-type: none"> <li>SLEP 2012 Item no. 11877</li> </ul>	Local	Neutral (Vibration) Negligible (settlement) Overall impact: Negligible	Neutral (Vibration) Negligible (settlement) Overall impact: Negligible	Unchanged
<b>Shakespeare Place</b>	Shakespeare Place, Sydney	<ul style="list-style-type: none"> <li>SLEP 2012 item no. 11949</li> </ul>	Local	Neutral (Vibration) Negligible (Settlement) Overall impact: Negligible	Neutral (Vibration) Negligible (Settlement) Overall impact: Negligible	Unchanged
<b>State Library of NSW</b>	1 Shakespeare Place, Sydney	<ul style="list-style-type: none"> <li>SHR item no. 01071</li> <li>Department of Education s170 register (no item number retrievable)</li> <li>SLEP 2012 item no. 01071</li> <li>RNE Place ID 1847</li> <li>NTR no. 6386</li> </ul>	State	Neutral (Vibration) Slight (Settlement) Overall impact: Minor	Neutral (Vibration) Slight (Settlement) Overall impact: Minor	Unchanged

Item	Address	Listing	Significance	Approved SMW Stage 2 potential impact	Potential impact as a result of proposed change	Summary of Consistency Assessment Impacts
<b>Royal Botanical Gardens and Domain (including Governor's Domain and Civic Precinct)</b>	Sydney	<ul style="list-style-type: none"> <li>NHL Place ID 106103</li> <li>SHR item no. 01070</li> <li>SLEP 2012 item no. 11653</li> <li>RNE Place ID 1863</li> <li>NTR no. 6489</li> </ul>	National	<p>Neutral (Vibration)</p> <p>Outside the zone of influence for potential settlement impacts and unlikely to be impacted (Settlement)</p> <p>Overall impact: Neutral</p>	<p>Neutral (Vibration)</p> <p>Outside the zone of influence for potential settlement impacts and unlikely to be impacted (Settlement)</p> <p>Overall impact: Neutral</p>	Unchanged

## Conclusion and Mitigation Measures

It has been assessed that the proposed changes to the approved project (*Sydney Metro West Stage 2 – Major civil construction between The Bays and Sydney CBD*) at the Hunter Street Station eastern construction site and revised tunnel alignment are generally minor in nature and are generally within the approved project corridor, extending partially outside the approved Hunter Street Station (Sydney CBD) eastern construction site boundary, and past the approved project corridor into The Domain. The works are consistent with the objectives of the approved project.

The proposed changes have been assessed by Artefact Heritage to confirm the potential to impact to surrounding heritage items as a result of change in excavation and tunnelling requirements – which has the potential to impact heritage items through vibration and ground settlement. It has been determined that vibration and settlement impacts are consistent with those assessed for the approved project, and would therefore not have any additional impacts on these heritage items.

As shown in Table 3, this assessment has determined that the potential impacts associated with the proposed changes would be consistent with the impacts identified for the approved project as described in the Non-Aboriginal Heritage Technical Paper 3 appended to the EIS.<sup>2</sup> As a result, there would be no additional adverse direct or indirect impacts to the significant heritage items within the 25m buffer zone around the Hunter Street Station eastern construction site and to items above the tunnel alignment. There would be no increase in cumulative impacts as a result of the proposed change in scope.

The following mitigation measures (Table 4) which were outlined in the Stage 2 EIS Non-Aboriginal Heritage Technical Paper would remain applicable for the works proposed in this Consistency Assessment.

**Table 4: Summary of Non-Aboriginal heritage impact management measures**

Reference	Impact	Mitigation measure	Applicable location(s) <sup>3</sup>
NAH8	Ground movement and settlement assessment	Further assessments at later design stages and during detailed construction planning would be undertaken to check the preliminary findings of the ground movement assessment in relation to listed heritage buildings. Other listed heritage infrastructure would also be subject to such further assessment of ground movement where identified as being required in Technical Paper 3 (Non-Aboriginal heritage).	Pymont Station construction sites Hunter Street Station (Sydney CBD) construction sites Tunnel alignment
NAH9	Monitoring	Where required, heritage items identified by NAH8 as requiring further assessment should undergo instrumentation and monitoring as part of further assessments and during the work.	Pymont Station construction sites Hunter Street Station (Sydney CBD) construction sites

<sup>2</sup> Artefact Heritage, *Sydney West Metro – Major civil construction work between The Bays and Sydney CBD: Non-Aboriginal Heritage Technical Paper*, October 2022