Melbourne Metro Rail Project

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Environmental Risk Assessment Report (Risk Register)

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Appendix A – Specific Consequence Criteria

1 Introduction

The Melbourne Metro Rail Project (Melbourne Metro) is one of the largest infrastructure projects to be undertaken in Australia. The project provides the foundation for further expansion of Melbourne's public transport network, helping to ensure Melbourne remains one of the world's most liveable cities now and into the future. Melbourne Metro would also catalyse significant urban renewal in a number of places, opening up opportunities for new housing, commercial development and jobs close to the city centre.

The Victorian Minister for Planning determined on 2 September 2015 that Melbourne Metro should be assessed through an Environment Effects Statement (EES). The Scoping Requirements for the EES states that the EES preparation should be consistent with the principles of a systems and risk-based approach, therefore a risk assessment has been undertaken to inform the specialist impact assessments and the approach is described in this report. The risk assessment process to be adopted for an EES is not prescribed in legislation or the Ministerial Guidelines for an EES, therefore MMRA has adopted a risk assessment process based on Risk Management Standard AS/NZS ISO 31000:2009.

1.1 Overview of the Environmental Risk Assessment Approach

An environmental risk is different from an environmental impact. Environmental risk is a function of the likelihood of an adverse event occurring and the consequence of the event. An environmental impact relates to the outcome of an action in relation to values of a resource or sensitivity of a receptor. Benefits are considered in an impact assessment but not in a risk assessment. An environmental impact assessment must be informed by an environmental risk assessment so that the level of action taken to avoid, minimise and mitigate the risk reduces impacts where possible.

As shown in Figure 1-1, the environmental risk assessment is an integral component of the project design and development, with the key output being a reduction in risks through the deployment of activities which would lower the potential impacts. These recommended Environmental Performance Requirements are embedded in the Environmental Management Framework which would guide the design, construction and operation of Melbourne Metro.

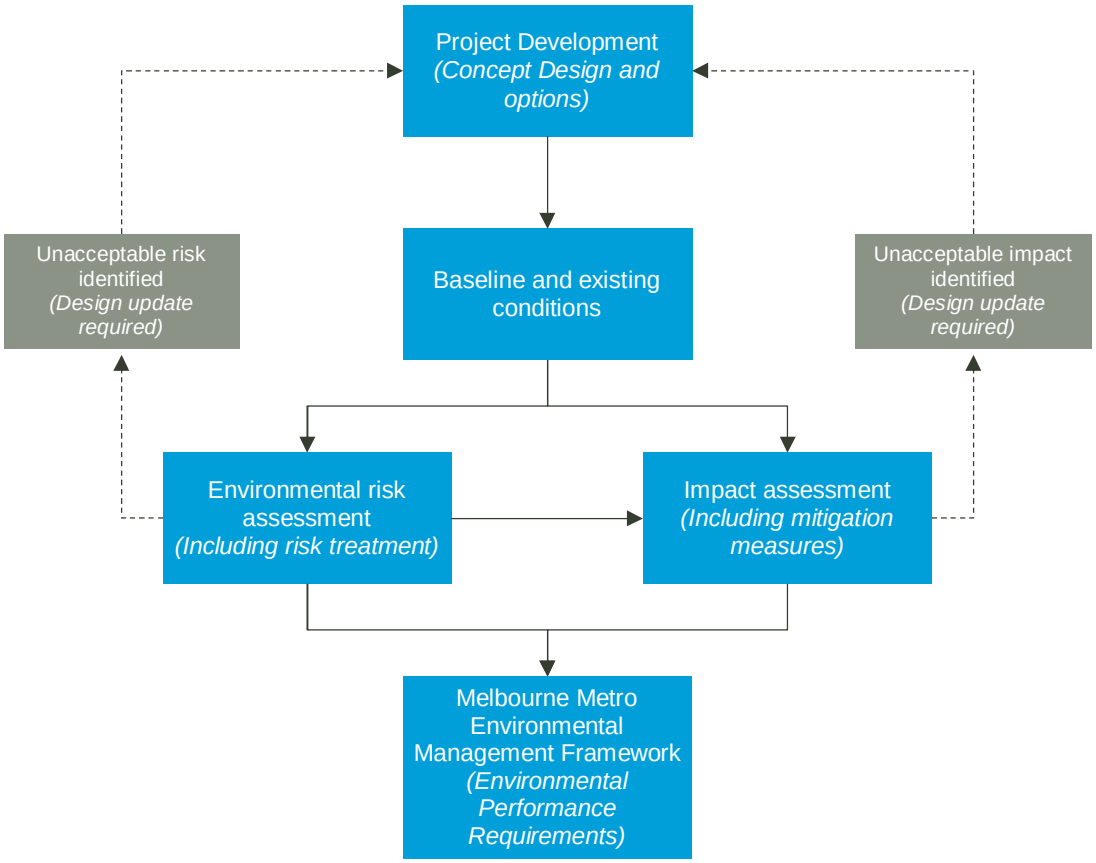

Figure 1-1 Risk and impact assessment process

Planning for Melbourne Metro incorporates three key components:

- Describing the Concept Design and alternative design options
- The environmental impact assessment process, underpinned by a risk assessment
- The recommended Environmental Performance Requirements to avoid mitigate or manage risks.

Together, these concepts are known as the 'project description', as shown in Figure 1-2.

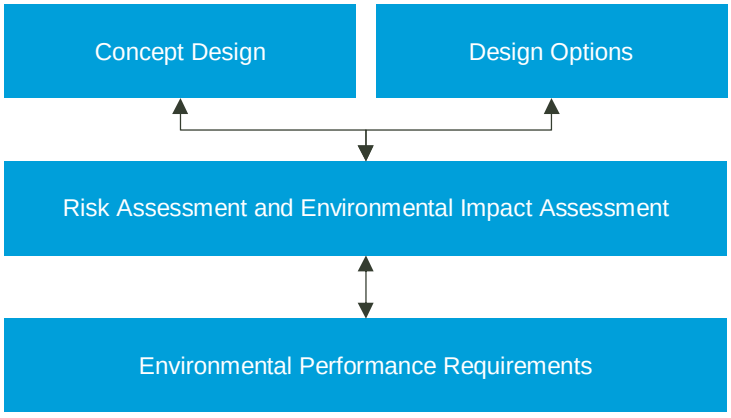

Figure 1-2 Project Description

1.2 Concept Design

The Concept Design (and alternative design options) for Melbourne Metro demonstrates a technically feasible way for the project to achieve the Victorian Government's Project Objectives and meet the recommended Environmental Performance Requirements. It provides the basis for the EES to assess the potential environmental risks and impacts of Melbourne Metro and demonstrate that the impacts associated with the Concept Design can be managed.

The Concept Design is not intended to be the final design for Melbourne Metro. Refinements to the Concept Design are anticipated to occur primarily within the proposed project boundary by the parties who are ultimately contracted by the State to develop Melbourne Metro. This is however on the basis that the final design meets the approved Project Objectives and the recommended Environmental Performance Requirements within the endorsed Environmental Management Framework.

The risk assessment process, as described in this report, was applied to the Melbourne Metro Concept Design, as described in EES Chapter 6 *Project Description*.

1.3 Objectives of the Environmental Risk Assessment

The objective of the environmental risk assessment undertaken for the EES was to identify key social, environmental and business risks associated with the construction and operation of Melbourne Metro, based on the Concept Design (as described in EES Chapter 6 *Project Description*) and to develop management and mitigation measures to reduce these risks where possible. The specific objectives of the risk assessment were to:

- Identify impact pathways and key project environmental risks which require detailed investigation
- Guide the level of investigation and formulation of recommended Environmental Performance Requirements in response to the relative risks
- Facilitate a consistent approach to the environmental risk assessment process across each of the specialist investigations for the project as a whole.

The environmental risk assessment considered the risks associated with the following 17 specialist areas:

- Aboriginal cultural heritage
- Air quality
- Arboriculture
- Aquatic ecology and river health
- Business
- Greenhouse Gas (GHG) emissions
- Groundwater
- Ground movement and land stability
- Historical cultural heritage
- Land contamination and spoil management
- Land use and planning
- Landscape and visual
- Noise and vibration
- Social and community
- Surface water
- Terrestrial ecology
- Transport

This risk assessment has informed the development of the Environmental Management Framework (EMF) and hence the recommended Environmental Performance Requirements, which provide the framework for implementing proposed mitigation measures to achieve compliance with regulatory requirements, alignment with government policy and a strategy to deliver Melbourne Metro.

1.4 Environmental Performance Requirements

The recommended Environmental Performance Requirements have been developed through the EES to address the environmental risks and impacts identified in the Environmental Risk Assessment of the Concept Design. The performance-based approach that forms the recommended Environmental Performance Requirements aims to achieve outcomes that provide a net community benefit, while allowing for a delivery model with sufficient flexibility to encourage innovation by the private sector to determine how the recommended Environmental Performance Requirements would be achieved. The Environmental Management Framework outlines clear accountabilities for the delivery and monitoring of the implementation of Environmental Performance Requirements so that the environmental effects and hazards of the project would be managed.

2 Method

2.1 Overview

The risk assessment process adopted was based on *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*. This provides a structured approach for the risk assessment and is widely used for EESs. An overview of the risk assessment process is illustrated in Figure 2-1.

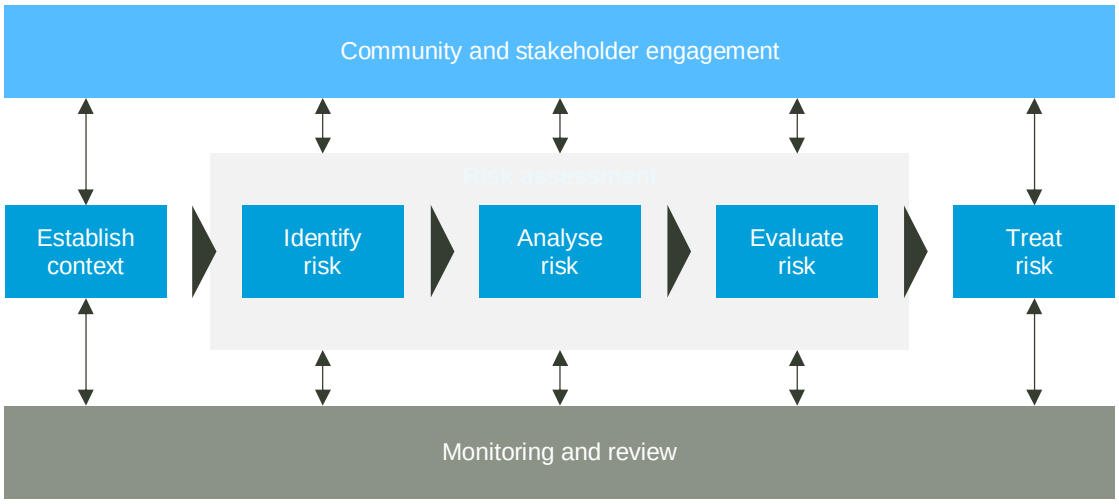

Figure 2-1 Overview of AS/NZS ISO 31000-2009 Risk Process

In applying the steps outlined above, the detailed risk assessment process for the Melbourne Metro EES is illustrated in Figure 2-2. It shows the key inputs (i.e. existing assets and values of the environment; community and stakeholder inputs, detailed investigations) and outputs (i.e. initial risk register, final risk register) that are all integral to the risk assessment process.

A description of the risk assessment methodology is provided in the following sections.

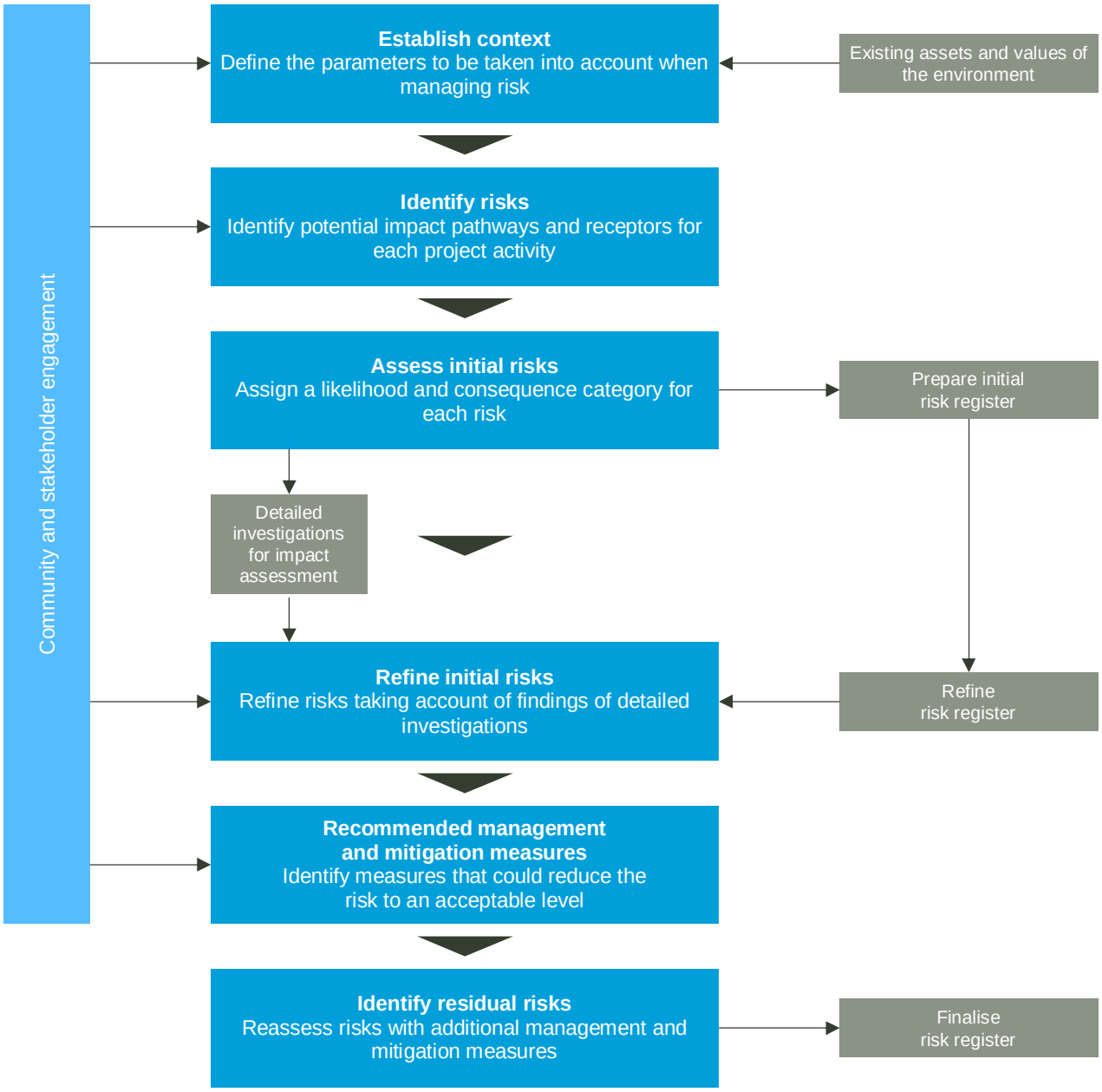

Figure 2-2 Detailed risk assessment process

2.2 Definitions

Definitions of key terms used in the risk assessment include:

- Risk – A function of the likelihood of an adverse event occurring and the consequence of the event. Risk is a condition involving exposure to events that would have an adverse impact, in this case, on the biophysical, social or business elements of the environment.
- Consequence – The most credible outcome that could occur if exposure to the hazard occurs.
- Likelihood – The chance of something happening; as a general guide, likelihood can be described as the probability or frequency of an event occurring.
- Impact pathway – The cause and effect 'pathway' that exists between a particular project activity and a component of the environment. It describes how aspects of project construction and operation interact with assets, values and uses.

- Existing performance requirements – Existing controls used to inform the assessment of initial risk ratings. These existing controls are based on statutory requirements, aspects that are inherent in the project design and standard requirements that are typically incorporated into construction contracts for rail projects.
- Initial risk – The risk prior to the application of treatment, other than measures inherent in the standard project design. Risk treatment / Environmental Performance Requirements – Recommended process to reduce the initial risk to an acceptable residual risk level.
- Residual risk – The risk remaining after applying risk treatment or control measures to the initial risk.

2.3 Establish the Context

The approach to establishing the context for the environmental risk assessment is outlined in Table 2-1.

Table 2-1 Approach to establishing the risk context

#	Approach to establishing the risk context	Refer
1	Defining the project design and construction approach	The detailed description of the design and construction approach is provided in EES Chapter 6 *Project Description*
2	Defining inherent controls, and relevant legislation, policy and guidelines	A full listing and explanation of legislative requirements, policy and guidelines is provided in EES Chapter 3 and impact assessment reports
3	Defining the external environment in which the Melbourne Metro Rail Authority (MMRA) would undertake the project (existing conditions) including consideration of the local and regional scale for the assessment	The risk context statement describing the project and external environment is provided in Section 3. It should be noted that this is an overarching context, with detailed context provided within the impact assessment reports.
4	Developing project specific risk criteria to be used for evaluating the significance of risk (i.e. likelihood and consequence criteria)	The approach to developing the likelihood and consequence criteria is provided in Section 2.3.1

2.3.1 Likelihood and consequence criteria

A risk is determined by the likelihood of an event occurring and the consequences of that event. Descriptions for the range of possible consequences and likelihoods were established in consultation with key technical specialists (e.g. surface water engineers, ecologists, etc.). These were influenced by the requirements of relevant legislation and guidelines, as well as the draft evaluation objectives for the EES defined in the EES Scoping Requirements. The outcome was the development of criteria that were reasonable and representative for their given disciplines.

The likelihood criteria framework is shown in Table 2-2 and contains a general description of the probability or frequency of an event occurring.

Table 2-2 Likelihood rating criteria

Level	Description
Rare	The event is very unlikely to occur but may occur in exceptional circumstances
Unlikely	The event may occur under unusual circumstances but is not expected
Possible	The event may occur once within a five-year timeframe
Likely	The event is likely to occur several times within a five-year timeframe

Level	Description
Almost Certain	The event is almost certain to occur one or more times a year

The consequence criteria framework used in the risk assessment is shown in Table 2-3. Each specialist has used this framework to develop criteria specifically for their assessment. The full suite of specific consequence criteria is provided in Appendix A.

Table 2-3 Consequence framework

Level	Qualitative description of biophysical/ environmental consequence	Qualitative description of socio-economic consequence
Negligible	No detectable change in a local environmental setting	No detectable impact on economic, cultural, recreational, aesthetic or social values
Minor	Short term, reversible changes, within natural variability range, in a local environmental setting	Short term, localised impact on economic, cultural, recreational, aesthetic or social values
Moderate	Long term but limited changes to local environmental setting that are able to be managed	Significant and/or long-term change in quality of economic, cultural, recreational, aesthetic or social values in local setting. Limited impacts at regional level.
Major	Long term, significant changes resulting in risks to human health and/or the environment beyond the local environmental setting.	Significant, long-term change in quality of economic, cultural, recreational, aesthetic or social values at local, regional and State levels. Limited impacts at national level.
Severe	Irreversible, significant changes resulting in widespread risks to human health and/or the environment at a regional scale or broader	Significant, permanent impact on regional economy and/or irreversible changes to cultural, recreational, aesthetic or social values at regional, State and national levels

2.4 Identify Risks and Impact Pathways

The impact pathway describes the cause and effect that exists between a particular project activity and a component of the environment. It defines the 'path' to the risk by describing how aspects of project construction and operation interact (adversely) with assets, values and uses.

Technical specialists in each of the 17 disciplines were tasked with identifying risks and impact pathways in their area of specialty, considering the design, construction and through-life operational phases of Melbourne Metro. Risks and impact pathways were identified via the following methodology:

- Assessment of existing environmental conditions within the Melbourne Metro area to determine assets, values and uses. This was primarily undertaken as part of earlier baseline studies.
- Assessment of Melbourne Metro's potential impacts on these assets, values and uses within the Melbourne Metro area and wider where applicable. This involved developing an understanding of all aspects of the Concept Design – including location of alignment and infrastructure; proposed construction methodology; operational function; etc. This information was provided to technical specialists at the inception of the detailed investigations which allowed the impact pathways to be developed and initial risks identified.
- Risks were recorded and consolidated into the Environmental Risk Register. Each risk was assigned a level of 'data certainty', to identify the reliability of the data used to identify risks and the level of certainty

of predictions. Linkages were also established for each risk where applicable, to recognise connections to other specialist areas (e.g. the risk of discharge offsite of contaminated groundwater has linkages between contaminated land, groundwater and river health).

- The initial risks were then assessed in a facilitated workshop environment (see Section 2.5).
- Additional risks were identified through the risk assessment process, taking into account modifications to the Concept Design, findings from modelling and data analysis and outcomes of stakeholder and community engagement.

2.5 Assess Initial Risks

Risk ratings were established for each impact pathway by technical specialists assigning a level of likelihood in accordance with the likelihood rating criteria shown in Table 2-2 and assigning levels of consequence in accordance with the consequence criteria provided in Appendix A.

The likelihood of the risk occurring took into account the probability of the maximum credible consequence as described in the Consequence Table, assuming the planned controls specified in the project description are in place and operating at their expected level of performance. A base level of mitigation is inherent through the implementation of standard Melbourne Metro environmental management controls. The adequacy of these controls to manage the risk was considered when assigning the likelihood rating.

A series of facilitated risk workshops were conducted to analyse the risks identified in the Environmental Risk Register.

i) Risk Workshop 1 was held on 24 September 2015 and was attended by lead practitioners from the following disciplines:
   - Terrestrial flora and fauna
   - Aquatic ecology
   - Surface water
   - Contaminated land and spoil management
   - Arboriculture
   - Groundwater
   - Geotechnical (ground movement)

ii) Risk Workshop 2 was held on 1 October 2015 and was attended by lead practitioners from the following disciplines:
   - Air quality
   - Greenhouse gas emissions
   - Historic heritage
   - Landscape and visual
   - Aboriginal cultural heritage
   - Noise and vibration
   - Transport
   - Land use and planning
   - Social and community
   - Business

In analysing the risks, the aim of the workshops was to:

- Provide more certainty that all risks of relevance were identified
- Enable the sharing of knowledge and information in order to identify inter-disciplinary pathways and interactions
- Provide greater understanding of the identified risks.

2.6 Refine Initial Risks

Through the course of the detailed impact studies, risks were further evaluated and refined through:

- Taking account of findings and outcomes from modelling, data analysis, stakeholder interviews, community engagement sessions, etc.
- Consideration of the tolerance of the risks borne
- Consideration of legal, regulatory and other requirements
- Consideration of risks which may not require additional treatment (beyond existing controls)

In some cases, risk evaluation has led to further analysis being undertaken.

In developing the risk-based approach for the EES, project specific consequence criteria were developed to be appropriately detailed and allow for assessment of the project across the range of disciplines being considered in the EES.

The degree of risk was established by considering its constituent components of likelihood and consequence in the matrix shown in Table 2-4. A risk event may pose a 'high' risk because it is likely to occur frequently, although the consequences may not be substantial for any single event. A risk event may also pose a 'high' risk if it has a low likelihood of occurrence but the magnitude of consequences would be substantial. A risk event that poses a 'very high' risk would represent both a high likelihood of occurrence and substantial consequences.

Through the development of the consequence criteria for each of the specialist disciplines, the risk matrix was continually tested to check its relevance.

Table 2-4 Risk Matrix

		Consequence rating				
		Negligible	**Minor**	**Moderate**	**Major**	**Severe**
Likelihood rating	**Rare**	Very Low	Very Low	Low	Medium	Medium
	Unlikely	Very Low	Low	Low	Medium	High
	Possible	Low	Low	Medium	High	High
	Likely	Low	Medium	Medium	High	Very High
	Almost Certain	Low	Medium	High	Very High	Very High

2.7 Recommend Treatment and Identify Residual Risks

Specific mitigation and management measures have been identified and residual risks determined based on the mitigation proposed. For the EES, the mitigation measures are the recommended Environmental Performance Requirements, to which proposed mitigation measures have been developed to form part of the

Environmental Management Framework, guiding development which achieves compliance with the Environmental Performance Requirement. The iterative risk assessment process involved:

- The initial risk ratings provided the identification of areas where additional mitigation or remedial measures were necessary, or where changes to the project were needed to avoid risks. Where initial risks were identified, avoidance, mitigation and management options were considered to lower the risk or reduce the level of risk. The risks were then assessed again to determine the result of the measure being applied. This second rating is known as the 'residual risk rating'.
- Where mitigation measures caused a significant change to the Concept Design, the Concept Design was updated and the impact pathways reassessed as appropriate.

The initial risk ratings also provided a way to screen out the less significant issues which did not require mitigation.

The key risk assessment outcomes of each impact assessment comprised:

- Recommended Environmental Performance Requirements which have been incorporated into the Environmental Management Framework. These were selected based on a range of factors, including:
  - Compliance with relevant legislation, regulations, standards and industry best practice
  - Values and perceptions of stakeholders
  - Balancing cost and effort against benefits derived
  - Risk treatments that are not justifiable, e.g. risks with a high consequence, but rare likelihood
  - Avoiding the creation of additional risks.
- Proposed mitigation measures that could be implemented to achieve the Environmental Performance Requirements
- A completed risk assessment identifying the initial and residual risk ratings.

3 Risk Context

This section describes the context for the environmental risk assessment undertaken to inform the impact assessment for the EES. The context is the setting within which the project is being developed and the risks have been evaluated. To determine the relevant context for the risk assessment an overview of the key design and construction assumptions is provided.

3.1 Key Design and Construction Assumptions

The project components and the level of specification set in the Concept Design is summarised in Table 3-1 and in detail in EES Chapter 6 *Project Description*. The specifications for most components are fixed; however, alternative design options have been proposed for some components to provide for flexibility during project delivery while still allowing for an integrated assessment of Melbourne Metro during the EES process. If further alternative design options were proposed following completion of the EES, these would be subject to a separate impact assessment and approval process. Any additional wider network enhancement works which take advantage of the Melbourne Metro infrastructure, located outside the EES boundary, would also be subject to a separate assessment and approval process.

Table 3-1 Concept Design components and options

Components		Description of components and options
Tunnels	Vertical alignment	The vertical alignment of the Concept Design is largely prescribed by the grade line and connection to Melbourne Central station and Flinders Street Station. The two tunnels would be 9 km long with a diameter of 7 m to 7.5 m. Along the tunnel alignment, the proposed rail level would be typically between 10 m to 40 m below ground level and pass under the existing City Loop tunnels. The deeper vertical alignment within the CBD has been chosen to minimise disruption to the CBD during construction and to avoid the City Loop tunnels. The Concept Design prescribes the use of tunnelling or mined construction methods (between CBD stations) for the tunnel to minimise surface impacts.
	Yarra River crossing	The Concept Design requires a bored tunnel under the river with the alignment largely prescribed based on connection to the CBD South station.
	Crossing of CityLink tunnels (options)	The Concept Design considers options to cross either above or below the CityLink tunnels between CBD South and Domain stations.
	Emergency access shafts (options)	Two shafts may be required. The Concept Design considers alternative locations for each shaft: • Fawkner Park: - North-east section of Fawkner Park or - At the potential TBM southern launch site location at and surrounding the current Fawkner Park Tennis Centre • Linlithgow Avenue: - Queen Victoria Gardens adjacent to Linlithgow Avenue or - Tom's Block adjacent to Linlithgow Avenue The final location and requirement for emergency access shafts would be determined in consultation with the Metropolitan Fire Brigade.

Components		Description of components and options
	TBM launch sites (options for southern launch site)	The Concept Design requires two TBM launch sites. The western TBM launch site is to be at the Arden station site to support construction of the tunnels west of the Yarra River. The southern TBM launch site considers alternative locations: • Single launch site at Domain station box or • Two launch sites at the Domain station box and a defined section in the north-east corner of Fawkner Park (where the tennis courts are located). Both options for the southern TBM launch require tunnelling activities to be supported by a construction work site at Edmund Herring Oval.
Portals (tunnel entrances)	Western portal (Kensington) (options)	The western portal would be located immediately north of the South Kensington station. The Concept Design considers two portal locations, which consider variations in vertical and horizontal alignments that are influenced by the position of the tunnel entrance / exit point (the portal). A number of options were considered, but only two options have been assessed in the EES (see Chapter 5 *Project Development* for further discussion of options considered). One option positions the portal within the council reserve on the south side of Childers Street directly to the west of the South Kensington station subway entrance located opposite Ormond Street. The second alternative design option positions the portal within the council reserve on the south side of Childers Street approximately 150 m west of the South Kensington station subway entrance located opposite Ormond Street, with a longer decline structure to enter the tunnel and a bridge over Kensington Road.
	Eastern portal (South Yarra)	The Concept Design is prescribed regarding the location of the eastern portal and is influenced by design standards required for crossing of the Sandringham and Frankston rail lines. A TBM retrieval box (incorporating other plant) would be required in the rail reserve between Osborne Street, South Yarra and the existing Sandringham Line.
Underground stations	Arden	The Concept Design is prescribed regarding station location (between Arden and Queensberry Streets, contained within publicly owned land) and construction method (bottom-up cut and cover station box construction). Initially, the station would have an entrance located on Laurens Street. There would be provision for a future second entrance located approximately 120 m south of Arden Street, in line with a future southward extension of Fogarty Street.
	Parkville (construction options)	The Concept Design is prescribed regarding the station location (under the Grattan Street road reserve, to the east of Royal Parade) and considers two possible construction options: top-down cut and cover construction or bottom-up cut and cover construction. Two entrances would be located at the University of Melbourne, one on the corner of Royal Parade and one on Grattan Street. A further entrance would be located outside the Victorian Comprehensive Cancer Centre (near the corner of Royal Parade). A tram stop would be located in Royal Parade, just north of Grattan Street.
	CBD North	The Concept Design is prescribed regarding the station location (under Swanston Street, between Franklin and La Trobe Streets) and construction method (mined cavern). One entrance would be located on Franklin Street, to the east of Swanston Street, and another entrance would be located on the corner of Swanston and La Trobe Streets, with an underground connection to Melbourne Central station. A plant room would be located under Franklin Street (between Swanston and Bowen Streets).

Components		Description of components and options
	CBD South	The Concept Design is prescribed regarding the station location (under Swanston Street, between Collins and Flinders Streets) and construction method (mined cavern). One entrance would be located on Collins Street at City Square and one entrance would be located on Flinders Street, opposite to and with an underground connection to Flinders Street Station. There would be an underground entrance connection to Federation Square.
	Domain	The Concept Design is prescribed regarding the station location (under St Kilda Road, adjacent to Albert Road) and construction method (cut and cover, with a mix of top-down and bottom-up). The station would have three entrances: within the Shrine of Remembrance Reserve, within the Domain tram interchange in St Kilda Road and within open space between Albert Road and St Kilda road where the South African Soldiers Memorial is located.
Turnback	Western turnback at West Footscray	The Concept Design is prescribed regarding the locations of the turnback and the requirement for a third platform and track at West Footscray station, with modifications to the existing concourse.
Electrical substation	Arden (options)	The Concept Design considers four options: • North of Arden Street, between CityLink to the west and Langford Street to the east • Co-location at Metro Trains Melbourne traction substation between CityLink and the Upfield line • Southern section of the Arden Station precinct, between rail to the west and Laurens Street to the east • In the existing 50 Lloyd Street Business Estate at the eastern corner of Childers and Tennyson Streets (dependent on the western portal option).

EES Chapter 6 *Project Description* provides a detailed listing of design and construction methodology assumptions. Impact Assessment Reports provide specific assumptions and limitations pertaining to individual impact assessments.

3.2 Context for Specialist Studies

The risk assessment for each specialist area incorporated the following:

- Use of semi-quantitative risk assessment
- Design, construction and operation risks
- Consideration of risks at local, regional and wider scale
- Consideration of environmental, social and business risks
- Financial, program or organisational risks were not considered
- Benefits of the project were not considered as part of risk assessment (however benefits and opportunities have been discussed in each Technical Report as part of the impact assessment)
- Consideration of the reliability of the data used to identify risks. This assists to identify level of certainty of predictions.

The scope of social, environmental and business risks covers 17 specialist areas. The risk context for each specialist area is described in Table 3-2.

Table 3-2 EES specialist studies – context for risk assessment

Discipline	Context
Aboriginal cultural heritage	Melbourne Metro is to be established within the heavily developed environs of the Melbourne CBD. As such, there is low-moderate likelihood of disturbing Aboriginal places. While there has been significant ground disturbance within the Melbourne CBD, prior archaeological assessments have indicated that small numbers of Aboriginal stone artefact scatters are still present underneath city buildings. These Aboriginal Places were found through historical heritage excavation and it is possible that further sites would be discovered in much the same manner. Buildings or roadways with footings/basements or bases that descend into sterile deposits, such as clay, are unlikely to contain Aboriginal heritage. There is one known Aboriginal Place within the area of ground potentially disturbed by construction of Melbourne Metro. For the majority of Melbourne Metro alignment, works would largely be constructed below ground, at depths below potential Aboriginal archaeological deposits. For the construction of stations, portals and other structures near the ground surface, as well as disturbance within construction work areas, the potential to destroy, reduce or intrude upon Aboriginal heritage is largely unknown. There is a higher potential for impact to occur in areas of potential archaeological sensitivity (as defined under the Aboriginal Heritage Regulations 2007), which include areas which are likely to have been most intensively occupied by Aboriginal communities. A Cultural Heritage Management Plan (CHMP) is being prepared in accordance with the *Aboriginal Heritage Act 2006*. A CHMP is a legally binding document that includes cultural heritage assessment, consultation with Aboriginal stakeholders and management recommendations/contingencies put in place to protect Aboriginal cultural heritage.
Air quality	The proposed construction of Melbourne Metro would have the potential to result in air quality impacts resulting from dust from construction work sites and emissions from construction machinery. The operation of Melbourne Metro would involve electric trains running through tunnels and station ventilation involving electric fans. There would be potential for localised air emissions associated with occasional maintenance activities during operation. MMRA would manage potential air quality impacts during both construction and operation through the State Environment Protection Policy (SEPP) for Ambient Air Quality and the SEPP (Air Quality Management), as well as the EPA Environmental Guidelines for Major Construction Sites.
Aquatic ecology and river health	Melbourne Metro is located wholly within the urbanised central area of Melbourne. With approximately 180 years of urban development associated with the evolution of the city, much of the original biodiversity values of its waterways, wetlands and riparian areas have been significantly disturbed, modified or destroyed. The infilling of large areas of estuarine habitat in land reclamation programs in low lying areas and the realignment of water courses to facilitate drainage have all contributed to major changes in the natural character of the area. This has greatly altered, and in large part removed altogether, habitat that supported the rich diversity of species that originally inhabited the area. Relevant major waterways in the study area include: • Maribyrnong River, which is approximately 500 m from the western portal • Moonee Ponds Creek, under which the tunnels would run and which is approximately 100 m from the Arden station • Yarra River, under which the tunnels would run and which is approximately 120 m from the CBD South station. The Yarra River could potentially receive runoff via the stormwater system from the eastern portal at South Yarra • Albert Park Lake, which could potentially receive runoff via the stormwater system from the Domain station • Stony Creek, which could potentially receive runoff via the stormwater system from the western turnback. Melbourne Metro would involve tunnelling under the estuarine section of the Yarra River and Moonee Ponds Creek (bored tunnels with no direct impacts on the waterways). The proposed project boundary is also near to the Maribyrnong River. However, the proposed portal construction, station construction, the western turnback and other works would result in open construction sites with potential for runoff to local drainage systems and hence, to waterways within or beyond the proposed project boundary. All discharges to waterways would require compliance with the State Environment Protection Policy (Waters of Victoria).

Discipline	Context
Arboriculture	The study area lies within and under some of Melbourne's most noted parks and tree-lined avenues, as well as other areas where trees are prominent components of the public realm and are valued by the community. The Melbourne Metro alignment and associated infrastructure potentially interacts with trees at discrete locations, including parks and treed avenues, for the construction of stations, emergency access shafts and construction work sites. Melbourne Metro would be constructed in a manner that minimised tree loss during construction and was aligned with the requirements and outcomes of the following strategies: • Urban Forest Tree Protection Guidelines (City of Melbourne) • Greening Port Phillip: An urban forest approach • City of Stonnington Street Tree Strategy • Conservation Management Plans for significant trees and avenues where applicable.
Business	Melbourne Metro traverses an area containing one of the most significant concentrations of business activity in Australia including the central business district of Melbourne, the education and hospitals precinct at Parkville, the education precinct around RMIT University and the commercial precinct in St Kilda Road. Central Melbourne has evolved and expanded over the past 180 years with almost continuous development and intensification of uses. In total, there is close to 35,000 businesses located within the districts of the CBD, Carlton, North Melbourne, Parkville, South Yarra (East and West), Southbank, and Kensington. This represents just under 10 per cent of the total number of businesses located in Greater Melbourne. A high share of these businesses are large, high value-add, professional services. In terms of 'land users', close to one million people are currently forecast to use the City of Melbourne local government area on a typical weekday, with visitors and workers making up close to 50 per cent and 30 per cent of city users respectively.
Contaminated land and spoil management	With around 180 years of urban development and redevelopment and a wide variety of past and current land uses, many of which would have had the potential to cause contamination of the land and/or groundwater, the proposed Melbourne Metro study area is either known to contain or has the potential to contain contamination of various types. Parts of the project area also contain soil or rock which is known to form acid when exposed to oxygen following excavation. The proposed Melbourne Metro therefore has the potential to disturb contaminated land, groundwater, and acid sulfate soil and rock. The scope of this component of the assessment includes risks associated with transport and disposal of solid wastes from excavation works, including potentially contaminated materials and acid sulfate soils and rock. The proponent would manage potential disposal of contaminated soils and acid sulfate soils and rock in accordance with a Spoil Management Strategy and relevant statutory requirements including the SEPP (Prevention and Management of Contaminated Land), SEPP (Groundwaters of Victoria) and Industrial Waste Management Policy (Waste Acid Sulfate Soils). Disposal of contaminated groundwater would need to be conducted in accordance with the Melbourne Metro Groundwater Disposal Strategy referred to under the interrelated Groundwater section below.
Greenhouse Gas (GHG) emissions	Greenhouse gases (GHGs) absorb the sun's heat in the Earth's atmosphere and when accumulating at increasing levels, contribute to the warming of the planet, with potential adverse consequences into the future. A significant proportion of GHG emissions produced from human activities come from the combustion of carbon-based fuels. GHGs are generated at a local level but have potential impacts at a global level and therefore need to be considered in this context. Melbourne Metro has potential to generate GHGs from use of energy derived from combustion of carbon (e.g. coal, oil or gas). This could occur during construction, for example, emissions from plant and construction equipment, or during operation, from consumption of energy by trains or by station and tunnel ventilation and lighting systems. Operational GHG emissions associated with the project have been considered over the larger Melbourne metropolitan area, given the complexity of the project's influences on the regional ground-based transport network. Best practice GHG abatement measures have been incorporated into the Concept Design (e.g. regenerative braking on trains, regenerative braking on vertical transportation at stations, in-tunnel temperature monitoring and adaptive response for tunnels ventilation) and during construction (e.g. use of biofuels) to reduce GHG emissions across the infrastructure lifecycle of the project.

Discipline	Context
Groundwater	Groundwater can be a valuable resource with a wide range of beneficial uses as described in the SEPP (Groundwaters of Victoria). Due to one or a combination of high salinity or contamination from previous urban activities, the beneficial uses in the central Melbourne area are generally, dependent upon location, restricted to maintenance of ecosystems (if surface water bodies or vegetation is dependent upon groundwater, at least at some times), agriculture, parks and gardens (restricted), stock watering (restricted), industrial water use, primary contact recreation (restricted) and/or buildings and structures. Many Groundwater Quality Restricted Use Zones have been designated by the EPA at sites in the vicinity of the proposed Melbourne Metro alignment, indicating that groundwater is contaminated to an extent that it is not suitable for certain beneficial uses. Disposal of groundwater in accordance with a Groundwater Disposal Strategy which would provide for treatment in accordance with the relevant statutory requirements, Water Industry Regulations 2006, SEPP (Waters of Victoria) and SEPP (Groundwaters of Victoria).
Ground movement and land stability	The proposed Melbourne Metro alignment runs through a number of distinctly different areas of Melbourne, distinguished by different building types, infrastructure, land uses and geological conditions. Buildings, utilities such as sewers and civil infrastructure such as roads, rail lines and bridges could be subjected to the effects of ground movements caused by excavation and construction of the tunnels, stations, shafts and portals (excavation induced settlement) or ground movement due to groundwater drawdown in soft soils (consolidation settlement), as referred to under the inter-related groundwater section above.
Historical heritage	The city and inner suburbs of Melbourne feature a large number of historical heritage places, including buildings, structures, heritage precincts, trees, landscapes and both registered and currently unknown archaeological sites, many of which fall within the Melbourne Metro investigation area and could be affected by the construction of Melbourne Metro. The proposed Melbourne Metro alignment and station and portal 'footprints' have been located to minimise direct impact on heritage places. Potential impacts to heritage places would be managed in accordance with the *Heritage Act 1995*, Conservation Management Plans (where available) and the applicable heritage related provision of the planning schemes.
Landscape and visual	The potential visual catchment for the project is defined as areas that may have views to the components of Melbourne Metro (permanent and temporary structures, construction hoardings, equipment, etc.) during construction and operation, and considers the potential for views to be blocked or screened by topography, built form or vegetation. The degree of visual impact relates to the sensitivity of the viewer and the nature of the land use and landscape. The nature and sensitivity of the potential visual catchment of Melbourne Metro varies significantly along the alignment and ranges from current industrial areas of low sensitivity through areas of parkland and streetscapes of high visual sensitivity. Some of Melbourne's most recognised urban streetscapes, boulevards and parks are within or close to the proposed project area. Melbourne Metro would require the removal of trees in locations such as within St Kilda Road or due to large construction work sites which would not be screened from elevated locations such as high rise buildings. The proponent would ensure that in accordance with the Urban Design Strategy a high standard of building design and landscaping would be delivered as part of Melbourne Metro.

Discipline	Context
Land use and planning	The Melbourne Metro area extends through land containing a diverse range of land uses from Kensington at the north-western end of the tunnel alignment to South Yarra at the south eastern end. It includes retail, commercial, educational, civic and mixed use land within the Melbourne CBD. Outside of the CBD, there is a diversity of land uses including industrial uses in the Arden and Western Portal precincts, residential uses in North Melbourne and South Yarra, education, health and research uses in the Parkville precinct, mixed commercial, residential and educational uses in the Domain precinct and parkland from the Yarra River to the Domain precinct (Alexandria Gardens, Queen Victoria Gardens, the Domain Parklands, Shrine of Remembrance Reserve) as well as Fawkner Park, the Albert Road Reserve, South Yarra Railway Siding Reserve and JJ Holland Park. These land uses have evolved over the past 180 years of development within central Melbourne. Any proposed changes to these existing land uses or applicable planning schemes would be undertaken in accordance with the *Planning and Environment Act 1987*, which provides for the orderly development of land for a range of public and private uses, including the development and control of land for public transport purposes. The provision for Melbourne Metro in the relevant planning scheme provisions is proposed via a planning scheme amendment to be exhibited with the EES. Land use and planning related aspects associated with the construction and operation of Melbourne Metro include issues relating to potential impacts on current and future land use and built form, land acquisition, access and existing planning controls and developments. A high standard of building design and landscaping in accordance with the Urban Design Strategy for the project would result in positive visual impacts of the project in the longer term and potential negative impacts during construction mitigated by fencing.
Noise and vibration	Melbourne Metro is located through the centre of Melbourne and into inner city suburbs of Kensington, North Melbourne, Parkville, Carlton, Melbourne, South Melbourne and South Yarra. The above ground components of Melbourne Metro connect to existing rail lines in highly urbanised environments. The project would be constructed in an environment that includes the busiest tram line in Melbourne (Swanston St/ St Kilda Road), high amounts of traffic and all other modes of transport. The centre of Melbourne is continually undergoing development with high-rise building construction, works on tramways and other public infrastructure a common occurrence. The background noise and vibration levels are therefore already elevated and a key consideration for the risk and impact assessment undertaken for this EES. For airborne noise there are separate sets of criteria in Victoria relating to construction noise, operational noise from trains and operational noise from fixed plant. Airborne noise generated during construction of the project would be managed to comply with EPA Noise Control Guidelines Publication 1254. Airborne noise generated during operation would be managed to comply with the Victorian Passenger Rail Infrastructure Noise Policy 2013. Compliance with the SEPP (Control of Noise from Industry Commerce and Trade) No. N1 would be required for noise from fixed plant post construction. In the absence of Victorian or Commonwealth requirements for managing ground borne noise the conservative NSW Department of Environment & Climate Change Interim Construction Noise Guideline 2009 has been used to provide Guideline Targets for ground borne noise from construction and the NSW EPA Rail Infrastructure Noise Guideline 2013 has been used to provide Guideline Targets for ground-borne noise from trains during operation of Melbourne Metro. In the absence of Victorian or Commonwealth requirements for management of vibration generated during construction, the internationally recognised DIN 4150-3 Structural Vibration Part 3: Effects of Vibration on Structures, 1999 has been used to provide Guideline Targets for vibration impacts on structures from both construction and operation of Melbourne Metro and the NSW Department of Environment & Climate Change Assessing Vibration: A Technical Guideline 2006 has been used to provide Guideline Targets for managing vibration with respect to human comfort.
Social and community	Melbourne Metro is proposed in localities containing a range of communities with varying socio-economic characteristics including Kensington, North Melbourne, Parkville, Carlton, Melbourne, South Melbourne, South Yarra and West Footscray. Stakeholders for a project of such scale and significance include residents, businesses, workers, students, sportspeople, visitors and tourists. The project would not only be of significance to the local community but to communities throughout the Melbourne metropolitan area and beyond, especially to current and future residents along the corridors serviced by the Cranbourne/Pakenham and Sunbury rail lines, which would run through the new tunnels. Social aspects associated with the construction and operation of Melbourne Metro include property acquisition, temporary and longer-term land use changes and temporary transport diversions.

Discipline	Context
Surface Water	The Melbourne Metro alignment and associated infrastructure potentially interface with a number of waterways and drainage systems. Relevant major drainage systems and waterways in the study area include: • Maribyrnong River, which is approximately 50 m from the western portal • Moonee Ponds Creek, which is approximately 100 m from the Arden station and construction works site • Yarra River, which is approximately 120 m from the CBD South station, and approximately 600 m from the proposed eastern portal at South Yarra • City of Melbourne drainage systems along Swanston Street, adjacent to CBD South station • Hannah Street Main Drain which is approximately 200 m west of Domain station • Prahran Main Drain and Yarra Street Outfall Drain and their tributaries, in the area around the eastern portal • Graingers Road Main Drain which crosses under West Footscray station at the proposed western turnback. Melbourne Metro would involve tunnelling under the Yarra River and Moonee Ponds Creek (bored tunnels), therefore there would be no direct interface with these waterways. However, the construction of some of the Melbourne Metro portals and stations could potentially interface with the floodplains of the Yarra River, Moonee Ponds Creek, Maribyrnong River and associated drainage systems. Each of these major waterways is subject to flood events of varying frequency and severity. Unobstructed overland flood paths are important to draining floodwaters and avoiding damage to property and infrastructure. Similarly, the availability of flood storage (where water is temporarily stored within the riverine floodplain) plays a critical role in ameliorating the effects of a flood event. All of the potential impacts of Melbourne Metro on flood flows and storage and of flooding on Melbourne Metro would be required to comply with the relevant statutory requirements being the relevant planning scheme provisions and the *Water Act 1989*. Surface water quality is addressed as part of the interrelated aquatic ecology and river health impact assessment.
Terrestrial flora and fauna	Melbourne Metro is wholly located within the highly urbanised central area of Melbourne. With approximately 180 years of urban development associated with the evolution of the city, much of the original biodiversity values of the area have been significantly disturbed, modified or destroyed. The baseline assessment of terrestrial flora and fauna for the project has concluded that the project area contains no remnant flora and that only one terrestrial fauna species of conservation significance – the Grey-headed Flying fox - is known to inhabit the proposed study area. The grey-headed flying fox is known to forage in Fawkner Park and the Domain parklands on occasions.
Transport	The Melbourne Metro alignment between Kensington and South Yarra is at the hub of the heavy rail and tramway systems of metropolitan Melbourne and within a dense urban area containing all categories of roads from freeways to laneways, an extensive on-road and off-road bicycle network and pedestrian paths. The railways, tramways and arterial roads within inner Melbourne are all congested during weekday morning and evening peak periods. The principal purpose of the project is to provide a significant increase in the capacity of Melbourne's heavy rail network and improve the connectivity of major parts of Melbourne, not just through the proposed project area but along the rail corridors to Cranbourne/Pakenham and Sunbury. The project would also reduce congestion on Melbourne's busiest tram route – along Swanston Street and St Kilda Road – by providing a heavy rail alternative.

4 Risk Register

A risk register was established to document the findings of the risk assessment process. The risk register contains details of impact pathways, their consequences, planned controls inherent in the Project Description, an initial risk assessment, additional treatment measures (Environmental Performance Requirements), and the revised risk assessment (residual risk). This complete risk register is provided in Table 4-1. Sections of the risk register are also contained in the relevant impact assessment reports appended to the EES.

The final risk register presented below is a refinement on the draft register that was initially reviewed at the risk workshops attended by technical specialists. Technical specialists reviewed and updated their risk assessment during the writing of their impact assessments, and as such the final risk register has changed to match the final impact assessments.

Table 4-1 EES Risk Register

[*Project Phase: Construction (C); Operation (O); Design (D)]

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Aboriginal Heritage	AH001	Removal and/or installation of underground services	Complete removal of one or more Aboriginal archaeological site(s) or removal of numerous objects at a number of site locations	C	All	Social	Low	To avoid or minimise harm to Aboriginal cultural heritage	Moderate	Possible	Medium	Comply with a Cultural Heritage Management Plan approved under the *Aboriginal Heritage Act 2006* and prepared in accordance with the Aboriginal Heritage Regulations 2007	Minor	Unlikely	Low
Aboriginal Heritage	AH002	Construction of Melbourne Metro - impacts on known Aboriginal Places	Partial disturbance or complete removal of Aboriginal archaeological site(s) or Aboriginal archaeological object(s)	C	All	Social	High	To avoid or minimise harm to Aboriginal cultural heritage	Moderate	Unlikely	Low	As per AH001	Moderate	Unlikely	Low
Aboriginal Heritage	AH003	Construction of Melbourne Metro - impacts on unknown Aboriginal Places	Partial disturbance or complete removal of Aboriginal archaeological site(s) or Aboriginal archaeological object(s)	C	All	Social	Low	To avoid or minimise harm to Aboriginal cultural heritage	Moderate	Possible	Medium	As per AH001	Moderate	Unlikely	Low
Aboriginal Heritage	AH004	Construction of Melbourne Metro - impacts on unknown Aboriginal skeletal remains	Disturbance/removal of Aboriginal human remains and/or Aboriginal archaeological sites/objects of high significance to the Aboriginal community or of high scientific significance	C	All	Social	Low	To avoid or minimise harm to Aboriginal cultural heritage	Major	Unlikely	Medium	As per AH001	Moderate	Rare	Low
Aboriginal Heritage	AH005	Construction of Melbourne Metro - within archaeologically sensitive areas	Complete removal of one or more Aboriginal archaeological site(s) or removal of numerous objects at a number of site locations	C	All	Social	Low	To avoid or minimise harm to Aboriginal cultural heritage	Moderate	Possible	Medium	As per AH001	Moderate	Unlikely	Low
Aboriginal Heritage	AH006	Construction of Melbourne Metro - damage to intangible cultural heritage	Intrusion to multiple values (e.g. aesthetic, social, religious, historic or cultural) of more than one intangible site	C	All	Social	Low	To avoid or minimise harm to Aboriginal cultural heritage	Major	Unlikely	Medium	As per AH001	Minor	Rare	Very Low
Aboriginal Heritage	AH007	Geotechnical investigations - impacts on known and unknown Aboriginal Places	Partial disturbance or removal of Aboriginal archaeological objects from one archaeological site	D	All	Social	Low	To avoid or minimise harm to Aboriginal cultural heritage	Minor	Unlikely	Low	As per AH001	Minor	Rare	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Air Quality	AQ001	General earthworks and construction	Increased emissions to air (dust and products of combustion) due to clearing for laydown areas; handling of materials used for the construction of tracks; and machinery and equipment exhausts. This may result in a deterioration to the existing air quality environment.	C	1 - Tunnels (Fawkner Park) 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		High	EPA Publication 480, Environmental Guidelines for Major Construction Sites SEPPs for Air Quality Management and Ambient Air Quality	Moderate	Possible	Medium	Develop and implement a plan(s) for dust management and monitoring, in consultation with EPA, to minimise and monitor the impact of construction dust. Undertake air modelling for construction to inform the plan(s). The plan must address monitoring requirements for key sensitive receptors including, but not limited to: • Residential and commercial properties • Hospitals and research facilities within the Parkville precinct • Universities, including The University of Melbourne and RMIT • Schools, including Melbourne Grammar School (Wadhurst Campus) and Christ Church Grammar School • Public parks including the Shrine of Remembrance Reserve and JJ Holland Reserve. Manage construction activities to minimise dust and other emissions in accordance with EPA Publication 480, Environmental Guidelines for Major Construction Sites (1996). Control the emission of smoke, dust, fumes and other pollution into the atmosphere during construction and operation in accordance with the SEPPs for Air Quality Management and Ambient Air Quality.	Moderate	Unlikely	Low
Air Quality	AQ002	Portal, and platform construction	Increased emissions to air (dust and products of combustion) due to the handling of materials used for the construction of portals, s and platforms, as well as machinery and equipment exhausts. This may result in a deterioration to the existing air quality environment	C	2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal 9 - Western turnback		Medium	As per AQ001	Minor	Possible	Low	As per AQ001	Minor	Possible	Low
Air Quality	AQ003	Construction of ventilation structures and access shafts	Increased emissions to air (dust and products of combustion) due to the handling of materials used for the construction of ventilation structures and access shafts. This may result in a deterioration to the existing air quality environment	C	2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		Medium	As per AQ001	Minor	Possible	Low	As per AQ001	Minor	Possible	Low
Air Quality	AQ004	Handling, storage and removal of spoil	Increased dust and combustion emissions to air in the vicinity of the surface construction worksites due to handling of spoil, wind erosion and operation of vehicles on unpaved surfaces, resulting in a deterioration to the existing air quality environment	C	1 - Tunnels (Fawkner Park) 3 - Arden 7 - Domain		High	As per AQ001	Major	Likely	High	As per AQ001	Moderate	Likely	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Air Quality	AQ005	Handling, storage and removal of spoil	Increased dust and combustion emissions to air in the vicinity of the surface construction worksites due to handling of spoil, wind erosion and operation of vehicles on unpaved surfaces, resulting in a deterioration to the existing air quality environment	C	1 - Tunnels (emergency access shafts) 2 - Western portal 4 - Parkville 5 - CBD North 6 - CBD South 8 - Eastern portal		High	As per AQ001	Moderate	Likely	Medium	As per AQ001	Moderate	Possible	Medium
Air Quality	AQ006	Restoration of surface areas	Increased emissions to air (dust and products of combustion) due to restoration activities and operation of machinery. This may result in a deterioration to the existing air quality environment.	C	1 - Tunnels (Fawkner Park) 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal 9 - Western turnback		Medium	As per AQ001	Minor	Possible	Low	As per AQ001	Minor	Possible	Low
Air Quality	AQ007	Operation of construction ventilation shafts / exhaust fans	Increased emissions to air (dust and products of combustion) due to the discharge of underground air (occupational atmosphere) from construction ventilation shafts (exit). This may result in a deterioration to the existing air quality environment.	C	1 - Tunnels (Fawkner Park) 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		Low	As per AQ001	Minor	Unlikely	Low	As per AQ001	Minor	Unlikely	Low
Air Quality	AQ008	Construction of Melbourne Metro - Boring, excavation and site works	Potential release of odour if excavation / boring works disturb contaminated soils and/or Acid Sulfate Soils (ASS), leading to potential odour impact (i.e. >1 OU) at sensitive receptors in proximity to where these materials are stockpiled.	C	All	Contaminated Land & Spoil Management	Low	*Industrial Waste Management Policy (Waste Acid Sulfate Soils)*	Minor	Possible	Low	As per CL002 to CL006, CL018 to CL020 and CL038 to CL042	Minor	Possible	Low
Air Quality	AQ009	Cleaning of tunnel walls	Increased particulate matter emissions at ventilation exit points (tunnel wall cleaning is anticipated on a 5 – 10 year interval). Potential for particulate residue (brake dust, airborne dust) from wall cleaning to be emitted. This may result in a deterioration to the existing air quality environment: possible elevated PM2.5 / PM10 ground level concentrations (GLCs) in vicinity of ventilation shafts; potential for impact at nearby sensitive receptors.	O	1 - Tunnels (Fawkner Park) 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		Low	Maintain high quality filters at ventilation exit points to performance specifications. Ensure periodical wall cleaning (quantity of dust build up can be minimised by more frequent wall cleaning operations)	Minor	Possible	Low	Control the emission of smoke, dust, fumes and other pollution into the atmosphere during construction and operation in accordance with the SEPPs for Air Quality Management and Ambient Air Quality.	Minor	Possible	Low

<table>
<tr><th rowspan="2">Discipline</th><th rowspan="2">Risk No.</th><th colspan="2">Impact Pathway</th><th rowspan="2">Project Phase</th><th rowspan="2">Precinct</th><th rowspan="2">Linkages</th><th rowspan="2">Data availability</th><th rowspan="2">Existing performance requirements</th><th colspan="3">Initial Risk</th><th rowspan="2">Recommended Environmental Performance Requirements</th><th colspan="3">Residual Risk</th></tr>
<tr><th>Category</th><th>Event</th><th>C</th><th>L</th><th>Risk</th><th>C</th><th>L</th><th>Risk</th></tr>
<tr><td>Air Quality</td><td>AQ010</td><td>Fire (accident / incident) in tunnel</td><td>Increased particulate matter emissions at ventilation exit points as a result of smoke from fire in an emergency. This may result in a deterioration to the existing air quality environment: possible elevated PM2.5 / PM10 ground level concentrations (GLCs) in vicinity of ventilation shafts; potential for impact at nearby sensitive receptors.</td><td>O</td><td>1 - Tunnels (Fawkner Park)
2 - Western portal
3 - Arden
4 - Parkville
5 - CBD North
6 - CBD South
7 - Domain
8 - Eastern portal</td><td></td><td>Low</td><td>Maintain high quality filters at ventilation exit points to performance specifications.
Ensure periodical wall cleaning (quantity of dust build up can be minimised by more frequent wall cleaning operations)</td><td>Moderate</td><td>Rare</td><td>Low</td><td>As per AQ009</td><td>Moderate</td><td>Rare</td><td>Low</td></tr>
<tr><td>Aquatic Ecology & River Health</td><td>AE001</td><td>Inputs of surface sediments, chemicals and rubbish from construction zones (including early works) into waterways, either directly or via stormwater drainage system during construction associated with rainfall runoff</td><td>Results in reduced water quality (increased turbidity, pollution event, oils and grease, etc.) at Moonee Ponds Creek, Maribyrnong River, Yarra River, Stony Creek and Albert Park Lake. This risk is present at all locations where there would be surface based construction activities, even well away from water courses. This is due to the potential for runoff to the drainage system that ultimately discharges to waterways.</td><td>C</td><td>All</td><td>Surface Water</td><td>High</td><td>Meet SEPP (Waters of Victoria) for discharge and run off from the project to the Yarra River, Moonee Ponds Creek, Albert Park Lake and Maribyrnong River</td><td>Moderate</td><td>Likely</td><td>Medium</td><td>Fully integrate the stormwater treatment system into the design of Melbourne Metro for construction to ensure that stormwater entering a receiving water body complies with SEPP (Waters of Victoria).
The best practice performance objectives for achieving compliance with SEPP (Waters of Victoria) during the construction phase are described below:
<table>
<tr><th>Pollutant type</th><th>Receiving water objective</th><th>Current best practice performance objective[1]</th></tr>
<tr><td>Suspended solids</td><td>Comply with SEPP</td><td>Effective treatment of 90% of daily run-off events (e.g. <4 months ARI). Effective treatment equates to a 50 percentile suspended solids concentration of 50 mg/L.
This can be achieved by installing a sediment pond(s) to remove 95% of sediment down to 125 µm for a 1 year ARI.</td></tr>
<tr><td>Litter</td><td>Comply with SEPP</td><td>Prevent litter from entering the stormwater system.</td></tr>
<tr><td>Other pollutants</td><td>Comply with SEPP</td><td>Limit the application, generation and migration of toxic substances to the maximum extent practicable.</td></tr>
</table>
Notes
1 Best practice performance objectives are based on the Best Practice Environmental Management Guidelines for Urban Stormwater – CSIRO.
Best practice sedimentation and pollution control measures must be applied to protect waterways in accordance with Best Practice Environmental Management: Environmental Guidelines for Major Construction Sites – EPA Publication 480 (1996) and in accordance with an approved construction environmental management plan.
Measures should include: vehicle wheel wash and rumble bars at worksite egress points, appropriate placement of material stockpiles and chemical storages, covered loads, street sweeping and water quality monitoring, where required.</td><td>Moderate</td><td>Unlikely</td><td>Low</td></tr>
</table>

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Aquatic Ecology & River Health	AE002	Accidental disposal of untreated groundwater to waterways during construction	Tunnelling activities cause groundwater infiltration to tunnel, creating slurry. Accidental discharge of slurry to waterways could result in a short-term reduction in water quality due to turbidity, salinity, oils and greases etc.	C	1 - Tunnels	Groundwater Contaminated Land & Spoil Management	High		Moderate	Unlikely	Low	During construction, discharge tunnel, station box and portal construction water to sewer. Where groundwater interception during construction is predicted to occur, dewatering is to be managed so that groundwater is not released to stormwater or sensitive surface water bodies Use the Groundwater Disposal Strategy and GMP to obtain a Trade Waste Agreement with the relevant Water Retailers for groundwater disposal.	Moderate	Rare	Low
Aquatic Ecology & River Health	AE003	Stabilisation of Yarra River bed above tunnel using grout	Disturbance of the river bed and the release of sediments or grout to the water column could degrade water quality.	C	1 - Tunnels	Ground Movement	High		Minor	Possible	Low	Where ground treatment works are required in waterways, design and implement methods that prevent discharge of sediments into the water column.	Minor	Rare	Very Low
Aquatic Ecology & River Health	AE004	Stabilisation of Yarra River bed above tunnel using grout	Potential disruption to fish passage from barge presence and grouting operation (upstream passage of juvenile fish in spring, downstream passage of eggs and larvae in autumn).	C	1 - Tunnels	Ground Movement	Low		Minor	Rare	Very Low	-	Minor	Rare	Very Low
Aquatic Ecology & River Health	AE005	TBM generated noise and vibration on Yarra River and Moonee Ponds Creek	Potential disruption to fish passage (behavioural) from ground-borne noise and vibration associated with TBM activity. The noise and vibration impact assessment indicates noise and vibration to be no more than background during construction (see Technical Appendix I *Noise and Vibration* Section 1.3.1).	C	1 - Tunnels	Noise & Vibration	High		Negligible	Rare	Very Low		Negligible	Rare	Very Low
Aquatic Ecology & River Health	AE006	Groundwater level drawdown causes subsidence and alters river flow patterns	Potential subsidence from changes in groundwater results in altered flow regime that impacts on river fauna. Technical Appendix O *Groundwater* and Technical Appendix P *Ground Movement and Land Stability* show drawdown and subsidence to be unlikely provided appropriate mitigation measures are adopted. Furthermore, river water regime is dominated by tidal process and not sensitive to changes in groundwater/surface water interactions.	C	1 - Tunnels	Ground Movement Groundwater Surface Water	Low		Minor	Possible	Low	Addressed in Groundwater Impact Assessment: risks GW009 – GW012, GW058; and Ground Movement & Land Stability Impact Assessment: risk GM018.	Minor	Unlikely	Low
Aquatic Ecology & River Health	AE007	Inputs to surface water drainage system and waterways by trucks (spoil haulage and other construction, including early works)	Potential for reduced water quality (increased turbidity, pollution event, oils and grease, etc.) at Moonee Ponds Creek, Maribyrnong River and Yarra River. This risk is present along transport routes and other construction related transport routes. The risk considers multiple construction sites, timeframe over which construction occurs and the large number of truck movements required.	C	All	Surface Water	Medium		Moderate	Likely	Medium	As per AE001	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Aquatic Ecology & River Health	AE008	Inputs of surface sediments, chemicals and rubbish from construction zones (including early works) into waterways, either directly or via stormwater drainage system during construction associated with overland flooding	Potential for reduced water quality in receiving waterways where overland flooding inundated construction zones. Technical Appendix N Surface Water indicates that some construction areas are located within land subject to inundation. However flood protection measures are recommended to minimise likelihood of construction zone inundation.	C	All	Surface Water	Medium	SEPP (Waters of Victoria) for discharge and run off from the project to the Yarra River, Moonee Ponds Creek, Albert Park Lake and Maribyrnong River EPA Publication 480, Environmental Guidelines for Major Construction Sites	Moderate	Possible	Medium	As per AE001	Moderate	Rare	Low
Aquatic Ecology & River Health	AE009	Portal design or operational management practices are inadequate to treat stormwater runoff prior to discharge to waterways	Runoff from tunnel portal contains oils and greases and some sediment. Inadequate treatment of portal drainage runoff could result in short-term reduction in water quality for the duration of the rainfall event.	O	2 - Western portal 8 - Eastern portal	Surface Water	Medium	SEPP (Waters of Victoria) for discharge and run off from the project to the Maribyrnong River and Yarra River	Moderate	Unlikely	Low	Fully integrate the stormwater treatment system into the design of the western portal and eastern portal to ensure that stormwater entering a receiving water body complies with SEPP (Waters of Victoria). The best practice performance objectives for achieving compliance with SEPP (Waters of Victoria) during the operations phase are described below: **Pollutant type** / **Receiving water objective** / **Current best practice performance objective[1]** Suspended solids (SS) / Comply with SEPP (not to exceed the 90th percentile of 80 mg/L) (1) / 80% retention of the typical urban annual load Total phosphorus (TP) / Comply with SEPP (base flow concentration not to exceed 0.08 mg/L) (2) / 45% retention of the typical urban annual load Total nitrogen (TN) / Comply with SEPP (base flow concentration not to exceed 0.9 mg/L) (2) / 45% retention of the typical urban annual load Litter / Comply with SEPP (No litter in waterways) (4) / 70% reduction of typical urban annual load (3) Flows / Maintain flows at pre-urbanisation levels / Maintain discharges for the 1.5 year ARI at pre-development levels **Notes** 1 Best practice performance objectives are based on the Best Practice Environmental Management Guidelines for Urban Stormwater – CSIRO. 2 An example using SEPP (Waters of Victoria), general surface waters segment. 3 SEPP Schedule F7 – Yarra Catchment – urban waterways for the Yarra River main stream. 4 Litter is defined as anthropogenic material larger than five millimetres.	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												Sedimentation and pollution control measures must be applied to protect waterways in accordance with industry best practice. This shall include water quality monitoring, where required.			
Aquatic Ecology & River Health	AE010	Tunnel drainage water to waterways during operations	Potential impact to water quality in receiving waterway due to the seepage of small volumes of saline groundwater (potentially with small quantities of grease and oil) into tunnels during operations. Fire quelling water during an emergency may also collect in the tunnel drainage system. Groundwater salinity varies across the tunnel length, from 4,000 mg/l to 22,000 mg/l. Receiving waterways are estuarine and volume of discharge is likely to be very small compared with river flows. Consequently, there would be significant dilution, hence salinity is not a significant risk, but oils, grease, chemicals and other pollutants should be avoided.	O	1 - Tunnels	Groundwater	Medium	SEPP (Waters of Victoria) for discharge and run off from the project to the Maribyrnong River and Yarra River.	Negligible	Likely	Low	During operation, discharge tunnel drainage water to sewer, unless otherwise agreed by EPA and Melbourne Water. Where groundwater interception during operation is predicted to occur, disposal is to be managed so that contaminated water is not released to stormwater or sensitive surface water bodies. (Addressed in Groundwater Impact Assessment: risk GW055.)	Negligible	Possible	Low
Aquatic Ecology & River Health	AE011	Train operations-generated noise and vibration on Yarra River and Moonee Ponds Creek	Potential disruption to fish passage (behavioural) from ground-borne noise and vibration associated with trains moving within the tunnels. The noise and vibration impact assessment indicates noise and vibration to be no more than background during operation (See Technical Appendix I *Noise and Vibration* Section 1.3.2).	O	1 - Tunnels	Noise & Vibration	High		Negligible	Unlikely	Very Low	Addressed in Noise and Vibration Impact Assessment: risks NV034, NV038.	Negligible	Unlikely	Very Low
Aquatic Ecology & River Health	AE012	Input of potentially toxic substances from the sub	Potential leakage of transformer cooling liquids due to equipment faults or flooding has the potential to enter the Moonee Ponds Creek, especially during flood events. Technical Appendix N *Surface Water* identifies flooding as a low risk if appropriate flood protection is adopted.	O	3 - Arden	Surface Water	Medium		Moderate	Unlikely	Low	Design the Arden electrical substation to provide appropriate protection against floodwaters during operation, to prevent the release of contaminants to Moonee Ponds Creek.	Moderate	Rare	Low
Arboriculture	AR001	Construction of portals, station boxes and entries and associated construction zones	Removal of trees from the public realm. Damage to trees on periphery of excavation (crown, trunk and roots).	C	4 - Parkville 7 - Domain 8 - Eastern portal	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Medium	Prepare and implement a Tree Protection Plan for each Precinct in accordance with AS4970-2009 Protection of Trees on Development Sites, addressing the detailed design and construction	Moderate	Almost Certain	High	During detailed design, review potential tree impacts and provide for maximum tree retention where possible. Prior to construction of main works develop and implement a plan in consultation with the relevant local council that identifies all trees in the project area which covers: • Trees to be removed or retained • Condition of the trees to be removed • Options for temporary re-location of palms and reinstatement at their former location or another suitable location.	Moderate	Almost Certain	High

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
								methodology of the project.				Reinstate quality soils to sufficient volumes to support long-term viable growth of replacement trees. Re-establish trees to replace loss of canopy cover and achieve canopy size equal to (or greater than) healthy, mature examples of the species in Melbourne. Consult with the City of Melbourne, the City of Post Phillip, the City of Stonnington, the Shrine of Remembrance and Shrine Trustees and Heritage Victoria as applicable. Policy documents that must be followed to re-establish trees and valued landscape character include: • The City of Melbourne's Tree Retention and Removal Policy and Urban Forest Strategy • The City of Port Philip's Community Amenity Local Law No. 1 and Greening Port Phillip - An Urban Forest Approach • The City of Stonnington's General Local Law 2008 (No 1) and City of Stonnington Street Tree Strategy • Any associated precinct plans • Specific policies of the Domain Parklands Conservation Management Plan (CMP), for trees within Domain Parklands • Shrine of Remembrance: Shrine of Remembrance CMP (Lovell Chen, 2010) or any future review and the Shrine of Remembrance Landscape Improvement Plan (rush Wright Associates, 2010) • South African Soldiers Memorial Reserve: Any relevant CMP for the South African Soldiers Memorial • Fawkner Park Conservation Analysis (Hassell, 2002) and the Fawkner Park Masterplan (City of Melbourne, 2005) • The preferred future character of the University of Melbourne, for trees in the grounds of the University of Melbourne. Prior to construction commencing of main works or shafts in affected areas, prepare and implement Tree Protection Plans for each Precinct in accordance with AS4970-2009 Protection of Trees on Development Sites, addressing the detailed design and construction methodology of the project.			
Arboriculture	AR002	Soil grout injection / soil mixing for soil stabilisation over shallow tunnel alignments	Removal of trees from Domain Parklands	C	1 - Tunnels	Historical Cultural Heritage Ground Movement Terrestrial Ecology Landscape and Visual	Low	As per AR001	Moderate	Almost Certain	High	As per AR001	Moderate	Almost Certain	High

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Arboriculture	AR014	Soil grout injection / soil mixing for soil stabilisation over shallow tunnel alignments	Removal of trees from Davis Avenue and surrounds	C	1 - Eastern portal	Historical Cultural Heritage Ground Movement Terrestrial Ecology Landscape and Visual	Low	As per AR001	Moderate	Unlikely	Low	As per AR001	Moderate	Unlikely	Low
Arboriculture	AR003	Construction of portals, station boxes, entries, access shafts and associated construction zones	Removal of trees from the public realm. Damage to trees on periphery of excavation (crown, trunk and roots).	C	1 - Tunnels 2 - Western portal 3 - Arden 5 - CBD North 6 - CBD South	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Medium	As per AR001	Minor	Almost Certain	Medium	As per AR001	Minor	Almost Certain	Medium
Arboriculture	AR004	Removal and/or installation of underground services	Damage to tree roots resulting in reduced health, tree death or destabilisation	C	All	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Low	As per AR001	Moderate	Possible	Medium	Prior to construction commencing of main works or shafts in affected areas, prepare and implement Tree Protection Plans for each Precinct in accordance with AS4970-2009 Protection of Trees on Development Sites, addressing the detailed design and construction methodology of the project. Within precincts 1, 4 and 7 a Tree Protection Plan must be developed for each heritage place as relevant to the satisfaction of Heritage Victoria or the responsible authority. For City of Melbourne trees that are to be retained and protected, a bank guarantee or bond of the trees value will be held against the approved Tree Protection Plan for the duration of the works in accordance with the City of Melbourne Tree Retention and Removal Policy.	Moderate	Unlikely	Low
Arboriculture	AR005	Chemical spill, including as a result of refuelling of construction equipment	Damage to trees resulting in reduced health or death	C	All	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Low	As per AR001	Minor	Possible	Low	As per AR004	Minor	Possible	Low
Arboriculture	AR006	Deep tunnel boring, mined station boxes	Tree destabilisation	C	1 - Tunnels 5 - CBD North 6 - CBD South	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Medium	As per AR001	Moderate	Rare	Low	None	Moderate	Rare	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Arboriculture	AR007	Modification to adjacent soil profiles and modification to existing run-off	Droughting / waterlogging tree root zones resulting in reduced health or death	C	All	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Low	As per AR001	Moderate	Possible	Medium	As per AR004	Minor	Possible	Low
Arboriculture	AR008	Installation of fill over root zones	Deoxygenation of soil and modification to water infiltration resulting in reduced health or death	C	1 - Tunnels 2 - Western portal 3 - Arden 7 - Domain 8 - Eastern portal	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Low	As per AR001	Moderate	Possible	Medium	As per AR004	Minor	Possible	Low
Arboriculture	AR009	Vehicular and pedestrian access through parkland, including use as set down areas	Soil compaction resulting in reduced tree health	C	1 - Tunnels 2 - Western portal 4 - Parkville 7 - Domain 8 - Eastern portal	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Low	As per AR001	Moderate	Likely	Medium	As per AR004	Minor	Possible	Low
Arboriculture	AR010	Piling / crane access / high load access within construction zones	Damage to tree crowns as a result of mechanical damage from machinery or loads	C	All	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Medium	As per AR001	Minor	Likely	Medium	As per AR004	Minor	Possible	Low
Arboriculture	AR011	Vehicular access to construction areas	Damage to tree crowns as a result of mechanical damage from trucks or high loads	C	All	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Low	As per AR001	Minor	Likely	Medium	As per AR004	Minor	Possible	Low
Arboriculture	AR012	Clearance pruning to tree crowns and installation of temporary aerial services	Damage to trees by poor pruning practices	C	All	Historical Cultural Heritage Terrestrial Ecology Landscape and Visual	Low	As per AR001	Minor	Possible	Low	As per AR004	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Arboriculture	AR013	Station and tunnel ventilation	Desiccation of adjacent tree canopies resulting in leaf loss and reduced vigour	C	All	Historical Cultural Heritage Landscape and Visual	Medium	As per AR001	Minor	Unlikely	Low	None	Minor	Unlikely	Low
Business	B001	Construction activity impacting operations (i.e. from noise, dust, vibration, construction materials)	Business functions unable to occur due to construction impacts. Some business types will be impacted more than others, particularly those operating sensitive equipment.	C	1 - Tunnels 2 - Western portal 3 - Arden 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Air Quality Noise & Vibration Social	Medium	None	Negligible	Likely	Low	Prepare a business disruption plan to manage impacts to non-acquired businesses and to engage with business, property owners and the community throughout construction. The plan shall include: • Timely information on key project milestones • Changes to traffic conditions and duration of impact • A project construction schedule developed in coordination with transport authorities and local councils and in consultation with businesses to minimise cumulative impacts of this and other projects • Plans for notifying customers of proposed changes to business operations, including the setting of suitable timeframes for notification prior to commencement of works • Measures to ensure access to businesses is maintained for customers, delivery and waste removal unless there has been prior engagement with affected businesses (including mutually agreed mitigation measures as required). This could include the installation of directional and business signage to assist customers. • Process for registering and management of complaints from affected businesses.	Negligible	Likely	Low
Business	B002	Construction activity impacting operations (i.e. from noise, dust, vibration, construction materials)	Business functions unable to occur due to construction impacts. Some business types will be impacted more than others, particularly those operating sensitive equipment.	C	4 - Parkville	Air Quality Noise & Vibration Social	Medium	None	Minor	Likely	Medium	As per B001; and Maintain vehicular and pedestrian access to hospital emergency departments at all times during construction and to other key health and medical facilities where practicable. Develop a stop work contingency plan for Class 1 emergencies (as defined in the *Emergency Management Act 2013*) in consultation with medical institutions in the Parkville precinct in the event that Melbourne Metro construction works are required to cease.	Minor	Likely	Medium
Business	B003	Construction activity causing a reduction in amenity (i.e. from noise, dust, vibration)	Business activity disrupted as customers avoid construction areas due to decreased amenity (real or perceived) and from decreased productivity of workers. Some business types will be impacted more than others, particularly those that rely on passing trade or where other easily accessible locations offer similar goods and services (e.g. retail or accommodation businesses such as the Westin Hotel).	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Air Quality Noise & Vibration Social	Medium	None	Negligible	Likely	Low	Following consultation with potentially affected businesses and prior to main works or shaft construction commencing, prepare management plans to minimise dust, noise and vibration impacts during construction.	Negligible	Likely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Business	B004	Construction activity impacting access to businesses (e.g. from changed traffic flows, increased congestion, occupation of car parks, changes in access for cyclists, pedestrians)	Business activity disrupted as customers cannot access the area, or because customers avoid the area due to real or perceived decrease in access. Business activity disrupted due to changes in access impacting business operation (e.g. delivery vehicle and truck access). Some business types will be impacted more than others, particularly those that rely on passing trade or where other easily accessible locations offer similar goods and services (e.g. retail or accommodation businesses).	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Social Transport	Medium	None	Negligible	Likely	Low	As per B001	Negligible	Likely	Low
Business	B005	Construction activity impacting business activity	Impacts to business activity, particularly those that rely on passing trade or where other easily accessible locations offer similar goods and services (e.g. retail and accommodation businesses).	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Social Transport	Medium	None	Negligible	Likely	Low	As per B002	Negligible	Likely	Low
Business	B006	Acquisition of businesses and properties	Relocation of businesses to new premises as a result of site acquisition by Melbourne Metro causing a disruption to business activity	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 8 - Eastern portal	Social	Medium	None	Negligible	Likely	Low	Reduce the disruption to businesses from direct acquisition or temporary occupation of land, and work with business and land owners to endeavour to reach agreement on the terms for possession of the land.	Negligible	Likely	Low
Business	B007	Construction activity leading to a reduction in public events that indirectly affect business activity	Reduction in public events indirectly affecting the level of business activity. Some business types will be impacted more than others, particularly those that rely on passing trade or where other easily accessible locations offer similar goods and services (e.g. retail or accommodation businesses).	C	1 - Tunnels 5 - CBD North 6 - CBD South 7 - Domain	Social	Medium	None	Negligible	Likely	Low	As per B002	Negligible	Likely	Low
Business	B008	Construction activity leading to a reduction in public events that indirectly affect business activity	Reduction in public events indirectly affecting the level of business activity. Some business types will be impacted more than others, particularly those that rely on passing trade or where other easily accessible locations offer similar goods and services (e.g. retail or accommodation businesses).	C	2 - Western portal 3 - Arden 4 - Parkville 8 - Eastern portal	Social	Medium	None	Negligible	Unlikely	Very Low	As per B002	Negligible	Unlikely	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Business	B009	Cumulative impacts due to concurrent construction activities	Impacts to businesses from construction activity are greater than described in the precinct due to construction of multiple projects and/or at multiple sites in proximity to the precinct.	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		Medium		Negligible	Likely	Low	As per B002	Negligible	Likely	Low
Business	B010	Increased connectivity from operation of Melbourne Metro	Change in commercial market demand leading to higher rents and displacement of some business types. Some business types will be impacted more than others, particularly those that do not benefit from productivity improvements from increased accessibility (e.g. manufacturing and industrial businesses).	O	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Social Transport	Medium	None	Negligible	Almost Certain	Low	None	Negligible	Almost Certain	Low
Contaminated Land & Spoil Management	CL001	Bulk earthworks and spoil management	Increased volumes and / or incorrect classification of 'Clean Fill' leading to inappropriate re-use	C	1 - Tunnels		Low	SEPP (Prevention and Management of Contamination of Land) Industrial Waste Resource Regulations 2009 EPA Publication IWRG631, Solid industrial waste hazard categorisation and management EPA Publication IWRG701, Sampling and analysis of waters, wastewaters, soils and wastes EPA Publication IWRG702, Soil sampling EPA Publication 480, Environmental Guidelines for Major Construction Sites	Moderate	Possible	Medium	Prior to construction of main works or shafts, prepare and implement a Spoil Management Plan (SMP) in accordance with MMRA's Spoil Management Strategy and relevant regulations, standards and best practice guidance. The SMP shall be developed in consultation with and to the satisfaction of the EPA. The SMP will include but is not limited to the following: • Applicable regulatory requirements • Identifying nature and extent of spoil across all precincts • Roles and responsibilities • Identification of management measures for handling and transport of spoil for the protection of health and the environment • Identification, design and development of specific environmental management plans for temporary stockpile areas • Identifying suitable sites for re-use, management or disposal of any spoil • Monitoring and reporting requirements. The SMP shall include sub-plans as appropriate, including but not limited to an Acid Sulfate Soil and Rock (ASS/ASR) Management Sub-Plan.	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Contaminated Land & Spoil Management	CL002	Bulk earthworks and spoil management	Increased volumes of natural acid sulfate soils (Coode Island Silts and Brighton Group), requiring management / off-site disposal	C	1 – Tunnels *(CBD South to Domain)*		Low	SEPP (Industrial Waste Management Policy - Waste Acid Sulfate Soils) EPA Victoria Publication 655.1: Acid sulfate soil and rock	Major	Possible	High	Prepare and implement an Acid Sulfate Soil and Rock (ASS/ASR) Management Sub-Plan prior to construction of the project as a Sub-Plan of an overarching SMP in accordance with the Regulations, Standards and best practice guidance and to the satisfaction of EPA. This sub-plan will include the general requirements of the SMP and also: • Identifying locations and extent of any potential ASS/ASR • Characterising ASS/ASR spoil prior to excavation • Identification and implementation of measures to prevent oxidation of ASS/ASR wherever possible • Identifying suitable sites for re-use, management or disposal of any ASS/ASR.	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL003			C	1 - Tunnels *(Western portal to Arden), (Domain to eastern portal)*		Low		Minor	Possible	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL004			C	1 - Tunnels *(Arden to CBD South)*		Low		Minor	Rare	Very Low		Minor	Rare	Very Low
Contaminated Land & Spoil Management	CL005	Bulk earthworks and spoil management	Increased volumes and / or incorrect classification of natural potential acid sulfate rock, requiring management / off-site disposal	C	1 - Tunnels *(Parkville to eastern portal)*		Low	SEPP (Industrial Waste Management Policy - Waste Acid Sulfate Soils) EPA Victoria Publication 655.1: Acid sulfate soil and rock	Major	Possible	High	As per CL002	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL006			C	1 - Tunnels *(Western portal to Arden)* (Based on moderate volumes of ASR compared to other tunnels)		Low	As per CL005	Moderate	Possible	Medium	As per CL002	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL007			C	1 – Tunnels *(Arden to Parkville)*		Low		Moderate	Unlikely	Low		Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL008	Groundwater inflow and vapour impact	If groundwater is contaminated with VOCs, inflows may result in raised levels of vapours in the tunnel atmosphere resulting in increased impact on human health	C / O	1 – Tunnels *(Parkville to CBD North), (Domain to eastern portal)*	Groundwater	Medium	General: SEPP (Prevention and Management of Contamination of Land) SEPP (Groundwaters of Victoria) EPA Publication 840:	Moderate	Possible	Medium	Prior to construction of main works or shafts, undertake a remedial options assessment (ROA) for contaminated land. The assessment must: • Consider the outcomes of further investigations • Interpret groundwater permeation and VOC result • Present and take account of the outcomes of risk assessments • If required, identify remedial options in accordance with	Minor	Rare	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
								The clean-up and management of polluted groundwater. National Environment Protection (Assessment of Site Contamination) Measure 1999 For vapour ingress: SEPP (Air Quality Management) NSW EPA 2012. Guidelines for the Assessment and management of Sites Impacted by Hazardous Gases CRC CARE 2013. Petroleum hydrocarbon vapour intrusion assessment: Australian guidance, CRC CARE Technical Report no. 23, CRC for Contamination Assessment and Remediation of the Environment BS8485:2015. Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings				relevant regulations, standards and best practice guidance and to the satisfaction of EPA. If required, as an outcome of the ROA, prepare a remedial action plan and integrate the remediation approach into the design in accordance with relevant regulations, standards and best practice guidance and to the satisfaction of EPA.			
Contaminated Land & Spoil Management	CL009				1 – Tunnels *(Western portal to Parkville), (CBD North to Domain)*	Groundwater	Medium		Moderate	Unlikely	Low		Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL010	Below ground structures	Disturbance of ground gases and migration and accumulation in tunnels	C / O	1 – Tunnels *(Western portal to Arden), (CBD South to Domain)*	Groundwater	Medium	General: As per CL008 For ground gases: BS8576:2013, Guidance on investigations for Ground gas – Permanent gases and Volatile Organic	Moderate	Possible	Medium	As per CL008	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
								Compounds (VOCs) BS8485:2015, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings							
Contaminated Land & Spoil Management	CL011			C / O	1 – Tunnels *(Arden to CBD South), (Domain to eastern portal)*	Groundwater	Medium		Moderate	Unlikely	Low		Moderate	Rare	Low
Contaminated Land & Spoil Management	CL012	Below ground structures	Disturbance of vapours and migration and accumulation in tunnels	C / O	1 – Tunnels		Medium		Moderate	Unlikely	Low		Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL013	Below ground structures	Impact on durability of building and construction materials	O	1 – Tunnels *(Western portal to Arden), (Parkville to CBD North), (CBD South to Domain)*		Medium	General As per CL008 For durability: AS 2159:2009 Piling – Design and installation Environment Agency (2005). Assessment and Management of Risks to Buildings, Building Materials and Services from Land Contamination. R&D Technical Report P5-035/TR/01 Environment Agency (2000). Risks of Contaminated Land to Buildings, Building Materials and services. R&D Technical Report P331	Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL014	Below ground structures	Impact on durability of building and construction materials	O	1 – Tunnels *(Arden to CBD South), (Domain to eastern portal)*		Medium		Moderate	Unlikely	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL015	Construction safety hazards	Potential impact to worker safety	C	1 - Tunnels		Low	WorkSafe 2005. Contaminated Construction Site – Industry Standard	Major	Possible	High	Prior to construction of main works or shafts commencing, prepare and implement a health, safety and environmental plan for the management of hazardous substances. The plan must include but not be limited to:	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
								WorkSafe (2013). Guide For Tunnelling Work EPA Publication 480, Environmental Guidelines for Major Construction Sites				• Consideration of the risks associated with exposure to hazardous substances for employees, visitors and general public • The identification of methods to control such exposure in accordance with relevant regulations, standards and best practice guidance and to the satisfaction of WorkSafe and the EPA. • Method statements detailing monitoring and reporting.			
Contaminated Land & Spoil Management	CL016	Bulk earthworks and spoil management	Increased volumes and / or incorrect classification of 'Clean Fill' leading to inappropriate re-use	C	2 - Western portal 8 - Eastern portal		Low	As per CL001	Moderate	Possible	Medium	As per CL001	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL017				9 - Western turnback		Low		Minor	Unlikely	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL018	Bulk earthworks and spoil management	Increased volumes of natural acid sulfate soils (Coode Island Silts and Brighton Group), requiring management / off-site disposal	C	8 - Eastern portal		Low	SEPP (Industrial Waste Management Policy - Waste Acid Sulfate Soils) EPA Victoria Publication 655.1: Acid sulfate soil and rock	Major	Possible	High	As per CL002	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL019			C	2 - Western portal		Low		Moderate	Unlikely	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL020			C	9 - Western turnback		Low		Minor	Unlikely	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL021	Bulk earthworks and spoil management	Inappropriate handling, stockpiling and/or treatment of contaminated spoil may lead to adverse impacts on the environment, human health and social impacts. Of particular relevance to Category A and B waste as options for disposing of these wastes are more limited that with Cat C or fill.	C	8 - Eastern portal		Low	As per CL001	Major	Possible	High	Prior to construction of main works or shafts, prepare and implement a Spoil Management Plan (SMP) in accordance with MMRA's Spoil Management Strategy and relevant regulations, standards and best practice guidance. The SMP shall be developed in consultation with and to the satisfaction of the EPA. The SMP will include but is not limited to the following: • Applicable regulatory requirements • Identifying nature and extent of spoil (clean fill and contaminated spoil) across all precincts • Roles and responsibilities • Identification of management measures for handling and transport of spoil for the protection of health and the environment • Identification, design and development of specific environmental management plans for temporary stockpile areas	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												• Identifying suitable sites for re-use, management or disposal of any spoil • Monitoring and reporting requirements • Identifying locations and extent of any prescribed industrial waste (PIW) and characterising PIW spoil prior to excavation • Identifying suitable sites for disposal of any PIW. The SMP shall include sub-plans as appropriate, including but not limited to an Acid Sulfate Soil and Rock (ASS/ASR) Management Sub-Plan.			
Contaminated Land & Spoil Management	CL022			C	2 - Western portal		Low	As per CL021	Major	Possible	High	As per CL021	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL023			C	9 - Western turnback		Low	As per CL021	Major	Possible	High	As per CL021	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL024	Bulk earthworks and spoil management	Inappropriate handling, stockpiling and/or treatment of asbestos containing materials may lead to adverse impacts on the environment, human health and social impacts. Of particular relevance to Category A and B waste as options for disposing of these wastes are more limited that with Cat C or fill.	C	8 - Eastern portal		Low	As CL021 and WorkSafe Victoria 2010. Guidance Note Asbestos contaminated soil EPA Victoria 2009. Asbestos transport and disposal. Publication IWRG611.	Major	Possible	High	As per CL021	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL025			C	2 - Western portal		Low	As per CL024	Major	Possible	High	As per CL021	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL026			C	9 - Western turnback		Low	As per CL024	Major	Possible	High	As per CL021	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL027	Groundwater inflow and vapour impact	If groundwater is contaminated with VOCs, inflows may result in raised levels of vapours in the tunnel atmosphere resulting in increased impact on human health	C / O	8 - Eastern portal	Groundwater	Medium	General: SEPP (Prevention and Management of Contamination of Land) SEPP (Groundwaters of Victoria) EPA Publication 840: The clean-up and management of polluted groundwater. National Environment	Moderate	Likely	Medium	As per CL008	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
								Protection (Assessment of Site Contamination) Measure 1999 For vapour ingress: SEPP (Air Quality Management) No. S240 NSW EPA 2012. Guidelines for the Assessment and management of Sites Impacted by Hazardous Gases CRC CARE 2013. Petroleum hydrocarbon vapour intrusion assessment: Australian guidance, CRC CARE Technical Report no. 23 BS8485:2015, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings								
Contaminated Land & Spoil Management	CL028				2 - Western portal	Groundwater	Medium		Minor	Possible	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL029				9 - Western turnback	Groundwater	Medium		Moderate	Unlikely	Low		Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL030	Below ground structures	Disturbance of ground gases and migration and accumulation in tunnels	C / O	8 - Eastern portal		Medium	General As per CL027 For Ground Gases: BS8576:2013, Guidance on investigations for Ground gas – Permanent gases and Volatile Organic Compounds (VOCs) BS8485:2015, Code	Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
								of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings							
Contaminated Land & Spoil Management	CL031				2 - Western portal		Medium		Minor	Unlikely	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL032				9 - Western turnback		Medium		Negligible	Unlikely	Very Low		Negligible	Unlikely	Very Low
Contaminated Land & Spoil Management	CL033	Below ground structures	Disturbance of vapours and migration and accumulation in tunnels	C / O	8 - Eastern portal		Medium	As per CL027	Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL034				2 - Western portal		Medium		Minor	Unlikely	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL035				9 - Western turnback		Medium		Negligible	Unlikely	Very Low		Negligible	Unlikely	Very Low
Contaminated Land & Spoil Management	CL036	Below ground structures	Impact on durability of building and construction materials	Operation	8 - Eastern portal		Medium	General: As per CL027 For durability: AS 2159-2009, Piling – Design and installation. Environment Agency (2005). Assessment and Management of Risks to Buildings, Building Materials and Services from Land Contamination Environment Agency (2000). Risks of Contaminated Land to Buildings, Building Materials and services	Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Contaminated Land & Spoil Management	CL037	Below ground structures	Impact on durability of building and construction materials	O	2 - Western portal		Medium		Moderate	Unlikely	Low		Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL038	Below ground structures	Impact on durability of building and construction materials	O	9 - Western turnback		Medium		Minor	Possible	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL039	Piling and retaining walls	Piling may disturb ground and cause the formation of pathways for contamination to migrate from impacted strata to un-impacted strata or may enable entrained gases and vapours to be released	C	8 - Eastern portal		Medium	General: As per CL027 For piling and retaining walls: AS 2159-2009, Piling – Design and installation SEPP (Prevention and Management of Contamination of Land) SEPP (Groundwaters of Victoria) EPA Publication 840, The clean-up and management of polluted groundwater	Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL040			C	2 - Western portal		Medium		Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL041			C	9 - Western turnback		Medium		Minor	Possible	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL042	Construction safety hazards	Potential impact to worker safety	C	2 - Western portal 8 - Eastern portal 9 - Western turnback		Low	WorkSafe 2005. Contaminated Construction Site – Industry Standard WorkSafe 2013. Guide For Tunnelling Work EPA Publication 480, Environmental Guidelines for Major Construction Sites	Major	Possible	High	As per CL0015	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Contaminated Land & Spoil Management	CL043	Bulk earthworks and spoil management	Increased volumes and / or incorrect classification of 'Clean Fill' leading to inappropriate re-use	C	All stations		Low	As per CL001	Moderate	Possible	Medium	As per CL001	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL044	Bulk earthworks and spoil management	Increased volumes of natural acid sulfate soils (Coode Island Silts and Brighton Group), requiring management / off-site disposal	C	3 - Arden		Low	SEPP (Industrial Waste Management Policy - Waste Acid Sulfate Soils) EPA Victoria Publication 655.1: Acid sulfate soil and rock	Major	Possible	High	As per CL002	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL045			C	4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain		Low		Moderate	Unlikely	Low		Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL046	Bulk earthworks and spoil management	Increased volumes and / or incorrect classification of natural potential acid sulfate rock, requiring management / off-site disposal	C	4 - Parkville 5 - CBD North 6 - CBD South		Low	SEPP (Industrial Waste Management Policy - Waste Acid Sulfate Soils) EPA Victoria Publication 655.1: Acid sulfate soil and rock	Major	Possible	High	As per CL002	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL047			C	3 - Arden 7 - Domain		Low		Moderate	Unlikely	Low		Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL048	Bulk earthworks and spoil management	Inappropriate handling, stockpiling and/or treatment of contaminated spoil may lead to adverse impacts on the environment, human health and social impacts. Of particular relevance to Category A and B waste as options for disposing of these wastes are more limited that with Cat C or fill.	C	All stations		Low	As per CL001	Major	Possible	High	As per CL021	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL049	Bulk earthworks and spoil management	Inappropriate handling, stockpiling and/or treatment of asbestos containing materials may lead to adverse impacts on the environment, human health and social impacts. Of particular relevance to Category A and B waste as options for disposing of these wastes are more limited that with Cat C or fill.	C	All stations		Low	As per CL049 and WorkSafe Victoria 2010, Guidance Note Asbestos-contaminated soil EPA Publication IWRG611, Asbestos transport and disposal	Major	Possible	High	As per CL048	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Contaminated Land & Spoil Management	CL050	Groundwater inflow and vapour impact	If groundwater is contaminated with VOCs, inflows may result in raised levels of vapours in the tunnel atmosphere resulting in increased impact on human health	C / O	5 - CBD North 7 - Domain	Groundwater	Medium	General: SEPP (Prevention and Management of Contamination of Land) SEPP (Groundwaters of Victoria) EPA Publication 840: The clean-up and management of polluted groundwater National Environment Protection (Assessment of Site Contamination) Measure 1999 For vapour ingress: SEPP (Air Quality Management) NSW EPA 2012. Guidelines for the Assessment and management of Sites Impacted by Hazardous Gases CRC CARE 2013. Petroleum hydrocarbon vapour intrusion assessment: Australian guidance, CRC CARE Technical Report no. 23 BS8485:2015, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings	Moderate	Likely	Medium	As per CL008	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL051				3 - Arden 4 - Parkville 6 - CBD South	Groundwater	Medium	As per CL050	Minor	Possible	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL052	Below ground structures	Disturbance of ground gases and migration and accumulation in tunnels	C / O	3 - Arden		Medium	General: As per CL050 For Ground Gases: BS8576:2013,	Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
								Guidance on investigations for Ground gas – Permanent gases and Volatile Organic Compounds (VOCs) BS8485:2015, Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings,							
Contaminated Land & Spoil Management	CL053				4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain		Medium		Minor	Unlikely	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL054	Below ground structures	Disturbance of vapours and migration and accumulation in tunnels	C / O	3 - Arden 4 - Parkville 5 - CBD North		Medium	As per CL050	Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL055				6 - CBD South 7 - Domain		Medium		Minor	Unlikely	Low		Minor	Unlikely	Low
Contaminated Land & Spoil Management	CL056	Below ground structures	Impact on durability of building and construction materials	O	3- Arden		Medium	General: As per CL050 For durability: AS 2159-2009, Piling – Design and installation. Environment Agency (2005). Assessment and Management of Risks to Buildings, Building Materials and Services from Land Contamination Environment Agency (2000). Risks of Contaminated Land to Buildings, Building Materials and services	Moderate	Possible	Medium	As per CL008	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL057	Below ground structures	Impact on durability of building and construction materials	O	4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain		Medium		Moderate	Unlikely	Low		Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Contaminated Land & Spoil Management	CL058	Piling	Piling may disturb ground and cause the formation of pathways for contamination to migrate from impacted strata to un-impacted strata or may enable entrained gasses and vapours to be released.	C	All stations		Medium	General As per CL050 For piling and retaining walls: AS 2159-2009, Piling – Design and installation SEPP (Prevention and Management of Contamination of Land) SEPP (Groundwaters of Victoria) EPA Publication 840, The clean-up and management of polluted groundwater	Moderate	Possible	Medium	As per CL050	Moderate	Unlikely	Low
Contaminated Land & Spoil Management	CL059	Construction safety hazards	Potential impact to worker safety	C	All stations		Low	WorkSafe 2005. Contaminated Construction Site – Industry Standard WorkSafe (2013). Guide For Tunnelling Work EPA Publication 480, Environmental Guidelines for Major Construction Sites	Major	Possible	High	As per CL0015	Moderate	Unlikely	Low
Greenhouse Gas	GH001	Design changes during detailed design (vertical/horizontal alignment, construction methods, scale of project)	Material changes from Concept Design during detailed design which materially affect (increase) the proposed construction carbon footprint; i.e. detailed design does not capture the GHG abatement / sustainability initiatives from Concept Design for Melbourne Metro construction, leading to high energy consuming construction methods and high embodied carbon in construction materials.	D / C / O	All		Low	None	Moderate	Possible	Medium	Develop and implement a Sustainability Management Plan to meet, as a minimum, the Melbourne Metro sustainability targets, including achieving the specified ratings under the Infrastructure Sustainability Council of Australia's Infrastructure Sustainability Rating Tool and the Green Star Design and As Built Melbourne Metro Rail Tool. Monitor and report on how each of the best practice GHG abatement measures and sustainability initiatives identified in the Concept Design is implemented in the detailed design of the project and whether any additional measures not included in the Concept Design are feasible.	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Greenhouse Gas	GH002	Design changes during detailed design (vertical/horizontal alignment, scale of project)	Material changes from Concept Design during detailed design which materially affect (increase) the proposed operational carbon footprint; i.e. detailed design does not capture the GHG abatement / sustainability initiatives from Concept Design for Melbourne Metro operation, leading to proposed high energy consuming and/or Business-As-Usual technologies and infrastructure.	D	All		Low	None	Moderate	Possible	Medium	Develop and implement a Sustainability Management Plan to meet, as a minimum, the Melbourne Metro sustainability targets, including achieving the specified ratings under the Infrastructure Sustainability Council of Australia's Infrastructure Sustainability Rating Tool and the Green Star Design and As Built Melbourne Metro Rail Tool. Monitor and report on how each of the best practice GHG abatement measures and sustainability initiatives identified in the Concept Design is implemented in the detailed design of the project and whether any additional measures not included in the Concept Design are feasible.	Moderate	Unlikely	Low
Ground Movement & Land Stability	GM001	Construction stage excavations cause ground movement	Potential impacts on existing buildings and/or infrastructure	C	All		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	Develop and maintain geological and groundwater models (as per the Groundwater Environmental Performance Requirement) which: • Use monitored ground movement and ground water levels prior to construction to identify pre-existing movement • Inform tunnel design and the construction techniques to be applied for the various geological and groundwater conditions • Assess potential drawdown and identify trigger levels for implementing additional mitigation measures to minimise potential primary consolidation settlement • Assess potential ground movement effects from excavation and identify trigger levels for implementing additional mitigation measures to minimise potential ground movement effects. Design and construct the permanent structures and temporary works to limit ground movements to within appropriate acceptability criteria (to be determined in consultation with relevant stakeholders) for vertical, horizontal, and angular deformation as appropriate for project activities during the construction and operational phase. Develop and implement a ground movement plan for construction and operational phases of the project that: • Addresses the location of structures/assets which may be susceptible to damage by ground movement resulting from Melbourne Metro works • Identifies appropriate ground movement impact acceptability criteria for buildings, utilities, trains, trams and pavement after consultation with the various stakeholders • Identifies mitigation measures to ensure acceptability criteria can be met • Identifies techniques for limiting settlement of buildings and protecting buildings from damage • Addresses additional measures to be adopted if acceptability criteria are not met such as reinstatement of any property damage • Addresses monitoring ground movement surrounding	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												• proposed Melbourne Metro works and at the location of various structures/assets to measure consistency with the predicted model • Consult with land and assets owners that could potentially be affected and where mitigation measures would be required. Conduct pre-construction condition surveys for the assets predicted to be affected by ground movement. Develop and maintain a data base of as built and pre construction condition information for each potentially affected structure, specifically including: • Identification of structures/assets which may be susceptible to damage resulting from ground movement resulting from Melbourne Metro works • Results of condition surveys of structures, pavements, significant utilities and parklands to establish baseline conditions and potential vulnerabilities • Records of consultation with landowners in relation to the condition surveys. • Post construction stage condition surveys conducted, where required, to ascertain if any damage has been caused as a result of Melbourne Metro. Adopt construction techniques for Melbourne Metro to limit ground movement to within appropriate acceptability criteria (to be determined in consultation with relevant stakeholders). For properties and assets affected by ground movement, undertake any required repair works.			
Ground Movement & Land Stability	GM002	Construction stage excavations cause ground movement	Damage to buildings on mixed or shallow foundations	C	8 - Eastern portal		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM003	Construction stage excavations cause ground movement	Damage to North Yarra Main on Lloyd Street	C	1 - Tunnels *(Western portal to Arden)*		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM004	Construction stage excavations cause ground movement	Damage to rail lines resulting in disruption of services	C	1 - Tunnels *(Western portal to Arden)* 2 - Western portal		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Moderate	Possible	Medium
Ground Movement & Land Stability	GM005	Construction stage excavations cause ground movement	Damage to Essendon Flyover and/or Lloyd Street Bridges	C	1 - Tunnels *(Western portal to Arden)*		Medium	Controls inherent in the concept design scheme.	Minor	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM006	Construction stage excavations cause ground movement	Damage to Royal Women's Hospital, Victoria Comprehensive Cancer Centre, Grattan Street Pedestrian Bridge	C	4 - Parkville		Medium	Controls inherent in the concept design scheme.	Minor	Likely	Medium	As per GM001	Negligible	Likely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Ground Movement & Land Stability	GM007	Construction stage excavations cause ground movement	Damage to road pavement and tram lines at CityLink over crossing	C	1 - Tunnels *(CBD South to Domain)*		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM008	Construction stage excavations cause ground movement	Damage to tram lines resulting in disruption to services	C	6 - CBD South		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Moderate	Possible	Medium
Ground Movement & Land Stability	GM009	Construction stage excavations cause ground movement	Damage to CityLink viaduct foundations compromising structural integrity	C	1 - Tunnels *(Western portal to Arden)*		Medium	Controls inherent in the concept design scheme.	Minor	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM010	Construction stage excavations cause ground movement	Damage to Princes Bridge resulting in disruption to bridge traffic or compromising structural integrity	C	1 - Tunnels *(CBD South to Domain)*		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM011	Construction stage excavations cause ground movement	Damage to exiting City Loop tunnels, resulting in disruption to operating rail lines	C	5 - CBD North		Medium	Controls inherent in the concept design scheme.	Minor	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM012	Construction stage excavations cause ground movement	Damage to CityLink Tunnels resulting in disruption to operating roads	C	1 - Tunnels *(CBD South to Domain)*		Medium	Controls inherent in the concept design scheme.	Minor	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM013	Construction stage excavations cause ground movement	Damage to Telstra Tunnels resulting in disruption to key infrastructure	C	6 - CBD South		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Minor	Likely	Medium
Ground Movement & Land Stability	GM014	Tunnel, portal and station construction	Damage to utilities vulnerable to ground movements and integrity could be affected.	C	All		Medium	Assessment by service providers to identify potentially sensitive or aged assets of high importance. Controls inherent in the concept design scheme.	Minor	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM015	Construction stage groundwater inflows to excavations result in ground movement (consolidation settlement)	Potential impacts on existing buildings, utilities and/or infrastructure	C	All		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Ground Movement & Land Stability	GM016	Combined effects of excavation induced ground movement and consolidation settlement	Potential impacts on existing buildings, utilities and/or infrastructure	C	All		Medium	Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM017	Construction activities in/at waterway crossings (perpendicular or parallel to) causing destabilisation of Moonee Ponds Creek or Yarra River	Local destabilisation of waterway banks and channel profile, leading to slips Increased erosive action on creek banks and bed	C	1 - Tunnels *(Western portal to Arden), (CBD South to Domain)*		Medium	Controls inherent in the concept design scheme.	Minor	Possible	Low	As per GM001	Negligible	Unlikely	Very Low
Ground Movement & Land Stability	GM018	Groundwater drawdown during construction	Depressurisation of compressible sediments resulting in consolidation settlement with subsequent unacceptable impacts on structures, utilities and/or infrastructure	C	1 - Tunnels *(Western portal to Arden), (CBD North to CBD South), (CBD South to Domain)* 2 - Western portal 3 - Arden 6 - CBD South	Groundwater	Medium	Ground Movement instrumentation and monitoring. Condition surveys Controls inherent in the concept design scheme.	Moderate	Likely	Medium	As per GM001	Minor	Possible	Low
Ground Movement & Land Stability	GM019	Unexpected ground conditions or unexpected ground movement	Moderate or worse impacts to existing structures and/or infrastructure	C	All		Medium	Additional geotechnical investigations to refine interpreted geological model.	Moderate	Possible	Medium	As per GM001	Moderate	Unlikely	Low
Ground Movement & Land Stability	GM020	Tunnel construction encountering rock with greater rock mass strength than expected	May necessitate a change in construction methods in a zone of mixed geological conditions leading to increased ground movement or cause TBM to go off-line. Requirement to change construction method or repair/retool TBM could result in project delays	C	1 - Tunnels *(Western portal to Arden), (Arden to Parkville), (CBD South to Domain)* 2 - Western portal 3 - Arden		Medium	Geotechnical assessment to identify excavatability of rock in areas where TBM and road header proposed as method of excavation	Major	Possible	High	As per GM001	Moderate	Possible	Medium
Ground Movement & Land Stability	GM021	Underground Excavations	Very high strength rock mass requires drilling and blasting as a method of excavation. This could result in delays in tanking of tunnels or underground excavations	C	1 – Tunnels *(CBD North to CBD South)* 5 - CBD North 6 - CBD South		Medium	Geotechnical assessment to identify excavatability of rock in areas where road header proposed as method of excavation	Moderate	Possible	Medium	As per GM001	Minor	Unlikely	Low
Ground Movement & Land Stability	GM022	Tunnel construction	Modelled levels of ground movement are underestimated as a consequence of unforeseen geology, groundwater conditions, surface conditions and unexpected building conditions or use	C	All		Medium	Review of modelled data against the detailed design and the construction	Major	Possible	High	As per GM001	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
			of different equipment types					methods. Additional investigations, baseline monitoring							
Ground Movement & Land Stability	GM023	Ground heave as a result of excessive face pressure by the TBMs in shallow cover areas	Unacceptable ground movement	C	1 - Tunnels 2 - Western portal		Medium		Major	Possible	High	As per GM001	Major	Unlikely	Medium
Ground Movement & Land Stability	GM024	Groundwater inflow to excavations much greater than that estimated due to interception of high permeability zones that are difficult to control	Consolidation settlement magnitude and extents greater than that estimated resulting in moderate or worse impacts to existing structures and/or infrastructure	C / O	All	Groundwater	Medium	Additional hydrogeological investigations	Major	Possible	High	As per GM001	Moderate	Unlikely	Low
Ground Movement & Land Stability	GM025	Ongoing leakage into tunnels and underground structures during operation	Depressurisation of compressible sediments resulting in consolidation settlement with subsequent unacceptable impacts on structures, utilities and/or infrastructure	O	All		Medium	Tanked construction of underground structures and tunnels	Major	Possible	High	As per GM001	Moderate	Unlikely	Low
Groundwater	GW001	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on existing private bore users	C / O	1 - Tunnels *(Arden to Parkville), (Domain to eastern portal)* 3 - Arden 4 - Parkville 5 - CBD North 7 - Domain 8 - Eastern portal		Medium	Controls inherent in Concept Design scheme	Negligible	Rare	Very low	Design the tunnel and underground structures so that they minimise groundwater drawdown during construction and operation to minimise impacts on groundwater dependent values, ground movement and contamination plume migration. Develop a groundwater model for the detailed design phase to predict impacts associated with any changes to construction techniques or operational design features proposed during detailed design, and reconfirm that the Environmental Performance Requirements and mitigation measures are sufficient to mitigate impacts from changes in groundwater levels, flow and quality. Undertake monitoring during construction to ensure that predictions are accurate and mitigation measures are appropriate.	Negligible	Rare	Very low
Groundwater	GW002	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on existing private bore users	O	1 - Tunnels *(Western portal to Arden), (Parkville to CBD North), (CBD North to CBD South), (CBD South to Domain)* 2 - Western portal 6 - CBD South		Medium	Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW003	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on existing private bore users	C	1 - Tunnels *(Western portal to Arden), (Parkville to CBD North), (CBD South to Domain)*		Medium	Controls inherent in Concept Design scheme	Negligible	Unlikely	Very low	As per GW001	Negligible	Unlikely	Very low
Groundwater	GW004	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on existing private bore users	C	1 - Tunnels *(Western portal to Arden - Cross passage 2, 3)*		Medium	Ground treatment controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW005	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on existing private bore users	C	1 - Tunnels *(CBD South to Domain - alternative design option - shaft)*		Medium	Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW006	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on existing private bore users	C	1 - Tunnels *(CBD North to CBD South)*		Medium	Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW007	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on existing private bore users	C	2 - Western portal		Medium	Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW008	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on existing private bore users	C	6 - CBD South		Medium	Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW009	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on surface water features and the potential GDEs they support	C / O	1 - Tunnels *(Arden to Parkville)* 4 - Parkville		Medium	Controls inherent in Concept Design scheme	Negligible	Rare	Very low	As per GW001	Negligible	Rare	Very low
Groundwater	GW010	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on surface water features and the potential GDEs they support	C / O	1 - Tunnels *(Western portal to Arden), (Parkville to CBD North), (CBD North to CBD South)* 2 - Western portal 3 - Arden 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		Medium	Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW011	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on surface water features and the potential GDEs they support	C / O	1 - Tunnels *(CBD South to Domain, cross passage 11), (Domain to eastern portal)*		Medium	Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW012	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on surface water features and the potential GDEs they support	C	1 - Tunnels *(CBD South to Domain - alternative design option - shaft)*		Low	Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW013	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	C / O	1 - Tunnels *(Western portal to Arden), (Arden to Parkville)* 2 - Western portal 3 - Arden 4 - Parkville		Low	Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW014	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	C / O	1 – Tunnels *(Parkville to CBD North), (CBD North to CBD South)* 5 - CBD North		Low	Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW015	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	O	1 - Tunnels *(CBD South to Domain), (Domain to eastern portal)* 6 - CBD South 7 - Domain 8 - Eastern portal		Low	Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW016	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	C	1 - Tunnels *(CBD South to Domain, cross passage 11)*		Medium	Ground treatment controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW017	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	C	1 - Tunnels *(CBD South to Domain - alternative design option - shaft)*		Low	Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW001, and Develop and implement a GMP detailing groundwater management approaches to address the predicted impacts to groundwater dependent values during construction. The GMP must be based on the detailed design phase groundwater model, and should include the following details: • Identifying and if necessary, specifying mitigation measures to protect groundwater dependent vegetation during periods of drawdown Develop and implement a groundwater monitoring plan as part of the GMP that details sufficient monitoring of drawdown to verify that no significant impacts occur from potential: • Reduction in access to groundwater for trees.	Moderate	Unlikely	Low
Groundwater	GW018	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	C	1 - Tunnels *(CBD South to Domain), (Domain to eastern portal)*		Low	Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW0017	Minor	Unlikely	Low
Groundwater	GW019	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	C	6 - CBD South		Low	Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW0017	Moderate	Unlikely	Low
Groundwater	GW020	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	C	7 - Domain		Low	Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW0017	Moderate	Unlikely	Low
Groundwater	GW021	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on potential groundwater dependent vegetation (such as large trees that may be using groundwater)	C	8 - Eastern portal		Low	Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW0017	Moderate	Unlikely	Low
Groundwater	GW022	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	1 - Tunnels *(Western portal to Arden), (Arden to Parkville), (Parkville to CBD North), (CBD South to Domain)*	Contaminated Land & Spoil Management	Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW023	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	O	1 - Tunnels *(All)* 2 - Western portal 3 - Arden 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW024	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	1 - Tunnels *(Western portal to Arden, cross passages 2, 3), (CBD South to Domain, cross passage 11)*		Low	SEPP Groundwaters of Victoria Ground treatment controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW025	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	1 - Tunnels *(CBD North to CBD South)*		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW001, and Develop and implement a Groundwater Management Plan (GMP) detailing groundwater management approaches to address the predicted impacts to groundwater dependent values during construction. The GMP must be based on the detailed design phase groundwater model, and should include the following details: • An approach identified in consultation with the EPA so that contaminant migration causes no significant impacts on beneficial uses and vapour intrusion into underground structures, and establish appropriate monitoring networks to confirm effectiveness of approach Develop and implement a groundwater monitoring plan as part of the GMP that details sufficient monitoring of drawdown to verify that no significant impacts occur from potential: • Contaminant migration on the beneficial uses of groundwater at third party properties caused by drawdown and vapour intrusion to underground structures	Moderate	Unlikely	Low
Groundwater	GW026	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	1 - Tunnels *(CBD South to Domain - alternative design option - shaft)*		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW027	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	1 - Tunnels *(Domain to eastern portal - shaft)*		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW025	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW028	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	2 - Western portal 3 - Arden		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW025	Moderate	Unlikely	Low
Groundwater	GW029	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C / O	4 - Parkville		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Minor	Likely	Medium	As per GW025	Minor	Unlikely	Low
Groundwater	GW030	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	5 - CBD North	Contaminated Land & Spoil Management	Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Major	Likely	High	As per GW025	Moderate	Possible	Medium
Groundwater	GW031	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	5 - CBD South		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW032	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	7 - Domain		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW033	Potential groundwater inflows to structures causing drawdown	Changing groundwater gradients results in movement of groundwater contaminant plumes onto third party properties with potential impacts to beneficial uses of groundwater, and potential for vapour intrusion to existing underground structures	C	8 - Eastern portal		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW025	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW034	Potential groundwater inflows to structures causing drawdown	Generation of acidic groundwater due to dewatering of acid sulfate soils and/or rock	C / O	1 - Tunnels *(CBD South to Domain - alternative design option - shaft), (Domain to eastern portal - shafts)* 2 - Western portal 4 - Parkville 7 - Domain 8 - Eastern Portal	Contaminated Land & Spoil Management	Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW035	Potential groundwater inflows to structures causing drawdown	Generation of acidic groundwater due to dewatering of acid sulfate soils and/or rock	C	1 - Tunnels *(Western portal to Arden), (Arden to Parkville), (Parkville to CBD North), (CBD South to Domain)*		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW036	Potential groundwater inflows to structures causing drawdown	Generation of acidic groundwater due to dewatering of acid sulfate soils and/or rock	O	1 - Tunnels *(All)* 3 - Arden 5 - CBD North 6 - CBD South		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW037	Potential groundwater inflows to structures causing drawdown	Generation of acidic groundwater due to dewatering of acid sulfate soils and/or rock	C	1 - Tunnels *(Western portal to Arden, cross passages 2, 3), (CBD South to Domain, cross passage 11)*		Low	SEPP Groundwaters of Victoria Ground treatment controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW038	Potential groundwater inflows to structures causing drawdown	Generation of acidic groundwater due to dewatering of acid sulfate soils and/or rock	C	1 - Tunnels *(CBD North to CBD South)*		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW001, and : • Methods for minimising drawdown in areas of known PASS and establishing appropriate monitoring networks to confirm effectiveness of approach Develop and implement a groundwater monitoring plan as part of the GMP that details sufficient monitoring of drawdown to verify that no significant impacts occur from potential: • Develop and implement a GMP detailing groundwater management approaches to address the predicted impacts to groundwater dependent values during construction. The GMP must be based on the detailed design phase groundwater model, and should include the following detailsActivation of PASS and groundwater acidification	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW039	Potential groundwater inflows to structures causing drawdown	Generation of acidic groundwater due to dewatering of acid sulfate soils and/or rock	C	3 - Arden		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW040	Potential groundwater inflows to structures causing drawdown	Generation of acidic groundwater due to dewatering of acid sulfate soils and/or rock	C	5 - CBD North 6 - CBD South		Low	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Unlikely	Low	As per GW001	Moderate	Unlikely	Low
Groundwater	GW041	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on CityLink recharge scheme	C / O	1 – Tunnels *(Western portal to Arden), (Arden to Parkville), (Parkville to CBD North), (CBD North to CBD South), (Domain to eastern portal)* 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 7 - Domain 8 - Eastern portal	Ground Movement & Land Stability	Medium	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Negligible	Rare	Very low	As per GW001	Negligible	Rare	Very low
Groundwater	GW042	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on CityLink recharge scheme	C	1 - Tunnels *(CBD South to Domain, cross passage 11)*	Ground Movement & Land Stability	Medium	SEPP Groundwaters of Victoria Ground treatment controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW043	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on CityLink recharge scheme	C	1 - Tunnels *(CBD South to Domain)*	Ground Movement & Land Stability	Medium	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW044	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on CityLink recharge scheme	O	1 - Tunnels *(CBD South to Domain)* 6 - CBD South	Ground Movement & Land Stability	Medium	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW045	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on CityLink recharge scheme	C	1 - Tunnels *(CBD South to Domain - alternative design option - shaft)*	Ground Movement & Land Stability	Medium	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW001 Develop and implement a GMP detailing groundwater management approaches to address the predicted impacts to groundwater dependent values during construction. The GMP must be based on the detailed design phase groundwater model, and should include the following details:	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												• Methods for minimising drawdown at any existing recharge bores, and establishing appropriate monitoring networks to confirm effectiveness of mitigation Develop and implement a groundwater monitoring plan as part of the GMP that details sufficient monitoring of drawdown to verify that no significant impacts occur from potential: • Change in groundwater levels in any existing recharge bores that may be present in the area around the project.			
Groundwater	GW046	Potential groundwater inflows to structures causing drawdown	Regional drawdown impacting on CityLink recharge scheme	C	6 - CBD South	Ground Movement & Land Stability	Medium	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW045	Moderate	Unlikely	Low
Groundwater	GW047	Stations/tunnels damming groundwater flow	The tunnel/ height spanning an aquifer could potentially dam the flow of groundwater through that aquifer, causing settlement on the downstream side and waterlogging on the upstream side	C / O	1 - Tunnels *(Arden to Parkville), (Parkville to CBD North), (CBD North to CBD South), (Domain to eastern portal)* 2 - Western portal 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		Medium	Controls inherent in Concept Design scheme	Negligible	Rare	Very low	As per GW001	Negligible	Rare	Very low
Groundwater	GW048	Stations/tunnels damming groundwater flow	The tunnel/ height spanning an aquifer could potentially dam the flow of groundwater through that aquifer, causing settlement on the downstream side and waterlogging on the upstream side	C / O	1 - Tunnels *(Western portal to Arden), (CBD South to Domain - alternative design option)* 3 - Arden		Medium	Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW049	Potential groundwater inflows to structures causing drawdown	Drawdown in aquifers beneath the Coode Island Silt causes settlement	C / O	1 - Tunnels *(Parkville to CBD North), (CBD North to CBD South), (Domain to eastern portal)* 4 - Parkville 5 - CBD North 6 - CBD South 8 - Eastern portal	Ground Movement & Land Stability	Medium	Controls inherent in Concept Design scheme	Minor	Unlikely	Low	Addressed in Ground Movement & Land Stability Impact Assessment: risks GM015, GM016, GM018, GM024			#N/A

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW050	Potential groundwater inflows to structures causing drawdown	Drawdown in aquifers beneath the Coode Island Silt causes settlement	C	1 - Tunnels *(Western portal to Arden), (Arden to Parkville), (CBD South to Domain)*	Ground Movement & Land Stability	Medium	Controls inherent in Concept Design scheme	Minor	Likely	Medium	Addressed in Ground Movement & Land Stability Impact Assessment: risks GM015, GM016, GM018, GM024			#N/A
Groundwater	GW051	Potential groundwater inflows to structures causing drawdown	Drawdown in aquifers beneath the Coode Island Silt causes settlement	O	1 - Tunnels *(Western portal to Arden), (Arden to Parkville), (CBD South to Domain)* 2 - Western portal 3 - Arden 7 - Domain	Ground Movement & Land Stability	Medium	Controls inherent in Concept Design scheme	Major	Possible	High	Addressed in Ground Movement & Land Stability Impact Assessment: risks GM015, GM016, GM018, GM024			#N/A
Groundwater	GW052	Potential groundwater inflows to structures causing drawdown	Drawdown in aquifers beneath the Coode Island Silt causes settlement	C	1 - Tunnels *(Western portal to Arden, cross passages 2, 3), (CBD South to Domain, cross passage 11)*	Ground Movement & Land Stability	Medium	Ground treatment controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Groundwater	GW053	Potential groundwater inflows to structures causing drawdown	Drawdown in aquifers beneath the Coode Island Silt causes settlement	C	2 - Western portal 3 - Arden 7 - Domain	Ground Movement & Land Stability	Medium	Controls inherent in Concept Design scheme	Minor	Likely	Medium	Addressed in Ground Movement & Land Stability Impact Assessment: risks GM015, GM016, GM018, GM024			#N/A
Groundwater	GW054	Potential inflows to structures - health	Contaminated groundwater inflows into tunnel and stations come into contact with train users and workers potentially impacting human health	C	All	Contaminated Land & Spoil Management	Medium	SEPP Groundwaters of Victoria Controls inherent in Concept Design scheme	Minor	Unlikely	Low	Addressed in Contaminated Land & Spoil Management Impact Assessment: risks CL008, CL009, CL015, CL027 to CL029, CL042, CL059			#N/A
Groundwater	GW055	Potential inflows to structures - disposal	Unexpected contaminated groundwater flowing into the tunnel and stations is not treated by the water treatment plant and results in untreated contaminated groundwater being released to the receiving environment (sewer, surface waters)	C / O	All	Contaminated Land & Spoil Management	Low	SEPP Groundwaters of Victoria SEPP Waters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW001, and Develop and implement a Groundwater Management Plan (GMP) detailing groundwater management approaches to address the predicted impacts to groundwater dependent values during construction. The GMP must be based on the detailed design phase groundwater model, and should include the following details: • Approach to collection, treatment and disposal of groundwater collected during construction in accordance with the MMRA Groundwater Disposal Strategy Use the Groundwater Disposal Strategy and GMP to obtain a Trade Waste Agreement with the relevant Water Retailers for groundwater disposal.	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Groundwater	GW056	Potential inflows to structures - disposal	Disposal of groundwater inflows causes impacts on receiving environment	C / O	All		Low	SEPP Groundwaters of Victoria SEPP Waters of Victoria Controls inherent in Concept Design scheme	Moderate	Possible	Medium	As per GW055	Moderate	Unlikely	Low
Groundwater	GW057	Groundwater quality impacting on the durability of structures	Structures are degraded by the aggressive groundwater quality resulting in structure breakdown. This may result in damage to nearby third party structures as well as the economic and social impacts on the transport system	O	All	Contaminated Land & Spoil Management	Medium	SEPP Groundwaters of Victoria	Major	Rare	Medium	Addressed in Contaminated Land & Spoil Management Impact Assessment: risks CL013, CL036, CL050			#N/A
Groundwater	GW058	Cumulative impact	Cumulative drawdown results in unexpected impacts to groundwater dependent values	C / O	All		Medium	Controls inherent in Concept Design scheme	Minor	Possible	Low	As per GW001	Minor	Possible	Low
Groundwater	GW059	South Yarra Main Sewer replacement	Change in groundwater levels may impact groundwater dependent values	C / O	7 - Domain		Medium	Controls inherent in Concept Design scheme	Minor	Unlikely	Low	As per GW001	Minor	Unlikely	Low
Historical Cultural Heritage	HH01	Subsurface disturbance	Damage or destruction of site of archaeological significance not identified and not included in VHI	C	All		Low		Moderate	Possible	Medium	As per HH11, and To the satisfaction of Heritage Victoria: • Develop archaeological management plans to manage disturbance of archaeological sites and values affected by the project • Undertake investigation in accordance with the Guidelines for Investigating Historical Archaeological Artefacts and Sites, Heritage Victoria 2014 (as amended or updated) and to the satisfaction of the Executive Director, Heritage Victoria Develop and implement a protocol for managing previously unidentified historical archaeological sites discovered during project works.	Minor	Possible	Low
Historical Cultural Heritage	HH02	Subsurface disturbance	Damage or destruction of site of archaeological significance included in the VHI	D / C	All		Medium		Moderate	Almost Certain	High	As per HH01	Minor	Almost Certain	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Historical Cultural Heritage	HH03	Vibration associated with construction and/or ground movement as a result of construction	Damage to heritage buildings or structures	C	All	Noise & Vibration	Medium		Minor	Possible	Low	As per HH11, and To avoid or minimise impacts on the cultural heritage values of heritage places: • Perform works in accordance with the following noise and vibration and ground movement Environmental Performance Requirements as related to heritage places: NV2, NV5, NV6, NV11, GM2, GM4, GM5, GM6 • Undertake condition assessments of heritage places prior to commencement of construction where located within the identified vibration and ground settlement zones of sensitivity and monitor as per NV6, GM4 and GM5 Should damage occur to a building or structure on the Victorian Heritage Register or that is subject to a Heritage Overlay' as a result of works, undertake rectification works in accordance with accepted conservation practice (with reference to the Australia ICOMOS Burra Charter 2013) to the satisfaction of Heritage Victoria or the responsible authority, as applicable.	Minor	Possible	Low
Historical Cultural Heritage	HH04	Ground improvement works (CityLink tunnels crossing – above City Link tunnels)	Loss of trees, potential to constrain future landscape reinstatement works, potential impact on significant memorials within the Domain Parklands (VHR H2304), Boer War Memorial (VHR H0382), Marquis of Linlithgow Memorial (VHR H0366)	C	1 - Tunnels	Arboriculture Landscape & Visual Social	Medium		Major	Likely	High	As per HH06 and Prior to construction of main works or shafts that affect heritage structures or places, develop detailed methodology in accordance with Australia ICOMOS Burra Charter and to the satisfaction of Heritage Victoria or the responsible authority (as applicable) where heritage fabric is required to be dismantled, stored and reconstructed. Work is to be documented and overseen by an appropriately qualified conservation practitioner. Prior to construction of main works or shafts that affect heritage structures or places, develop and implement appropriate protection measures for heritage places and objects including sculptures, memorials, monuments and associated heritage fabric where retained in proximity to works. This is to be done to the satisfaction of Heritage Victoria or the responsible authority (as applicable).	Moderate	Likely	Medium
Historical Cultural Heritage	HH05	Emergency access shaft and associated construction work site - Queen Victoria Gardens (Concept Design)	Loss of trees, visual impact of new structure within the Domain Parklands (VHR H2304)	D / C	1 - Tunnels	Arboriculture Landscape & Visual	Low		Minor	Almost Certain	Medium	As per HH06 and Prior to construction of main works or shafts that affect heritage structures or places, develop and implement appropriate protection measures for heritage places and objects including sculptures, memorials, monuments and associated heritage fabric where retained in proximity to works. This is to be done to the satisfaction of Heritage Victoria or the responsible authority (as applicable).	Minor	Almost Certain	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Historical Cultural Heritage	HH06	Emergency access shaft and associated construction site construction work site – Tom's Block within Alexandra Park	Tree removal, visual impact of new structure within park, access may disrupt significant elm row within the Domain Parklands (VHR H2304)	D / C	1 - Tunnels	Arboriculture Landscape & Visual	Low		Minor	Almost Certain	Medium	As per HH11, and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified. To the satisfaction of Heritage Victoria and the responsible authority (as applicable), ensure new development is responsive to heritage places in terms of height, massing, form, façade articulation and materials. Replace removed trees as part of project delivery in accordance with relevant policy documents and to re-establish valued landscape character and in consultation with the City of Melbourne, the City of Post Phillip, the Shrine of Remembrance and Shrine Trustees and Heritage Victoria as applicable. Policy documents are as follows: • Domain Parklands: Domain Parklands CMP (in preparation, context, draft 2015–16) and the Domain Parklands Masterplan (in preparation) • Shrine of Remembrance: Shrine of Remembrance CMP (Lovell Chen, 2010) or any future review and the Shrine of Remembrance Landscape Improvement Plan (rush Wright Associates, 2010) South African Soldiers Memorial Reserve: Any relevant CMP for the South African Soldiers Memorial Fawkner Park: Fawkner Park Conservation Analysis (Hassell, 2002) and the Fawkner Park Masterplan (City of Melbourne, 2005).	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH07	TBM Southern Launch site: located in Fawkner Park open space and tennis courts	Tree removal within Fawkner Park (within HO6)	D / C	1 - Tunnels	Arboriculture	Medium		Minor	Almost Certain	Medium	As per HH06	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH08	Emergency access shaft – Fawkner Park north-east location (Concept Design)	Tree removal and visual impact of permanent structure within Fawkner Park (within HO6)	D / C	1 - Tunnels	Arboriculture Landscape & Visual	Medium		Minor	Almost Certain	Medium	As per HH06	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH09	Emergency access shaft – Fawkner Park location of the Fawkner Park TBM launch site (alternative design options to the Concept Design)	Visual impact of permanent structure within Fawkner Park (within HO6)	D	1 - Tunnels	Arboriculture Landscape & Visual	Medium		Minor	Almost Certain	Medium	As per HH06	Minor	Almost Certain	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Historical Cultural Heritage	HH10	Operations within the western portal construction work site	In Concept Design, demolition of four (4) graded buildings in Childers Street and Ormond Street, Kensington (within HO9). Adverse impact on local heritage precinct	D / C	2 - Western portal		High		Moderate	Almost Certain	High	As per HH11; and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified.	Moderate	Almost Certain	High
Historical Cultural Heritage	HH11	Operations within the western portal construction work site	In the alternative design option, demolition of one (1) ungraded building in Ormond Street, Kensington (within HO9)	D / C	2 - Western portal		High		Negligible	Almost Certain	Low	Design permanent and temporary works to avoid or minimise impacts on the cultural heritage values of heritage places. Consult as required with Heritage Victoria and/or the responsible authority (as applicable).	Negligible	Almost Certain	Low
Historical Cultural Heritage	HH12	Operations within the western portal construction work site	Potential impact on locally significant place, Kensington Glue Works complex (HO239)	D / C	2 - Western portal		Medium		Minor	Possible	Low	As per HH11; and To the satisfaction of the responsible authority, ensure no direct impact on heritage buildings on the former Glueworks site in Kensington.	Negligible	Almost Certain	Low
Historical Cultural Heritage	HH13	Construction work site - VicTrack lease and private property acquisition and demolition at Laurens Street and construction of Arden	Demolition of buildings in the proposed Railway Reserve Precinct (proposed HO1093) Complete loss of a locally significant heritage place	D / C	3 - Arden		Medium		Moderate	Almost Certain	High	As per HH10	Moderate	Almost Certain	High
Historical Cultural Heritage	HH14	Sub associated with Arden	Demolition of existing pumping – part of the proposed Moonee Ponds Creek and Infrastructure Precinct (proposed HO1092)	D / C	3 - Arden		High		Minor	Possible	Low	As per HH11; and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified. To the satisfaction of the responsible authority, retain and protect Langford Street pumping (part of proposed Moonee Ponds Creek and Infrastructure Precinct) as part of the design for the new sub.	Minor	Unlikely	Low
Historical Cultural Heritage	HH15	Station box under Grattan Street, to the east of Royal Parade (option 3)	Removal and reinstatement of four (4) trees in Royal Parade (VHR H2198)	D / C	4 - Parkville		Medium		Minor	Almost Certain	Medium	As per HH11; and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified. To the satisfaction of Heritage Victoria and the responsible authority, replace removed Elm trees in Royal Parade as part of project delivery using appropriate species and re-establish the boulevard formation. Provide suitable soil conditions to facilitate the growth of new trees to reach the size of the existing mature trees in the boulevard.	Minor	Almost Certain	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Historical Cultural Heritage	HH16	Road functional layout of Royal Parade	Removal and reinstatement of six (6) trees in Royal Parade (VHR H2198) and permanent changes to medians, replanted trees in proximate locations	D / C	4 - Parkville		Medium		Minor	Almost Certain	Medium	As per HH15	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH17	Station box under Grattan Street, to the east of Royal Parade (option 3)	Physical impact on University of Melbourne Main Entrance Gate (Gate 6) Pillars and Fence (VHR H918)– potential to dismantle and reconstruct	D / C	4 - Parkville		Medium		Moderate	Almost Certain	High	As per HH11; and Prior to construction of main works or shafts that affect heritage structures or places, develop detailed methodology in accordance with Australia ICOMOS Burra Charter and to the satisfaction of Heritage Victoria or the responsible authority (as applicable) where heritage fabric is required to be dismantled, stored and reconstructed. Work is to be documented and overseen by an appropriately qualified conservation practitioner.	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH18	Station box under Grattan Street, to the east of Royal Parade (option 3)	Potential visual impact on Gatekeeper's cottage (VHR H919) and Vice-Chancellor's House (VHR H1003)	D / C	4 - Parkville	Landscape & Visual	High		Minor	Likely	Medium	As per HH11; and Prior to construction of main works or shafts that affect heritage structures or places, develop and implement appropriate protection measures for heritage places and objects including sculptures, memorials, monuments and associated heritage fabric where retained in proximity to works. This is to be done to the satisfaction of Heritage Victoria or the responsible authority (as applicable). To the satisfaction of Heritage Victoria and the responsible authority (as applicable), ensure new development is responsive to heritage places in terms of height, massing, form, façade articulation and materials. To the satisfaction of Heritage Victoria, in detailed design ensure the eastern Parkville station entry is set no less than 8–10 metres from the original Gatekeeper's Cottage and an appropriate boundary treatment is retained or re-established for the heritage building.	Negligible	Possible	Low
Historical Cultural Heritage	HH19	Station box under Grattan Street, to the east of Royal Parade (option 3)	Potential removal of remnant bluestone pillar and cast iron fencing at the corner of Grattan Street and Royal Parade (no statutory controls)	D / C	4 - Parkville		High		Minor	Likely	Medium	As per HH11, and Prior to construction of main works or shafts that affect heritage structures or places, develop detailed methodology in accordance with Australia ICOMOS Burra Charter and to the satisfaction of Heritage Victoria or the responsible authority (as applicable) where heritage fabric is required to be dismantled, stored and reconstructed. Work is to be documented and overseen by an appropriately qualified conservation practitioner. Integrate the bluestone pillar and cast iron fencing at the corner of Grattan Street and Royal Parade into the design for the entry and surrounds in consultation with the University of Melbourne.	Negligible	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Historical Cultural Heritage	HH20	Permanent above ground infrastructure within HO1 (Carlton Precinct) at Barry and Grattan Streets	Visual impact of new structures in proximity to heritage buildings	D / C	4 - Parkville	Landscape & Visual	Medium		Minor	Possible	Low	As per HH11, and To the satisfaction of Heritage Victoria and the responsible authority (as applicable), ensure new development is responsive to heritage places in terms of height, massing, form, façade articulation and materials.	Minor	Possible	Low
Historical Cultural Heritage	HH21	Station located under Swanston Street, between Franklin and LaTrobe streets	Visual impact on City Baths (VHR H0466) of new entry in Franklin Street	D / C	5 - CBD North	Landscape & Visual	Medium		Moderate	Almost Certain	High	As per HH20	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH22	Flinders Street entrance including Port Phillip Arcade with underground connection to Flinders Street (Option 2)	Loss of significant fabric and impact of new works on Flinders Street Railway Station (VHR H1083)	D / C	6 - CBD South		Medium		Moderate	Almost Certain	High	As per HH11, and To the satisfaction of Heritage Victoria and the responsible authority (as applicable), ensure new development is responsive to heritage places in terms of height, massing, form, façade articulation and materials. Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified.	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH23	Collins Street entrance at City Square Flinders Street entrance including Port Phillip Arcade with underground connection to Flinders Street (Option 2)	Demolition of five (5) graded buildings in Flinders Gate Precinct (HO505)	D / C	6 - CBD South		High		Moderate	Almost Certain	High	As per HH11, and To the satisfaction of the responsible authority, in detailed design for the CBD South station, incorporate the Charles Bush sculpture into the design for the new building on the Port Phillip Arcade site, preferably in a prominent position on the Flinders Street façade.	Moderate	Almost Certain	High
Historical Cultural Heritage	HH24	Collins Street entrance at City Square (may include 65 and 67 Swanston Street) Flinders Street entrance including Port Phillip Arcade with underground connection to Flinders Street (Option 2)	New development in Flinders Gate Precinct (HO505) may have an adverse visual impact on the precinct and registered buildings in it including Young and Jackson's Hotel	D / C	6 - CBD South	Landscape & Visual	Low		Moderate	Likely	Medium	As per HH20	Minor	Likely	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Historical Cultural Heritage	HH25	Collins Street entrance at City Square (may include 65 and 67 Swanston Street)	Relocation of Burke and Wills statue (within HO505)	D / C	6 - CBD South		Medium		Minor	Almost Certain	Medium	As per HH11, and Prior to construction of main works or shafts that affect heritage structures or places, develop detailed methodology in accordance with Australia ICOMOS Burra Charter and to the satisfaction of Heritage Victoria or the responsible authority (as applicable) where heritage fabric is required to be dismantled, stored and reconstructed. Work is to be documented and overseen by an appropriately qualified conservation practitioner. Prior to construction of main works or shafts that affect heritage structures or places, develop and implement appropriate protection measures for heritage places and objects including sculptures, memorials, monuments and associated heritage fabric where retained in proximity to works. This is to be done to the satisfaction of Heritage Victoria or the responsible authority (as applicable). In the event the permanent relocation of the Burke and Wills Monument from its current site is required, resolve the final location of the monument to the satisfaction of the appropriate responsible authority and/or in consultation with the City of Melbourne prior to the commencement of construction.	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH26	Station located under St Kilda Road, adjacent to Albert and Domain Roads	Detrimental visual impact of entry in Shrine Reserve (Shrine of Remembrance, VHR H0848)	D / C	7 - Domain	Landscape & Visual	Medium		Minor	Almost Certain	Medium	As per HH11, and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified. Prior to construction of main works or shafts that affect heritage structures or places, develop and implement appropriate protection measures for heritage places and objects including sculptures, memorials, monuments and associated heritage fabric where retained in proximity to works. This is to be done to the satisfaction of Heritage Victoria or the responsible authority (as applicable). To the satisfaction of Heritage Victoria and the responsible authority (as applicable), ensure new development is responsive to heritage places in terms of height, massing, form, façade articulation and materials. To the satisfaction of Heritage Victoria, review the siting and design of the eastern Domain station entry in detailed design to ensure it is as recessive as possible in this location and has only a limited presence on the edge of the Reserve. The design needs to allow for the maintenance of an appropriate setting to the Macpherson Robertson Memorial Fountain.	Minor	Almost Certain	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Historical Cultural Heritage	HH27	Station located under St Kilda Road, adjacent to Albert and Domain Roads	Relocation of South African Soldiers Memorial (VHR H1374) and loss of trees with adverse impact on setting and presentation	D / C	7 - Domain	Arboriculture Social	Medium		Major	Almost Certain	Very High	As per HH11, and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified. Prior to construction of main works or shafts that affect heritage structures or places, develop detailed methodology in accordance with Australia ICOMOS Burra Charter and to the satisfaction of Heritage Victoria or the responsible authority (as applicable) where heritage fabric is required to be dismantled, stored and reconstructed. Work is to be documented and overseen by an appropriately qualified conservation practitioner. To the satisfaction of Heritage Victoria and the responsible authority (as applicable), ensure new development is responsive to heritage places in terms of height, massing, form, façade articulation and materials. To the satisfaction of Heritage Victoria, review the siting and design of the western Domain station entry in detailed design to ensure the South African Soldiers Memorial has an appropriate landscaped setting if relocated on this site. If no appropriate setting can be established, consider options for relocation of the memorial to an alternative site.	Moderate	Almost Certain	High
Historical Cultural Heritage	HH28	Construction work site with or without TBM launch site	Tree loss in St Kilda Road (not listed but of state significance) for construction work site, trees to be replanted consistent with road functional layout	D / C	7 - Domain	Arboriculture	Medium		Moderate	Almost Certain	High	As per HH11, and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified. To the satisfaction of the City of Melbourne, City of Port Phillip and/or the responsible authority, as applicable replace removed trees in St Kilda Road to re-stablish the boulevard formation.	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH29	Construction work site with or without TBM launch site	Tree loss and other impacts in Shrine Reserve (Shrine of Remembrance, VHR H0848)	D / C	7 - Domain	Arboriculture Social	Medium		Minor	Almost Certain	Medium	As per HH11, and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified. Prior to construction of main works or shafts that affect heritage structures or places, develop and implement appropriate protection measures for heritage places and objects including sculptures, memorials, monuments and associated heritage fabric where retained in proximity to works. This is to be done to the satisfaction of Heritage Victoria or the responsible authority (as applicable). Replace removed trees as part of project delivery in	Minor	Almost Certain	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												accordance with relevant policy documents and to re-establish valued landscape character and in consultation with the City of Melbourne, the City of Post Phillip, the Shrine of Remembrance and Shrine Trustees and Heritage Victoria as applicable. Policy documents are as follows: • Domain Parklands: Domain Parklands CMP (in preparation, context, draft 2015–16) and the Domain Parklands Masterplan (in preparation) • Shrine of Remembrance: Shrine of Remembrance CMP (Lovell Chen, 2010) or any future review and the Shrine of Remembrance Landscape Improvement Plan (rush Wright Associates, 2010) • South African Soldiers Memorial Reserve: Any relevant CMP for the South African Soldiers Memorial Fawkner Park: Fawkner Park Conservation Analysis (Hassell, 2002) and the Fawkner Park Masterplan (City of Melbourne, 2005).			
Historical Cultural Heritage	HH30	Construction work site with or without TBM launch site	Tree loss and other impacts in Domain Parklands (VHR H2304), Edmund Herring Oval	D / C	7 - Domain	Arboriculture Social	Medium		Negligible	Almost Certain	Low	As per HH11, and Replace removed trees as part of project delivery in accordance with relevant policy documents and to re-establish valued landscape character and in consultation with the City of Melbourne, the City of Post Phillip, the Shrine of Remembrance and Shrine Trustees and Heritage Victoria as applicable. Policy documents are as follows: • Domain Parklands: Domain Parklands CMP (in preparation, context, draft 2015–16) and the Domain Parklands Masterplan (in preparation) • Shrine of Remembrance: Shrine of Remembrance CMP (Lovell Chen, 2010) or any future review and the Shrine of Remembrance Landscape Improvement Plan (rush Wright Associates, 2010) • South African Soldiers Memorial Reserve: Any relevant CMP for the South African Soldiers Memorial Fawkner Park: Fawkner Park Conservation Analysis (Hassell, 2002) and the Fawkner Park Masterplan (City of Melbourne, 2005).	Negligible	Almost Certain	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Historical Cultural Heritage	HH31	Construction work site with or without TBM launch site	Potential relocation and reinstatement of Tram Shelter (VHR H1869)	D / C	7 - Domain		Medium		Moderate	Possible	Medium	As per HH11, and Prior to construction of main works or shafts that affect heritage structures or places, develop detailed methodology in accordance with Australia ICOMOS Burra Charter and to the satisfaction of Heritage Victoria or the responsible authority (as applicable) where heritage fabric is required to be dismantled, stored and reconstructed. Work is to be documented and overseen by an appropriately qualified conservation practitioner. Prior to construction of main works or shafts that affect heritage structures or places, develop and implement appropriate protection measures for heritage places and objects including sculptures, memorials, monuments and associated heritage fabric where retained in proximity to works. This is to be done to the satisfaction of Heritage Victoria or the responsible authority (as applicable).	Minor	Possible	Low
Historical Cultural Heritage	HH32	Construction of portal, cut and cover construction works, works activities on the construction work site to the eastern portal (South Yarra)	Potential impact of works within the railway reserve and changes to elements which contribute to the Toorak Road precinct (HO150) (Lovers Walk, railway cutting, South Yarra Sidings reserve) potential. Impact on heritage values associated with the precinct.	D / C	8 - Eastern portal		Medium		Minor	Almost Certain	Medium	As per HH11, and Prior to construction undertake archival photographic recording in accordance with Heritage Victoria Technical Note: Photographic Recording for Heritage Places and Objects where heritage places are to be demolished or modified.	Minor	Almost Certain	Medium
Historical Cultural Heritage	HH33	Early works (services and tram relocation)	Works could have an impact on significant trees	D / C	All	Arboriculture	High		Moderate	Possible	Medium	As per HH11, and To the satisfaction of Heritage Victoria and the responsible authority (as applicable) undertake all underground service works beneath or within heritage places or tree protection zones (TPZs) for trees as part of heritage places to avoid, minimise and mitigate impacts to the heritage fabric.	Minor	Rare	Very Low
Historical Cultural Heritage	HH34	Early works (services and tram relocation)	Works could have an impact on significant buildings, structures or places	D / C	All		Medium		Moderate	Possible	Medium	As per HH33	Minor	Rare	Very Low
Historical Cultural Heritage	HH35	Construction of the western turnback	Possible demolition of Cross Street Electrical Sub (HO192) included within construction work site	D / C	9 - Western turnback		Medium		Major	Possible	High	As per HH11, and Retain and protect the Cross Street Electrical Sub in situ within or abutting proposed construction site.	Moderate	Unlikely	Low
Land Use & Planning	LU001	The acquisition of properties	Acquisition of residential, commercial and retail titles for the project, resulting in some changes in land use.	D	5 - CBD North	Business Social	High	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Moderate	Almost Certain	High	Develop and implement measures for construction and operation of Melbourne Metro that aim to minimise impacts to the development and/or operation of existing land uses, including: • Limiting the permanent change of use within existing public open space • Minimising footprints of construction sites and permanent infrastructure on public land	Minor	Likely	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												• Minimising impacts to existing public open spaces and recreational facilities and the users of these facilities, including (but not limited to): JJ Holland Park, University Square, City Baths, City Square, Federation Square, the Shrine of Remembrance and the Shrine Reserve, Domain Parklands, Edmund Herring Oval, Fawkner Park and the Albert Road Reserve. Such measures must be developed in consultation with affected land managers for public land. Prior to main works or shaft construction, develop and implement a community and business involvement plan to engage potentially affected stakeholders and advise them of the planned construction activities and project progress. The plan must include: • Measures to minimise impacts to the development and/or operation of existing facilities • Measures for providing advance notice of significant milestones, changed traffic conditions, periods of predicted high noise and vibration activities • Process for registering and management of complaints Measures to address any other matters which are of concern or interest to them.			
Land Use & Planning	LU002	The acquisition of properties	Acquisition of titles for the project, however only minimal land use change is anticipated.	D	1 - Tunnels 2 - Western portal 6 - CBD South 7 - Domain	Business Social	High	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Minor	Almost Certain	Medium	As per LU001; and Development of the project is to have regard to the relevant Open Space Master Plans (including but not limited to, the Domain Parklands and Fawkner Park Master Plans) in designing and constructing above-ground infrastructure for the tunnels. Consultation must occur with land managers and/or agencies responsible for the implementation of the relevant Open Space Master Plans.	Minor	Possible	Low
Land Use & Planning	LU003	The acquisition of properties	Acquisition of titles for the project, however no change in land use is anticipated.	D	4 - Parkville 8 - Eastern portal	Business Social	High	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Minor	Almost Certain	Medium	As per LU001	Minor	Possible	Low
Land Use & Planning	LU004	The acquisition of properties	Strata below surface of old law titles may be required for Precinct 1 (Tunnels) for the project. Number not yet determined. Strata acquisition would not impact on land use.	D	1 - Tunnels (including emergency access shafts)	Business Social	High	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Minor	Almost Certain	Medium	As per LU001	Minor	Possible	Low
Land Use & Planning	LU005	The proposed location and siting of the project	Land use changes that would result in minor inconsistencies with local planning policies and current planning scheme provisions	D	1 - Tunnels (including emergency access shafts)		High	None	Minor	Almost Certain	Medium	As per LU002	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Land Use & Planning	LU006	The proposed construction methodology for the project	The use of the South Yarra Siding Reserve, City Square, University Square, Domain Parklands and Fawkner Park for the project is inconsistent with the intended use of the land for public parks	D	1 - Tunnels (including emergency access shafts) 4 - Parkville 6 - CBD South 7 - Domain 8 - Eastern portal	Social	High	None	Minor	Almost Certain	Medium	As per LU002; and In consultation with key stakeholders and in accordance with the Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works.	Minor	Possible	Low
Land Use & Planning	LU007	Change in access to properties	Temporary limited access (potential short term disruption to existing land use) to properties but properties are still able to be used for existing purposes (potential long term access changes).	C / O	2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Business Social	Medium	None	Minor	Almost Certain	Medium	As per LU001; and Prepare a business disruption plan to manage impacts to non-acquired businesses and to engage with business, property owners and the community throughout construction. The plan shall include: • Timely information on key project milestones • Changes to traffic conditions and duration of impact • A project construction schedule developed in coordination with transport authorities and local councils and in consultation with businesses to minimise cumulative impacts of this and other projects • Plans for notifying customers of proposed changes to business operations, including the setting of suitable timeframes for notification prior to commencement of works • Measures to ensure access to businesses is maintained for customers, delivery and waste removal unless there has been prior engagement with affected businesses (including mutually agreed mitigation measures as required). This could include the installation of directional and business signage to assist customers • Process for registering and management of complaints from affected businesses. In consultation with key stakeholders and in accordance with the Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works.	Minor	Possible	Low
Land Use & Planning	LU008	Change to future development of the land	The development of the project potentially impacts the future development potential of land	D	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal		Medium	None	Moderate	Possible	Medium	As per LU001; and Design and construction of Arden station must consider the ongoing strategic planning of the Arden-Macaulay Urban Renewal Area and include consultation with the Metropolitan Planning Authority, City of Melbourne and any other relevant agencies. In consultation with key stakeholders and in accordance with the Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works. Develop and implement a plan in consultation with the Office of Victorian Government Architect, local councils and other land managers to comply with the Melbourne Metro Urban Design Strategy to re-establish public open space, recreation	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												reserves and other valued places disturbed by temporary works. The plan must include, but not be limited to a methodology for storage, reinstatement or replacement of existing public art, monuments and public infrastructure such as poles, bins, and other street furniture.			
Land Use & Planning	LU009	Relocation of infrastructure	The relocation of infrastructure (including power lines and bike paths) causes short term disruption to existing land use.	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Social	High	None	Minor	Likely	Medium	Prior to main works or shaft construction, develop and implement a community and business involvement plan to engage potentially affected stakeholders and advise them of the planned construction activities and project progress. The plan must include: • Measures to minimise impacts to the development and/or operation of existing facilities • Measures for providing advance notice of significant milestones, changed traffic conditions, periods of predicted high noise and vibration activities • Process for registering and management of complaints • Measures to address any other matters which are of concern or interest to them. Develop and implement a plan in consultation with the Office of Victorian Government Architect, local councils and other land managers to comply with the Melbourne Metro Urban Design Strategy to re-establish public open space, recreation reserves and other valued places disturbed by temporary works. The plan must include, but not be limited to a methodology for storage, reinstatement or replacement of existing public art, monuments and public infrastructure such as poles, bins, and other street furniture. In consultation with key stakeholders and in accordance with the Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works.	Minor	Possible	Low
Landscape & Visual	LV001	Construction activities - non-elevated Parks - Recreation	Potential for impact on landscape and visual values - Parks - Recreation uses – JJ Holland Park	C	2 – Western portal	Social		None	Minor	Almost Certain	Medium	Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the MMRA Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values, particularly in relation to: • Tunnels: Queen Victoria Gardens, Fawkner Park • Western portal: JJ Holland Park • Parkville : University of Melbourne, Victorian Comprehensive Cancer Centre, Royal Melbourne Hospital, University Square • CBD North : Royal Melbourne Institute of Technology, the State Library • CBD South : St Paul's Cathedral, Federation Square, City Square and Flinders Street Station • Domain : The Shrine of Remembrance, South African Soldiers Memorial Reserve, Domain Parklands • Eastern portal: South Yarra Siding Reserve. Develop and implement a plan in consultation with the Office	Minor	Almost Certain	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												of Victorian Government Architect, local councils and other land managers to comply with the Melbourne Metro Urban Design Strategy to re-establish public open space, recreation reserves and other valued places disturbed by temporary works. The plan must include, but not be limited to a methodology for storage, reinstatement or replacement of existing public art, monuments and public infrastructure such as poles, bins, and other street furniture. Develop and implement measures to minimise light spillage during construction to protect the amenity of adjacent neighbourhoods, parks and community facilities.			
Landscape & Visual	LV002	Construction activities - non-elevated Parks - Recreation	Potential for impact on visual and landscape values - Parks - Recreation uses – Queen Victoria Gardens	C	1 - Tunnels	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV003	Construction activities - non-elevated Parks - Recreation	Potential for impact on visual and landscape values - Parks - Recreation uses – Domain Parklands and the outer perimeter of the Shrine Reserve	C	7 – Domain	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV004	Construction activities - non-elevated Parks - Recreation	Potential for impact on visual and landscape values from Parks - Recreation uses – Fawkner Park	C	1 - Tunnels	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV005	Construction activities - non-elevated Parks - Recreation	Potential for impact on visual and landscape values - Parks - Recreation uses – South Yarra Siding Reserve	C	8 – Eastern portal	Social			Moderate	Almost Certain	High	As per LV001	Moderate	Almost Certain	High
Landscape & Visual	LV006	Construction activities - elevated Park -Recreation (Shrine of Remembrance)	Potential for impact on visual and landscape values - Parks - Recreation uses - the Shrine of Remembrance	C	7 – Domain	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV007	Construction activities - Parks - Urban Plazas	Potential for impact on visual and landscape values - Parks - Urban Plaza uses – University Square (Southern section)	C	4 – Parkville	Social			Moderate	Almost Certain	High	As per LV001	Moderate	Almost Certain	High
Landscape & Visual	LV008	Construction activities - Parks - Urban Plazas	Potential for impact on visual and landscape values - Parks - Urban Plazas uses – State Library Forecourt	C	5 – CBD North	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV009	Construction activities - Parks - Urban Plazas	Potential for impact on visual and landscape values - Parks - Urban Plazas uses –Federation Square	C	6 – CBD South	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Landscape & Visual	LV010	Construction activities - Parks - Urban Plazas	Potential for impact on visual and landscape values - Parks - Urban Plaza uses –City Square	C	6 – CBD South	Social			Moderate	Almost Certain	High	As per LV001	Moderate	Almost Certain	High
Landscape & Visual	LV011	Construction activities - non-elevated residential / accommodation	Potential for impact on visual and landscape values - Residential / Accommodation uses – Residences in Kensington	C	2 – Western portal	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV012	Construction activities - non-elevated residential / accommodation	Potential for impact on visual and landscape values - Residential / Accommodation uses – Residences in Queensberry Street	C	3 – Arden	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV013	Construction activities - non-elevated residential / accommodation	Potential for impact on visual and landscape values - Residential / Accommodation uses – Residences in William and Osborne Streets	C	8 - Eastern portal	Social			Moderate	Almost Certain	High	As per LV001	Moderate	Almost Certain	High
Landscape & Visual	LV014	Construction activities - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Apartments in Kensington	C	2 – Western portal	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV015	Construction activities - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Apartments and Hotels in Swanston Street	C	5 – CBD North 6 – CBD South	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV016	Construction activities - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Westin Hotel	C	6 – CBD South	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV017	Construction activities - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Domain Towers	C	7 – Domain	Social			Moderate	Almost Certain	High	As per LV001	Moderate	Almost Certain	High

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Landscape & Visual	LV018	Construction activities - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Hallmark Apartments.	C	7 – Domain	Social			Moderate	Almost Certain	High	As per LV001	Moderate	Almost Certain	High
Landscape & Visual	LV019	Construction activities - retail uses (assumes primarily non-elevated)	Potential for impact on visual and landscape values - Retail uses – Melbourne Central, Swanston Street	C	5 – CBD North 6 – CBD South	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV020	Construction activities - health, education and community facility uses (assumes primarily elevated)	Potential for overlooking impact on visual and landscape values - Health and Educational uses – Victorian Comprehensive Cancer Centre	C	4 – Parkville	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV021	Construction activities - health, education and community facility uses (assumes primarily elevated)	Potential for overlooking impact on visual and landscape values - Health and Educational uses – Royal Melbourne Hospital	C	4 – Parkville	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV022	Construction activities - health, education and community facility uses (assumes primarily elevated)	Potential for overlooking impact on visual and landscape values - Health and Educational uses – University of Melbourne	C	4 – Parkville	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV023	Construction activities - health, education and community facility uses (assumes primarily elevated)	Potential for overlooking impact on visual and landscape values - Health and Educational uses – RMIT	C	5 – CBD North	Social			Minor	Almost Certain	Medium	As per LV001	Minor	Almost Certain	Medium
Landscape & Visual	LV024	Construction activities - Swanston Street to the Shrine of Remembrance	Potential for impact on visual and landscape values - along the Swanston Street visual axis to the Shrine of Remembrance	C	5 – CBD North 6 – CBD South	Social			Minor	Possible	Low	As per LV001	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Landscape & Visual	LV025	Construction activities - Royal Parade	Potential for impact on visual and landscape values - along the Royal Parade Boulevard	C	4 – Parkville	Social			Moderate	Almost Certain	High	As per LV001	Moderate	Almost Certain	High
Landscape & Visual	LV026	Project components - Parks - Recreation	Potential for impact on visual and landscape values - Parks - Recreation uses – JJ Holland Park	O	2 – Western portal	Social			Minor	Likely	Medium	Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the MMRA Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values, particularly in relation to: • Tunnels: Queen Victoria Gardens, Fawkner Park • Western portal: JJ Holland Park • Parkville : University of Melbourne, Victorian Comprehensive Cancer Centre, Royal Melbourne Hospital, University Square • CBD North : Royal Melbourne Institute of Technology, the State Library • CBD South : St Paul's Cathedral, Federation Square, City Square and Flinders Street Station • Domain : The Shrine of Remembrance, South African Soldiers Memorial Reserve, Domain Parklands Eastern portal: South Yarra Siding Reserve. Develop and implement a plan in consultation with the Office of Victorian Government Architect, local councils and other land managers to comply with the Melbourne Metro Urban Design Strategy to re-establish public open space, recreation reserves and other valued places disturbed by temporary works. The plan must include, but not be limited to a methodology for storage, reinstatement or replacement of existing public art, monuments and public infrastructure such as poles, bins, and other street furniture.	Minor	Unlikely	Low
Landscape & Visual	LV027	Project components - Parks - Recreation	Potential for impact on visual and landscape values - Parks - Recreation uses – Queen Victoria Gardens	O	1 - Tunnels	Social			Minor	Likely	Medium	As per LV026	Minor	Unlikely	Low
Landscape & Visual	LV028	Project components - Parks - Recreation	Potential for impact on visual and landscape values - Parks - Recreation uses – Domain Parklands and the outer perimeter of the Shrine Reserve	O	7 – Domain	Social			Minor	Likely	Medium	As per LV026	Minor	Unlikely	Low
Landscape & Visual	LV029	Project components - Parks - Recreation	Potential for impact on visual and landscape values - Parks - Recreation uses – Fawkner Park	O	1 - Tunnels	Social			Minor	Likely	Medium	As per LV026	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Landscape & Visual	LV030	Project components - Parks - Recreation	Potential for impact on visual and landscape values - Parks - Recreation uses – South Yarra Siding Reserve	O	8 – Eastern portal	Social			Moderate	Almost Certain	High	As per LV026	Minor	Unlikely	Low
Landscape & Visual	LV031	Project components - elevated Park - Recreation (Shrine of Remembrance)	Potential for impact on visual and landscape values - Parks - Recreation uses (the Shrine of Remembrance surrounds)	O	7 – Domain	Social			Minor	Likely	Medium	As per LV026	Minor	Possible	Low
Landscape & Visual	LV032	Project components - Parks - Urban Plazas	Potential for impact on visual and landscape values - Parks - Urban Plaza uses – University Square (Southern section)	O	4 – Parkville	Social			Minor	Likely	Medium	As per LV026	Minor	Unlikely	Low
Landscape & Visual	LV033	Project components - Parks - Urban Plazas	Potential for impact on visual and landscape values - Parks - Urban Plazas uses –, State Library Forecourt	O	5 – CBD North	Social			Negligible	Likely	Low	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV034	Project components - Parks - Urban Plazas	Potential for impact on visual and landscape values - Parks - Urban Plazas uses –Federation Square	O	6 – CBD South	Social			Negligible	Likely	Low	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV035	Project components - Parks - Urban Plazas	Potential for impact on visual and landscape values - Parks - Urban Plazas uses –City Square	O	6 – CBD South	Social			Minor	Likely	Medium	As per LV026	Minor	Possible	Low
Landscape & Visual	LV036	Project components - non-elevated residential/accommodation	Potential for impact on visual and landscape values - Residential / Accommodation uses – Residences in Kensington	O	2 – Western portal	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV037	Project components - non-elevated residential/accommodation	Potential for impact on visual and landscape values - Residential / Accommodation uses – Residences in Queensberry Street	O	3 – Arden	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV038	Project components - non-elevated residential/accommodation	Potential for impact on visual and landscape values - Residential / Accommodation uses – Residences in William and Osborne Streets	O	8 - Eastern portal	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Landscape & Visual	LV039	Project components - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Apartments in Kensington	O	2 – Western portal	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV040	Project components - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Apartments and Hotels in Swanston Street	O	5 – CBD North 6 – CBD South	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV041	Project components - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Westin Hotel	O	6 – CBD South	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV042	Project components - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Domain Towers	O	7 – Domain	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV043	Project components - mid-level elevated residential/accommodation (Levels 2 and above)	Potential for overlooking impact on visual and landscape values - Residential / Accommodation uses – Hallmark Apartments.	O	7 – Domain	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV044	Project components - retail uses (assumes primarily non-elevated)	Potential for impact on visual and landscape values - Retail uses – Melbourne Central, Swanston Street	O	5 – CBD North 6 – CBD South	Social			Negligible	Likely	Low	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV045	Project components - health, education and community facility uses (assumes primarily elevated)	Potential for overlooking impact on visual and landscape values - Health and Educational uses – Victorian Comprehensive Cancer Centre	O	4 – Parkville	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Landscape & Visual	LV046	Project components - health, education and community facility uses (assumes primarily elevated)	Potential for overlooking impact on visual and landscape values - Health and Educational uses – Royal Melbourne Hospital	O	4 – Parkville	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV047	Project components - health, education and community facility uses (assumes primarily elevated)	Potential for overlooking impact on visual and landscape values - Health and Educational uses – University of Melbourne	O	4 – Parkville	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV048	Project components - health, education and community facility uses (assumes primarily elevated)	Potential for overlooking impact on visual and landscape values - Health and Educational uses – RMIT	O	5 – CBD North	Social			Minor	Likely	Medium	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV049	Project components - Swanston Street spine to the Shrine of Remembrance	Potential for impact on visual and landscape values - along the Swanston Street visual axis to the Shrine of Remembrance	O	5 – CBD North 6 – CBD South	Social			Negligible	Unlikely	Very Low	As per LV026	Negligible	Unlikely	Very Low
Landscape & Visual	LV050	Project components - Royal Parade	Potential for impact on visual and landscape values - along the Swanston Street visual axis to the Shrine of Remembrance	O	4 – Parkville	Social			Negligible	Unlikely	Very Low	As per LV026	Negligible	Unlikely	Very Low
Noise & Vibration	NV001	**Airborne Noise** Construction of Melbourne Metro – general construction activities	Noise levels exceeding relevant criteria	C	All	Business Social	Medium	Compliance with *EPA Victoria Publication 1254 Noise Control Guideline*	Minor	Almost Certain	Medium	Develop and implement a plan to manage construction noise in accordance with EPA Publication 1254 Noise Control Guidelines. Appoint an acoustic and vibration consultant to predict construction noise and vibration (through modelling) and update the modelling to reflect current construction methodology, site conditions and specific equipment noise and vibration levels (this will require noise and vibration measurements). The model would be used to determine appropriate mitigation to achieve the Environmental Performance Requirements. The acoustic and vibration consultant will also be required to undertake noise and vibration monitoring to assess levels with respect to Guideline Targets specified in the Environmental Performance Requirements. Where monitoring indicates exceedances of Guideline Targets, apply appropriate management measures as a soon as possible.	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availabilit y	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												Develop and implement a communications plan to liaise with potentially affected community stakeholders and land owners regarding potential noise and vibration impacts. The plan shall include procedures for complaint management. Airborne Construction Noise Guideline Targets (Internal): Implement management actions if construction noise exceeds the internal noise levels below for Highly Sensitive Areas (based on AS/NZS 2107:2000) and a noise sensitive receptor is adversely impacted. **Highly Sensitive Area** — **Maximum Internal Construction Noise Level ($L_{Aeq, 15\ mins}$)** Intensive Care Wards — 45 Operating Theatres — 45 Surgeries — 45 Wards — 40			
Noise & Vibration	NV002	**Vibration** Construction of Melbourne Metro - tunnelling	Vibration levels from tunnelling exceeding Guideline Targets for structural damage and resulting in structural damage	C	1 - Tunnels 2 - Western portal 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Business Historical Cultural Heritage Social	Medium		Moderate	Possible	Medium	As per NV001 and NV003; and For construction works conducted between CBD South station and Domain station, comply with the requirements of the Notification of Referral Decision for the Melbourne Metro Rail Project (EPBC 2015/7549, dated 22 September 2015) under the EPBC Act for vibration monitoring and measurement	Minor	Possible	Low

<table>
<tr><th rowspan="2">Discipline</th><th rowspan="2">Risk No.</th><th colspan="2">Impact Pathway</th><th rowspan="2">Project Phase</th><th rowspan="2">Precinct</th><th rowspan="2">Linkages</th><th rowspan="2">Data availability</th><th rowspan="2">Existing performance requirements</th><th colspan="3">Initial Risk</th><th rowspan="2">Recommended Environmental Performance Requirements</th><th colspan="3">Residual Risk</th></tr>
<tr><th>Category</th><th>Event</th><th>C</th><th>L</th><th>Risk</th><th>C</th><th>L</th><th>Risk</th></tr>
<tr><td>Noise & Vibration</td><td>NV003</td><td>Vibration
Construction of Melbourne Metro - tunnelling</td><td>Vibration levels from tunnelling exceeding Guideline Targets for structural damage and resulting in structural damage</td><td>C</td><td>3 - Arden</td><td>Business
Historical Cultural Heritage
Social</td><td>Medium</td><td></td><td>Minor</td><td>Possible</td><td>Low</td><td><u>Vibration Guideline Targets for Structures:</u> Implement management actions if due to construction activity, the following DIN 4150 Guideline Targets for structural damage to buildings (for short-term vibration or long-term vibration) are not achieved.
Short-term vibration on structures:
<table>
<tr><th rowspan="2">Type of structure</th><th colspan="3">Vibration at the foundation, mm/s (Peak Component Particle Velocity)</th><th>Vibration at horizontal plane of highest floor at all frequencies</th></tr>
<tr><th>1 to 10 Hz</th><th>10 to 50 Hz</th><th>50 to 100 Hz[1]</th><th>mm/s (Peak Component Particle Velocity)</th></tr>
<tr><td>Type 1: Buildings used for commercial purposes, industrial buildings and buildings of similar design</td><td>20</td><td>20 to 40</td><td>40 to 50</td><td>40</td></tr>
<tr><td>Type 2: Dwellings and buildings of similar design and/or occupancy</td><td>5</td><td>5 to15</td><td>15 to 20</td><td>15</td></tr>
<tr><td>Type 3: Structures that have a particular sensitivity to vibration, such as heritage buildings</td><td>3</td><td>3 to 8</td><td>8 to 10</td><td>8</td></tr>
</table>
Notes
1. At frequencies above 100 Hz, the values given in this column may be used as minimum values.
2. Vibration levels marginally exceeding those vibration levels in the table would not necessarily mean that damage would occur and further investigation would be required to determine if higher vibration levels can be accommodated without risk of damage.
3. For civil engineering structures (e.g. with reinforced concrete constructions used as abutments or foundation pads) the values for Type 1 buildings may be increased by a factor of 2.
4. Short-term vibration is defined as vibration which does not occur often enough to cause structural fatigue and which does not produce resonance in the structure being evaluated.</td><td>Negligible</td><td>Possible</td><td>Low</td></tr>
</table>

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk

Long-term vibration on structures:

Type of Structure	Vibration Velocity, mm/s (Peak Component Particle Velocity) in horizontal plane at all frequencies
Buildings used for commercial purposes, industrial buildings and similar design	10
Dwellings and buildings of similar design and/or occupancy	5
Structures that have a particular sensitivity to vibration, such as heritage buildings	2.5

Notes

1. Vibration levels marginally exceeding those in the table would not necessarily mean that damage would occur and further investigation is required would be required to determine if higher vibration levels can be accommodated without risk of damage.
2. Long-term vibration means vibration events that may result in a resonant structural response.

Undertake condition assessments of above and below ground utility assets and establish construction vibration limits with asset owners.

Monitor vibration during construction to demonstrate compliance with agreed vibration guideline targets. Take remedial action if limits are not met.

<u>Vibration Guideline Targets for Underground Infrastructure:</u>
Implement management actions if the following DIN 4150 Guideline Targets for buried pipework/underground infrastructure from construction are not achieved.

Pipe material	Vibration Velocity, mm/s (PPV)
Steel	100
Clay, concrete, reinforced concrete, prestressed concrete, metal	80
Masonry, plastic	50

Notes

1. These values may be reduced by 50% when evaluating the effects of long-term vibration on buried pipework.
2. It is assumed pipes have been manufactured and laid using current technology (however it is noted that this is not the case for the majority of buried pipework potentially affected by Melbourne Metro).
3. Compliance with is to be achieved with asset owner's Utility Standards.

<table>
<tr><th rowspan="2">Discipline</th><th rowspan="2">Risk No.</th><th colspan="2">Impact Pathway</th><th rowspan="2">Project Phase</th><th rowspan="2">Precinct</th><th rowspan="2">Linkages</th><th rowspan="2">Data availability</th><th rowspan="2">Existing performance requirements</th><th colspan="3">Initial Risk</th><th rowspan="2">Recommended Environmental Performance Requirements</th><th colspan="3">Residual Risk</th></tr>
<tr><th>Category</th><th>Event</th><th>C</th><th>L</th><th>Risk</th><th>C</th><th>L</th><th>Risk</th></tr>
<tr><td>Noise & Vibration</td><td>NV004</td><td>Vibration
Construction of Melbourne Metro - tunnelling</td><td>Vibration levels from tunnelling exceeding Guideline Targets for human comfort</td><td>C</td><td>1 - Tunnels
4 - Parkville</td><td>Social</td><td>Medium</td><td></td><td>Moderate</td><td>Almost Certain</td><td>High</td><td><u>Vibration Dose Values (VDVs) (Human Comfort):</u> Implement management actions if the following Guideline Targets (VDVs) (based Table 1 in BS6472-1:2008) for continuous (as for TBMs and road headers), intermittent, or impulsive vibration are not achieved.
<table><tr><th rowspan="3">Location</th><th colspan="4">VDV (m/s$^{1.75}$)</th></tr><tr><th colspan="2">Day
7:00am to 10:00pm</th><th colspan="2">Night
10:00pm to 7:00am</th></tr><tr><th>Preferred Value</th><th>Maximum Value</th><th>Preferred Value</th><th>Maximum Value</th></tr><tr><td>Residences</td><td>0.20</td><td>0.40</td><td>0.10</td><td>0.20</td></tr><tr><td>Offices, schools, educational institutions, places of worship</td><td>0.40</td><td>0.80</td><td>0.40</td><td>0.80</td></tr><tr><td>Workshops</td><td>0.80</td><td>1.60</td><td>0.80</td><td>1.60</td></tr></table>Notes
1. The Guideline Targets are non-mandatory; they are goals that should be sought to be achieved through the application of feasible and reasonable mitigation measures. If exceeded then management actions would be required.
2. The VDVs may be converted to PPVs within a future noise and vibration construction management plan.</td><td>Moderate</td><td>Likely</td><td>Medium</td></tr>
<tr><td>Noise & Vibration</td><td>NV005</td><td>Vibration
Construction of Melbourne Metro - tunnelling</td><td>Vibration levels from tunnelling exceeding Guideline Targets for human comfort</td><td>C</td><td>5 - CBD North
6 - CBD South</td><td></td><td>Medium</td><td></td><td>Major</td><td>Almost Certain</td><td>Very High</td><td>As per NV004</td><td>Major</td><td>Possible</td><td>High</td></tr>
<tr><td>Noise & Vibration</td><td>NV006</td><td>Vibration
Construction of Melbourne Metro - tunnelling</td><td>Vibration levels from tunnelling exceeding Guideline Targets for human comfort</td><td>C</td><td>2 - Western portal
3 - Arden
7 - Domain
8 - Eastern portal</td><td>Social</td><td>Medium</td><td></td><td>Minor</td><td>Possible</td><td>Low</td><td>As per NV004</td><td>Minor</td><td>Unlikely</td><td>Low</td></tr>
<tr><td>Noise & Vibration</td><td>NV007</td><td>Vibration
Construction of Melbourne Metro - tunnelling</td><td>Vibration levels from tunnelling exceeding Guideline Targets for vibration-sensitive equipment</td><td>C</td><td>1 - Tunnels
2 - Western portal
3 - Arden
6 - CBD South
7 - Domain
8 - Eastern portal</td><td>Business</td><td>Low</td><td></td><td>Negligible</td><td>Rare</td><td>Very Low</td><td></td><td>Negligible</td><td>Rare</td><td>Very Low</td></tr>
<tr><td>Noise & Vibration</td><td>NV008</td><td>Vibration
Construction of Melbourne Metro - tunnelling</td><td>Vibration levels from tunnelling exceeding Guideline Targets for vibration-sensitive equipment</td><td>C</td><td>4 - Parkville</td><td>Business</td><td>Medium</td><td></td><td>Major</td><td>Almost Certain</td><td>Very High</td><td><u>Vibration-sensitive Equipment Guideline Targets:</u> Implement management actions if the ASHRAE equipment vibration Guideline Targets or measured background levels (whichever is higher) are exceeded for vibration-sensitive equipment during construction and operation at Parkville and CBD North stations. (Refer to EES Chapter 23 – EPR NV10 for Guideline Targets.)
The proponent may undertake consultation with the users and agree alternative Guideline Targets.</td><td>Moderate</td><td>Likely</td><td>Medium</td></tr>
</table>

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Noise & Vibration	NV009	**Vibration** Construction of Melbourne Metro - tunnelling	Vibration levels from tunnelling exceeding Guideline Targets for vibration-sensitive equipment	C	5 - CBD North	Business	Low		Minor	Likely	Medium	As per NV008	Minor	Possible	Low
Noise & Vibration	NV010	**Ground-borne noise and vibration** Construction of Melbourne Metro - tunnelling	Ground-borne noise and vibration levels from tunnelling impacting on Highly Sensitive Areas (hospital wards, operating theatres)	C	4 - Parkville	Business Social	Medium		Moderate	Likely	Medium	As per NV003	Moderate	Likely	Medium
Noise & Vibration	NV011	**Ground-borne noise and vibration** Construction of Melbourne Metro - Addition Construction Works	Ground-borne noise and vibration from general construction impacting on Highly Sensitive Areas (hospital wards, operating theatres)	C	4 - Parkville	Business Social	Medium		Moderate	Possible	Medium	As per NV003	Minor	Possible	Low
Noise & Vibration	NV012	**Ground-borne noise and vibration** Construction of Melbourne Metro - tunnelling	Ground-borne noise and vibration levels from tunnelling impacting on Bioresources	C	4 - Parkville	Business Social	Medium		Moderate	Possible	Medium	As per NV003; and To protect the amenity of Bio-resources and sensitive research during construction and operation, the following criteria apply: • Background noise should be kept below 50 dB and should be free of distinct tones (internal) • Short exposure should be kept to less than 85 dB (internal). **Notes** 1 The levels above should take into consideration the frequency threshold for the Bio-resource under consideration. 2 Higher levels may be acceptable if it can be shown that the Bio-resource under consideration is exposed to higher levels and is not adversely impacted by them.	Moderate	Unlikely	Low
Noise & Vibration	NV013	**Ground-borne noise and vibration** Construction of Melbourne Metro - Additional Construction Works	Ground-borne vibration levels from general construction impacting on Bio-resources	C	4 - Parkville	Business Social	Medium		Moderate	Possible	Medium	As per NV003	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Noise & Vibration	NV014	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration levels from general construction exceeding Guideline Targets for structural damage	C	1 - Tunnels	Business Historical Cultural Heritage Social	Medium		Moderate	Likely	Medium	As per NV002 and NV003; and For construction works conducted between CBD South station and Domain station, comply with the requirements of the Notification of Referral Decision for the Melbourne Metro Rail Project (EPBC 2015/7549, dated 22 September 2015) under the EPBC Act for vibration monitoring and measurement	Minor	Possible	Low
Noise & Vibration	NV015	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration levels from general construction exceeding Guideline Targets for structural damage	C	2 - Western portal 9 - Western turnback	Business Historical Cultural Heritage Social	Medium		Moderate	Possible	Medium	As per NV003	Negligible	Possible	Low
Noise & Vibration	NV016	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration levels from general construction exceeding Guideline Targets for structural damage	C	3 - Arden 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Business Social	Medium	-	Moderate	Likely	Medium	As per NV003	Minor	Possible	Low
Noise & Vibration	NV017	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration levels from general construction exceeding Guideline Targets for structural damage	C	4 - Parkville	Business Historical Cultural Heritage Social	Medium		Moderate	Likely	Medium	As per NV003; and <u>Blasting</u>: Comply with Australian Standard AS2187.2-2006, Explosives – Storage and use Part 2 – Use of explosives for all blasting For Highly Sensitive Areas, hospital wards, operating theatres and Bio-resources and areas with vibration-sensitive equipment which are not covered in AS2187.2-2006, develop a plan in consultation with facilities owners that: • Avoids damage to vibration-sensitive equipment • Minimises adverse impact on Highly Sensitive Areas and Bio-resources.	Moderate	Possible	Medium
Noise & Vibration	NV018	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration from general activities exceeds Guideline Targets for human comfort	C	1 - Tunnels 5 - CBD North	Social	Low		Moderate	Almost Certain	High	As per NV004	Minor	Likely	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Noise & Vibration	NV019	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration from general activities exceeds Guideline Targets for human comfort	C	4 - Parkville	Social	Low		Moderate	Almost Certain	High	As per NV004; and Blasting: Comply with Australian Standard AS2187.2-2006, Explosives – Storage and use Part 2 – Use of explosives for all blasting For Highly Sensitive Areas, hospital wards, operating theatres and Bio-resources and areas with vibration-sensitive equipment which are not covered in AS2187.2-2006, develop a plan in consultation with facilities owners that: • Avoids damage to vibration-sensitive equipment • Minimises adverse impact on Highly Sensitive Areas and Bio-resources.	Moderate	Possible	Medium
Noise & Vibration	NV020	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration from general activities exceeds Guideline Targets for human comfort	C	2 - Western portal 7 - Domain 8 - Eastern portal	Social	Low		Moderate	Possible	Medium	As per NV004	Minor	Possible	Low
Noise & Vibration	NV021	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration from general activities exceeds Guideline Targets for human comfort	C	2 - Western portal 3 - Arden 9 - Western turnback	Social	Low	-	Minor	Possible	Low	As per NV004	Negligible	Possible	Low
Noise & Vibration	NV022	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration exceeds Guideline Targets for vibration-sensitive equipment	C	1 - Tunnels 2 - Western portal 3 - Arden 6 - CBD South 7 - Domain 8 - Eastern portal	Business Social	Medium		Minor	Rare	Very Low		Minor	Rare	Very Low
Noise & Vibration	NV023	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration exceeds Guideline Targets for vibration-sensitive equipment	C	4 - Parkville	Business Social	Medium		Major	Almost Certain	Very High	As per NV008	Moderate	Almost Certain	High

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Noise & Vibration	NV024	**Vibration** Construction of Melbourne Metro - general construction activities (not including tunnelling)	Vibration exceeds Guideline Targets for vibration-sensitive equipment	C	5 - CBD North	Business Social	Medium		Minor	Possible	Low	As per NV008	Minor	Likely	Medium
Noise & Vibration	NV025	**Ground-borne Noise** Construction of Melbourne Metro - tunnelling	Ground-borne noise exceeds Guideline Targets	C	1 - Tunnels	Business Social	Medium		Moderate	Almost Certain	High	<u>Ground-borne (internal) Noise Guideline Targets for Amenity</u>: Implement management actions as determined in consultation with potentially affected land owners to protect amenity at residences, sleeping areas in hospital wards, student accommodation and hotel rooms where the following ground-borne noise Guideline Targets (from the NSW Interim Construction Noise Guideline) are exceeded during construction. **Time Period** / **Internal $L_{Aeq,15min}$, dB** Evening, 6pm to 10pm: 40 Night, 10pm to 7am: 35 **Notes** 1 Levels are only applicable when ground-borne noise levels are higher than airborne noise levels. 2 The noise levels are assessed at the centre of the most affected habitable room. 3 Management actions include extensive community consultation to determine acceptable level of disruption and provision of respite accommodation in some circumstances.	Moderate	Almost Certain	High
Noise & Vibration	NV026	**Ground-borne Noise** Construction of Melbourne Metro - tunnelling	Ground-borne noise exceeds Guideline Targets	C	4 - Parkville 5 - CBD North 6 - CBD South	Business Social	Medium		Major	Almost Certain	Very High	As per NV025	Moderate	Almost Certain	High
Noise & Vibration	NV027	**Ground-borne Noise** Construction of Melbourne Metro - tunnelling	Ground-borne noise exceeds Guideline Targets	C	2 - Western portal 3 - Arden 7 - Domain 8 - Eastern portal	Business Social	Medium		Minor	Possible	Low	As per NV025	Minor	Possible	Low
Noise & Vibration	NV028	**Ground-borne Noise** Construction of Melbourne Metro - Additional Construction Works (not including tunnelling)	Ground-borne noise exceeds Guideline Targets	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Business Social	Medium		Moderate	Likely	Medium	As per NV025	Minor	Possible	Low

<table>
<tr><th rowspan="2">Discipline</th><th rowspan="2">Risk No.</th><th colspan="2">Impact Pathway</th><th rowspan="2">Project Phase</th><th rowspan="2">Precinct</th><th rowspan="2">Linkages</th><th rowspan="2">Data availability</th><th rowspan="2">Existing performance requirements</th><th colspan="3">Initial Risk</th><th rowspan="2">Recommended Environmental Performance Requirements</th><th colspan="3">Residual Risk</th></tr>
<tr><th>Category</th><th>Event</th><th>C</th><th>L</th><th>Risk</th><th>C</th><th>L</th><th>Risk</th></tr>
<tr><td>Noise & Vibration</td><td>NV029</td><td>Ground-borne Noise
Construction of Melbourne Metro - Additional Construction Works (not including tunnelling)</td><td>Ground-borne noise exceeds Guideline Targets</td><td>C</td><td>9 - Western turnback</td><td>Business
Social</td><td>Medium</td><td></td><td>Minor</td><td>Unlikely</td><td>Low</td><td>As per NV025</td><td>Minor</td><td>Unlikely</td><td>Low</td></tr>
<tr><td>Noise & Vibration</td><td>NV030</td><td>Airborne noise - trains
Operation of passenger trains causes increase in airborne noise</td><td>Exceeds criteria</td><td>O</td><td>1 - Tunnels
4 - Parkville
5 - CBD North
6 - CBD South
7 - Domain</td><td>Social</td><td>Medium</td><td></td><td>Minor</td><td>Possible</td><td>Low</td><td>Appoint an acoustic and vibration consultant to predict noise and vibration and determine appropriate mitigation to achieve the Environmental Performance Requirements. The acoustic and vibration consultant would also be required to undertake commissioning noise and vibration measurements to assess levels with respect to the Environmental Performance Requirements.</td><td>Minor</td><td>Unlikely</td><td>Low</td></tr>
<tr><td>Noise & Vibration</td><td>NV031</td><td>Airborne noise - trains
Operation of passenger trains causes increase in airborne noise</td><td>Exceeds criteria</td><td>O</td><td>2 - Western portal
8 - Eastern portal
9 - Western turnback</td><td>Social</td><td>Medium</td><td></td><td>Moderate</td><td>Possible</td><td>Medium</td><td>As per NV030; and
<u>Victorian Passenger Rail Infrastructure Noise Policy (PRINP):</u> Avoid, minimise or mitigate rail noise where the following PRINP (April 2013) Investigation Thresholds are exceeded during operation:
<table>
<tr><th>Time</th><th>Type of Receiver</th><th>Investigation Thresholds</th></tr>
<tr><td>Day
(6am – 10pm)</td><td>Residential dwellings and other buildings where people sleep including aged persons homes, hospitals, motels and caravan parks
Noise sensitive community buildings, including schools, kindergartens, libraries</td><td>65 dBL_{Aeq} and a change in 3 dB(A) or more
or
85 dBL_{Amax} and a change in 3 dB(A) or more</td></tr>
<tr><td>Night
(10pm – 6am)</td><td>Residential dwellings and other buildings where people sleep including aged persons homes, hospitals, motels and caravan parks</td><td>60 dBL_{Aeq} and a change in 3 dB(A) or more
or
85 dBL_{Amax} and a change in 3 dB(A) or more</td></tr>
</table>
Notes
1 If an investigation shows that the thresholds are not exceeded, then no further action is considered under the PRINP.
2 LAmax, is defined as maximum A-weighted sound pressure level and is the 95 percentile of the highest value of the A-weighed sound pressure level reached within the day or night.
3 For Melbourne Metro the location of assessment is at 1m from the centre of the window of the most exposed external façade.</td><td>Minor</td><td>Possible</td><td>Low</td></tr>
</table>

<table>
<tr><th rowspan="2">Discipline</th><th rowspan="2">Risk No.</th><th colspan="2">Impact Pathway</th><th rowspan="2">Project Phase</th><th rowspan="2">Precinct</th><th rowspan="2">Linkages</th><th rowspan="2">Data availability</th><th rowspan="2">Existing performance requirements</th><th colspan="3">Initial Risk</th><th rowspan="2">Recommended Environmental Performance Requirements</th><th colspan="3">Residual Risk</th></tr>
<tr><th>Category</th><th>Event</th><th>C</th><th>L</th><th>Risk</th><th>C</th><th>L</th><th>Risk</th></tr>
<tr><td>Noise & Vibration</td><td>NV032</td><td>Airborne noise – fixed Infrastructure
Operation of fixed infrastructure causes increase in airborne noise</td><td>Exceeds criteria</td><td>O</td><td>1 - Tunnels
2 - Western portal
3 - Arden
4 - Parkville
5 - CBD North
6 - CBD South
7 - Domain
8 - Eastern portal</td><td>Social</td><td>Medium</td><td></td><td>Moderate</td><td>Possible</td><td>Medium</td><td>As per NV030; and
For operation, comply with State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1 (SEPP N-1). This does not apply to trains and trams.</td><td>Minor</td><td>Possible</td><td>Low</td></tr>
<tr><td>Noise & Vibration</td><td>NV033</td><td>Airborne noise – fixed Infrastructure
Operation of fixed infrastructure causes increase in airborne noise</td><td>Exceeds criteria</td><td>O</td><td>9 - Western turnback</td><td>Social</td><td>Medium</td><td></td><td>Minor</td><td>Possible</td><td>Low</td><td>As per NV032</td><td>Minor</td><td>Unlikely</td><td>Low</td></tr>
<tr><td>Noise & Vibration</td><td>NV034</td><td>Vibration
Operation of passenger trains generates vibration</td><td>Exceeds human comfort Guideline Targets (and building damage Guideline Targets)</td><td>O</td><td>All</td><td>Social</td><td>Medium</td><td></td><td>Minor</td><td>Likely</td><td>Medium</td><td>As per NV030; and
<u>Vibration Guideline Targets for Operation</u>: During operation, achieve the Guideline Targets (based on Table 1 in BS6472-1:2008) or background levels (whichever is higher) for vibration as follows:
<table>
<tr><th rowspan="3">Location</th><th colspan="4">VDV (m/s$^{1.75}$)</th></tr>
<tr><th colspan="2">Day
7:00am to 10:00pm</th><th colspan="2">Night
10:00pm to 7:00am</th></tr>
<tr><th>Preferred Value</th><th>Maximum Value</th><th>Preferred Value</th><th>Maximum Value</th></tr>
<tr><td>Residences</td><td>0.20</td><td>0.40</td><td>0.10</td><td>0.20</td></tr>
<tr><td>Offices, schools, educational institutions, places of worship</td><td>0.40</td><td>0.80</td><td>0.40</td><td>0.80</td></tr>
<tr><td>Workshops</td><td>0.80</td><td>1.60</td><td>0.80</td><td>1.60</td></tr>
</table>
Notes
1 The Guideline Targets are non-mandatory; they are goals that should be sought to be achieved through the application of feasible and reasonable mitigation measures.
2 Compliance with these values implies no structural damage due to operation.</td><td>Minor</td><td>Rare</td><td>Very Low</td></tr>
<tr><td>Noise & Vibration</td><td>NV035</td><td>Vibration
Operation of passenger trains generates vibration</td><td>Exceeds Guideline Targets for vibration-sensitive equipment</td><td>O</td><td>1 - Tunnels
2 - Western portal
3 - Arden
6 - CBD South
7 - Domain
8 - Eastern portal
9 - Western turnback</td><td>Business
Social</td><td>Medium</td><td></td><td>Minor</td><td>Possible</td><td>Low</td><td>As per NV008 and NV030</td><td>Minor</td><td>Unlikely</td><td>Low</td></tr>
</table>

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Noise & Vibration	NV036	**Vibration** Operation of passenger trains generates vibration	Exceeds Guideline Targets for vibration-sensitive equipment	O	4 - Parkville	Business Social	Medium		Major	Almost Certain	Very High	As per NV008 and NV030	Negligible	Likely	Low
Noise & Vibration	NV037	**Vibration** Operation of passenger trains generates vibration	Exceeds Guideline Targets for vibration-sensitive equipment	O	5 - CBD North	Business Social	Medium		Minor	Likely	Medium	As per NV008 and NV030	Negligible	Likely	Low
Noise & Vibration	NV038	**Ground-borne Noise** Operation of passenger trains generates ground-borne noise	Exceeds Guideline Targets	O	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Business Social	Medium		Minor	Possible	Low	As per NV030; and <u>Ground-borne Noise Guideline Targets for Operation</u>: Where operational ground-borne noise trigger levels are exceeded for sensitive occupancies as shown in the table below (trigger levels are based on the Rail Infrastructure Noise Guideline, 17 May 2013 (RING(1)), assess feasible and reasonable mitigation to reduce noise towards the relevant ground-borne noise trigger level.	Minor	Unlikely	Low

Sensitive land use	Time of day	Internal noise trigger levels
Residential	Day *(7am-10pm)*	40 dBL_{ASmax} and an increase in existing rail noise level by 3 dB(A) or more
	Night *(10pm-7am)*	35 dBL_{ASmax} and an increase in existing rail noise level by 3 dB(A) or more
Schools, educational institutions, places of worship	When in use	40-45 dBL_{ASmax} and an increase in existing rail noise level by 3 dB(A) or more
Hospitals(bed wards and operating theatres)	24 hours	35 dB(A) L_{ASMax}
Offices	When in use	45 dB(A) L_{ASMax}
Cinemas and Public Halls	When in use	30 dB(A) L_{ASMax}
Drama Theatres	When in use	25 dB(A) L_{ASMax}
Concert halls, Television and Sound Recording Studios	When in use	25 dB(A) L_{ASMax}

Notes

1 RING provides trigger levels for residential and schools, educational institutions and places of worship, but does not provide guidance on acceptable ground-borne noise levels for other types of sensitive receivers. Ground-borne noise trigger levels for other types of sensitive occupancies have been devised based on RING and industry knowledge.

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												2 Specified noise levels refer to noise from heavy or light rail transportation only (not ambient noise from other sources). 3 Assessment location is internal near to the centre of the most affected habitable room. 4 LASmax refers to the maximum noise level not exceeded for 95% of the rail pass-by events. 5 For schools, educational institutions, places of worship the lower value of the range is most applicable where low internal noise levels is expected. 6 The values for performing arts spaces may need to be reassessed to address the specific requirements of a venue.			
Social & Community	SC001	Planned construction within residential areas	Residential property owners subject to acquisition or in proximity to construction areas postpone or reconsider their plans for their properties.	D	1 - Tunnels 2 - Western portal 3 - Arden 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Land Use & Planning	Medium	None	Moderate	Likely	Medium	Prior to main works or shaft construction, develop and implement a community and business involvement plan to engage potentially affected stakeholders and advise them of the planned construction activities and project progress.	Moderate	Possible	Medium
Social & Community	SC002	Project varies from the Concept Design	Community opposition to the final design due to differences from the Concept Design on which the community were consulted.	D	All	Landscape & Visual	Medium	None	Major	Possible	High	As per SC001	Major	Unlikely	Medium
Social & Community	SC003	Residential strata acquisitions - Tunnel	Strata acquisition creates concern and anxiety about vibration and subsidence amongst affected property owners and tenants	C	1 - Tunnels	Land Use & Planning	Medium	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Moderate	Almost Certain	High	As per SC001	Moderate	Likely	Medium
Social & Community	SC004	Construction activities in residential areas	Reduced or loss of access to residences due to traffic management or construction activities	C	5 - CBD North 6- CBD South	Transport	Medium	None	Moderate	Possible	Medium	Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction	Moderate	Unlikely	Low
Social & Community	SC005	Construction activities in residential areas	Reduced or loss of access to residences due to traffic management	C	8 - Eastern portal	Transport	Medium	None	Moderate	Likely	Medium	As per SC004	Moderate	Possible	Medium
Social & Community	SC006	Construction activities alter existing community access patterns	Construction activities act as a barrier to social infrastructure, recreational assets or cause social severance diminishing community networks.	C	4 - Parkville 7 - Domain	Transport	Medium	None	Major	Likely	High	As per SC001 and SC004	Moderate	Possible	Medium
Social & Community	SC007	Construction activities alter existing community access patterns	Construction activities act as a barrier to social infrastructure, recreational assets or cause social severance diminishing community networks.	C	1 - Tunnels 5 - CBD North 6 - CBD South 8 - Eastern portal	Transport	Medium	None	Major	Possible	High	As per SC001 and SC004	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Social & Community	SC008	Construction activities alter existing community access patterns	Construction activities act as a barrier to social infrastructure, recreational assets or cause social severance diminishing community networks.	C	2 - Western portal 3 - Arden	Transport	Medium	None	Major	Unlikely	Medium	As per SC001 and SC004	Moderate	Unlikely	Low
Social & Community	SC009	Construction activities in residential areas	Construction activities impact on the amenity of households diminishing their ability to enjoy their dwelling or use it as they do currently.	C	1 - Tunnels 2 - Western portal 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Landscape & Visual	High	None	Major	Likely	High	As per SC001; and Prior to main works or shaft construction in areas affected, develop a relocation management framework that allows for a uniform approach across the project for the voluntary (temporary) relocation of households subject to: • Construction activities likely to unduly affect their amenity (e.g. out of hours works or sustained loss of amenity during the day for shift workers) • Loss of access Develop and implement measures to minimise light spillage during construction to protect the amenity of adjacent neighbourhoods, parks and community facilities.	Moderate	Likely	Medium
Social & Community	SC010	Construction activities in proximity to health, educational, commercial, recreational and other facilities	Sustained amenity impacts on Fawkner Park Child Care Centre, Kindergarten and South Yarra Senior Citizens Centre affects staff or users of these facilities	C	1 - Tunnels	Historical Cultural Heritage Business Land Use & Planning Landscape & Visual	Medium	None	Moderate	Likely	Medium	As per SC001	Moderate	Unlikely	Low
Social & Community	SC011	Construction activities in proximity to health, educational, commercial, recreational and other facilities	Sustained amenity impacts on JJ Holland Park and North Melbourne Recreation Centre and Football Club.	C	2 - Western portal 3 - Arden	Historical Cultural Heritage Business Land Use & Planning Landscape & Visual	Medium	None	Minor	Possible	Low	As per SC001; and Work with relevant local councils to plan for and coordinate with key stakeholders during major public events Develop and implement measures for construction and operation of Melbourne Metro that aim to minimise impacts to the development and/or operation of existing land uses Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the MMRA Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values	Minor	Unlikely	Low
Social & Community	SC012	Construction activities in proximity to health, educational, commercial, recreational and other facilities	Sustained amenity impacts on the University of Melbourne, Royal Melbourne Hospital and Peter Doherty Institute affects staff or users of these facilities	C	4 - Parkville	Historical Cultural Heritage Business Land Use & Planning Landscape & Visual	Medium	None	Moderate	Almost Certain	High	As per SC001; and Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the Melbourne Metro Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values	Moderate	likely	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Social & Community	SC013	Construction activities impacting on the amenity of health, educational, commercial, recreational and other facilities	Sustained amenity impacts on RMIT and Melbourne City Baths affects staff or users of these facilities	C	5 - CBD North	Historical Cultural Heritage Business Land Use & Planning Landscape & Visual	Medium	None	Moderate	Almost Certain	High	As per SC001; and Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the Melbourne Metro Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values	Moderate	likely	Medium
Social & Community	SC014	Construction activities impacting on the amenity of health, educational, commercial, recreational and other facilities	Sustained amenity impacts on St Paul's Cathedral and Federation Square affects staff or users of these facilities	C	6 - CBD South	Historical Cultural Heritage Business Land Use & Planning	Medium	None	Moderate	Likely	Medium	As per SC001; and Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the Melbourne Metro Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values	Moderate	Possible	Medium
Social & Community	SC015	Construction activities impacting on the amenity of health, educational, commercial, recreational and other facilities	Sustained amenity impacts on the Shrine of Remembrance Reserve and Melbourne Grammar affects staff or users of these facilities	C	7 - Domain	Historical Cultural Heritage Business Land Use & Planning Landscape & Visual	Medium	None	Moderate	Likely	Medium	As per SC001 and SC004 Work with relevant local councils to plan for and coordinate with key stakeholders during major public events Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the MMRA Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values	Moderate	Possible	Medium
Social & Community	SC016	Construction activities in proximity to Fawkner Park Child Care Centre, Kindergarten and Senior Citizens Centre	Construction activities in proximity to areas frequented by children such as the Fawkner Park Fawkner Park Child Care Centre and Kindergarten or in proximity to Melbourne Grammar could result in a perceived diminishment in public safety.	C	1 - Tunnels 7 - Domain		Medium	None	Moderate	Likely	Medium	As per SC001 and SC004	Moderate	Unlikely	Low
Social & Community	SC017	Truck movements in residential areas	Truck movements and changes to local access sever existing community networks and disrupt access patterns particularly for families with young children, those with mobility impairments or the elderly	C	7 - Domain 8 - Eastern portal		Medium		Moderate	Likely	Medium	As per SC001 and SC004	Moderate	Possible	Medium
Social & Community	SC018	Truck movements in residential areas	Truck movements and changes to local access sever existing community networks and disrupt access patterns particularly for families with young children, those with mobility impairments or the elderly	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 9- Western turnback		Medium		Moderate	Possible	Medium	As per SC001 and SC004	Moderate	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Social & Community	SC019	Construction activities located within open spaces or recreation areas used for passive recreation	Construction activities in Fawkner Park displace passive recreation in an area with limited alternatives, reducing recreational opportunities for the community	C	1 - Tunnels		High		Minor	Possible	Low	As per SC001	Minor	Unlikely	Low
Social & Community	SC020	Construction activities located within open spaces or recreation areas used for passive recreation	Construction activities in City Square displace passive recreation in an area with limited alternatives, reducing recreational opportunities for the community	C	6 - CBD South		High		Moderate	Almost Certain	High	Develop and implement measures for construction and operation of Melbourne Metro that aim to minimise impacts to the development and/or operation of existing land uses Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the Melbourne Metro Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values	Moderate	Unlikely	Low
Social & Community	SC021	Construction activities located within open spaces or recreation areas used for passive recreation	Construction activities in University Square displace passive recreation in an area with limited alternatives, reducing recreational opportunities for the community	C	4 - Parkville		Medium		Minor	Almost Certain	Medium	As per SC001 and SC004 Prior to main works or shaft construction commencing, work with the City of Melbourne to identify possible alternative areas of public open space for community use during the construction phase to minimise the impacts of loss of existing public open space that are to be utilised as construction worksites Work with relevant local councils to plan for and coordinate with key stakeholders during major public events In consultation with key stakeholders and in accordance with the Melbourne Metro Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works Develop and implement measures for construction and operation of Melbourne Metro that aim to minimise impacts to the development and/or operation of existing land uses	Minor	Possible	Low
Social & Community	SC022	Construction activities located within open spaces or recreation areas used for passive recreation	Construction activities in Edmund Herring Reserve, Shrine of Remembrance Reserve and Albert Road Reserve displace passive recreation in an area with limited alternatives, reducing recreational opportunities for the community	C	7 - Domain		High		Minor	Almost Certain	Medium	Prior to main works or shaft construction commencing, work with the City of Melbourne to identify possible alternative areas of public open space for community use during the construction phase to minimise the impacts of loss of existing public open space that are to be utilised as construction worksites In consultation with key stakeholders and in accordance with the Melbourne Metro Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works Develop and implement measures for construction and operation of Melbourne Metro that aim to minimise impacts to the development and/or operation of existing land uses	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Social & Community	SC023	Construction activities located within open spaces or recreation areas used for passive recreation	Construction activities in South Yarra Siding Reserve and Osborne Reserve displace passive recreation in an area with limited alternatives, reducing recreational opportunities for the community	C	8 - Eastern portal		High		Moderate	Almost Certain	High	Prior to main works or shaft construction, develop and implement a community and business involvement plan to engage potentially affected stakeholders and advise them of the planned construction activities and project progress. Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction In consultation with key stakeholders and in accordance with the Melbourne Metro Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works	Moderate	Likely	Medium
Social & Community	SC024	Construction activities located within open spaces or recreation areas used for active recreation	Construction activities displace organised sports with limited local alternatives for reducing recreational opportunities for the community	C	1 - Tunnels		High		Moderate	Likely	Medium	Develop a relocation strategy for sports clubs and other formal users of directly impacted recreational facilities	Moderate	Unlikely	Low
Social & Community	SC025	Construction activities located within open spaces or recreation areas used for active recreation	Construction activities displace organised sports with limited local alternatives for reducing recreational opportunities for the community	C	7 - Domain		High		Moderate	Almost Certain	High	Prior to main works or shaft construction commencing, work with the City of Melbourne to identify possible alternative areas of public open space for community use during the construction phase to minimise the impacts of loss of existing public open space that are to be utilised as construction worksites Develop a relocation strategy for sports clubs and other formal users of directly impacted recreational facilities. Develop and implement measures for construction and operation of Melbourne Metro that aim to minimise impacts to the development and/or operation of existing land uses	Moderate	Likely	Medium
Social & Community	SC026	Construction workforce use of public parking	Reduction in parking available for residents, workers or other visitors to the area resulting in a loss of access to community facilities, recreational spaces or severance of social networks	C	All		Medium		Major	Likely	High	Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction	Major	Unlikely	Medium
Social & Community	SC027	Truck movements in proximity to residential areas	Truck movements impact on residential amenity	C	All		Medium		Moderate	Almost Certain	High	Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction Prior to main works or shaft construction, develop and implement a community and business involvement plan to engage potentially affected stakeholders and advise them of the planned construction activities and project progress.	Moderate	Possible	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Social & Community	SC028	Acquisition of nine (9) dwellings in Kensington	Displacement of households and diminishment of networks within the surrounding community due to the limited availability of equivalent housing in Kensington	C	2 - Western portal	Land Use & Planning	High	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Major	Almost Certain	Very High	Reduce the disruption to residences from direct acquisition or temporary occupation.	Major	Possible	High
Social & Community	SC029	Acquisition of one dwelling in Kensington	Displacement of a household and diminishment of networks within the surrounding community due to the limited availability of equivalent housing in Kensington	C	2 - Western portal	Land Use & Planning	High	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Moderate	Possible	Medium	As per SC028	Moderate	Unlikely	Low
Social & Community	SC030	Acquisition of 49 dwellings in CBD North	Displacement of 49 mostly tenanted dwellings and diminishment of networks within the surrounding community due to a limited immediate availability of this number of equivalent dwellings in the locality	C	5 - CBD North	Land Use & Planning	Medium	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Moderate	Likely	Medium	As per SC028	Moderate	Possible	Medium
Social & Community	SC031	Acquisition of seven (7) dwellings in the eastern portal	Displacement of two (2) households (the remaining five (5) households are vacant or proposed for multi-unit developments) and diminishment of networks within the surrounding community	C	8 - Eastern portal	Land Use & Planning	High	Acquisition to be undertaken in accordance with the *Land Acquisition and Compensation Act 1986.*	Moderate	Likely	Medium	As per SC028	Moderate	Possible	Medium
Social & Community	SC032	Construction activities would take place within the Shrine of Remembrance Reserve permanently changing it with ongoing infrastructure retained	Works within the Shrine of Remembrance Reserve have the potential to create distress for veterans and other members of the community who value the site.	C / O	1 - Tunnels 7 – Domain	Historical Cultural Heritage Land Use & Planning Landscape & Visual	Medium	None	Moderate	Almost Certain	High	As per SC028	Moderate	Possible	Medium
Social & Community	SC033	Construction and operation of the potential Fawkner Park Tunnel Boring Machine launch site	Community concern about works within the park, particularly the impact on trees, paths and amenity.	C / O	1 - Tunnels	Arboriculture Land Use & Planning Landscape & Visual	Medium	Nil	Major	Likely	High	Prior to main works or shaft construction, develop and implement a community and business involvement plan to engage potentially affected stakeholders and advise them of the planned construction activities and project progress. Work with relevant local councils to plan for and coordinate with key stakeholders during major public events In consultation with key stakeholders and in accordance with the Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works	Moderate	Possible	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Social & Community	SC034	Fawkner Park emergency access shaft	Construction of the intervention shaft results in loss of an area used for passive recreation. Construction of the emergency access shaft in Fawkner Park is inconsistent with community expectations the placement of transport infrastructure in the park.	C / O	1 - Tunnels		High		Minor	Likely	Medium	As per SC001, SC020; and Work with relevant local councils to plan for and coordinate with key stakeholders during major public events In consultation with key stakeholders and in accordance with the Melbourne Metro Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works	Minor	Possible	Low
Social & Community	SC035	Loss of street trees	Changes to valued streetscapes creates community concern	C / O	4 - Parkville 7 - Domain	Arboriculture Land Use & Planning Landscape & Visual	Medium	None	Major	Likely	High	As per SC001; and In consultation with key stakeholders and in accordance with the Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works Develop and implement measures for construction and operation of Melbourne Metro that aim to minimise impacts to the development and/or operation of existing land uses	Major	Possible	High
Social & Community	SC036	Loss of street trees	Changes to valued streetscapes creates community concern	C / O	5 - CBD North	Arboriculture Land Use & Planning Landscape & Visual	Medium	None	Moderate	Possible	Medium	As per SC035	Moderate	Unlikely	Low
Social & Community	SC037	Loss of street trees	Changes to valued streetscapes creates community concern	C / O	6 - CBD South	Arboriculture Land Use & Planning Landscape & Visual	Medium	None	Moderate	Possible	Medium	As per SC035	Moderate	Possible	Medium
Social & Community	SC038	Construction activities require the temporary movement of the South African War Memorial and other monuments	Impacts on the South African War Memorial and other monuments are of concern to the local community	C / O	7 - Domain	Arboriculture Land Use & Planning Landscape & Visual	Medium	None	Moderate	Likely	Medium	As per SC035	Moderate	Possible	Medium
Social & Community	SC039	Ground improvement works in the Domain Parklands result in the permanent loss of trees along the alignment between Birdwood and Linlithgow Avenues	Community concern about the impact on this valued place and ongoing diminishment in the perceived value of this wooded parkland.	C / O	1 - Tunnels		Medium	None	Moderate	Likely	Medium	As per SC001; and Reinstate quality soils to sufficient volumes to support long-term viable growth of replacement trees In consultation with key stakeholders and in accordance with the Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works Develop and implement measures for construction and operation of Melbourne Metro that aim to minimise impacts to the development and/or operation of existing land uses	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Social & Community	SC040	Queen Victoria Gardens emergency access shaft	Placement of the emergency access shaft in Queen Victoria Gardens is inconsistent with community expectations on the uses of this park.	C / O	1 - Tunnels		Medium		Moderate	Possible	Medium	As per SC001, SC020; and In consultation with key stakeholders and in accordance with the Melbourne Metro Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works	Moderate	Unlikely	Low
Social & Community	SC041	Placement of the Tom's Block emergency access shaft	The placement of this infrastructure is inconsistent with community aspirations for Domain Parklands. Parts of the community likely to be particularly impacted include those traveling on St Kilda Road in trams or by foot who value this part of the landscape.	C / O	1 - Tunnels		Medium		Moderate	Likely	Medium	As per SC001, SC020; and In consultation with key stakeholders and in accordance with the Melbourne Metro Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works Prior to main works or shaft construction, develop and implement a community and business involvement plan to engage potentially affected stakeholders and advise them of the planned construction activities and project progress.	Moderate	Possible	Medium
Social & Community	SC043	Design and construction of acoustic treatments	Acoustic treatments such as noise walls impact on visual amenity	C / O	2 - Western portal		Medium		Moderate	Likely	Medium	As per SC001; and In consultation with key stakeholders and in accordance with the Melbourne Metro Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works	Moderate	Unlikely	Low
Social & Community	SC044	Placement of above ground infrastructure in proximity to residences	The placement of project infrastructure such as ventilation shafts in the Osborne Street Reserve, or noise walls on Childers Street has an ongoing impact on the amenity of households, diminishing their ability to enjoy their property.	C / O	2 - Western portal 8 - Eastern portal	Landscape & Visual	Medium	None	Moderate	Likely	Medium	As per SC001; and In consultation with key stakeholders and in accordance with the Melbourne Metro Urban Design Strategy, relevant statutory approvals and other relevant requirements, re-establish sites impacted by construction works Design permanent and temporary works in consultation with local councils and the Office of Victorian Government Architect to comply with the Melbourne Metro Urban Design Strategy. The design shall avoid or minimise visual impacts on sensitive receptors and maintain broader landscape character values	Moderate	Possible	Medium
Social & Community	SC045	Placement of above ground infrastructure in proximity to residences	Acoustic treatments such as noise walls discourage people from using Lovers Walk or result in a perceived reduction of safety for users of the walkway	C / O	8 - Eastern portal	Air Quality Landscape & Visual	Medium	None	Moderate	Likely	Medium	As per SC044	Moderate	Unlikely	Low
Surface Water	SW001	Flood event on Yarra River	Potential flooding of the Melbourne Metro tunnels from the existing City Loop tunnels could potentially compromise the safety of construction workers.	C	1 - Tunnels		Low		Severe	Rare	Medium	For all precincts (with the exception of the western turnback) design permanent and temporary works and, if necessary, develop and implement emergency flood management measures for the tunnels, tunnel portals, access shafts, station entrances and Arden electrical substation to provide appropriate protection against floodwaters and overland stormwater flows. This would be informed by a flood immunity risk assessment that considers a range of events, and to the requirements and satisfaction of the responsible authority. Undertake modelling of the design of permanent and temporary works to demonstrate the resultant flood levels	Negligible	Rare	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												and risk profile to the satisfaction of the responsible authority.			
Surface Water	SW002	Rainfall/overland flow event in Fawkner Park	Potential flooding of the TBM launch site and tunnels. This could result in injury to construction workers	C	1 - Tunnels		Low		Major	Rare	Medium	As per SW001	Negligible	Rare	Very Low
Surface Water	SW003	Flood event on Maribyrnong River	Potential flooding of the tunnels, from the western portal during construction which could potentially compromise the safety of construction workers if this occurred before the retaining walls had been built. Lesser consequence could arise due to inundation from local drainage	C	2 - Western portal		High		Severe	Possible	High	As per SW001	Negligible	Rare	Very Low
Surface Water	SW004	Flood event on Maribyrnong River or Moonee Ponds Creek	Minor potential increase in flood levels to surrounding properties, due to loss of flood storage	C	2 - Western portal 3 - Arden		High	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event.	Minor	Unlikely	Low	Maintain existing flood plain storage capacity potentially impacted by the project, to the requirements and satisfaction of the responsible authority. Permanent and associated temporary construction works must not increase flood levels that result in an additional flood risk to the requirements and satisfaction of the responsible authority. Ensure permanent and associated temporary works do not increase flow velocities that would potentially affect the stability of property, structures or assets, and/or result in erosion during operation or construction, to the requirements and satisfaction of the responsible authority. Undertake modelling of the design of permanent and temporary works to demonstrate the resultant flood levels and risk profile to the satisfaction of the responsible authority.	Negligible	Unlikely	Very Low
Surface Water	SW005	Flood event on Moonee Ponds Creek	Potential flooding of Arden station and tunnels could potentially compromise the safety of construction workers	C	3 - Arden		High		Severe	Unlikely	High	As per SW001	Negligible	Rare	Very Low
Surface Water	SW006	Flood event on Moonee Ponds Creek	Potential minor increases in flood levels during construction of the sub	C	3 - Arden		High	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event.	Minor	Unlikely	Low	As per SW004	Negligible	Unlikely	Very Low
Surface Water	SW007	Rainfall/overland flow event in Parkville local catchment	Potential flooding of the Parkville station and/or tunnels during construction could result in injury to construction workers	C	4 - Parkville		Low		Major	Rare	Medium	As per SW001	Negligible	Rare	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Surface Water	SW008	Rainfall/overland flow event in Parkville, CBD North or CBD South local catchments	Minor potential increase in flood levels to surrounding infrastructure (expected to be confined to roads)	C	4 - Parkville 5 - CBD North 6 - CBD South		Medium	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event	Minor	Unlikely	Low	As per SW004	Minor	Unlikely	Low
Surface Water	SW009	Rainfall/overland flow event in CBD North local catchment	Potential flooding of CBD North station and/or tunnels during construction. This could result in injury to construction workers	C	5 - CBD North		Low		Major	Rare	Medium	As per SW001	Negligible	Rare	Very Low
Surface Water	SW010	Rainfall/overland flow event in CBD South local catchment	Potential flooding of CBD South station and/or tunnels during construction. This could potentially compromise the safety of construction workers	C	6 - CBD South		Medium		Severe	Rare	Medium	As per SW001	Negligible	Rare	Very Low
Surface Water	SW011	Rainfall/overland flow event in Domain local catchment	Potential flooding of Domain station, TBM launch site and/or tunnels during construction could result in injury to construction workers	C	7 - Domain		Low		Major	Rare	Medium	As per SW001	Negligible	Rare	Very Low
Surface Water	SW012	Rainfall/overland flow event in Domain local catchment	Potential increase in flood levels to surrounding properties	C	7 - Domain		Medium	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event	Major	Unlikely	Medium	As per SW004	Minor	Unlikely	Low
Surface Water	SW013	Rainfall/overland flow event in eastern portal local catchments	Minor potential increase in flood levels to surrounding properties, due to construction infrastructure	C	8 - Eastern portal		Medium	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event	Minor	Unlikely	Low	As per SW004	Minor	Unlikely	Low
Surface Water	SW014	Flood event on Yarra River	Potential flooding of the tunnels, from the eastern portal during construction. The level of the high point on the existing rail line between the Yarra River and the eastern portal in the current design is above the 0.1 per cent AEP existing flood level. If flood waters were to enter the tunnels from the portal, this could potentially compromise the safety of construction workers	C	8 - Eastern portal		Medium		Severe	Rare	Medium	As per SW001	Negligible	Rare	Very Low
Surface Water	SW015	Rainfall/overland flow event in eastern portal local catchments	Potential flooding of the tunnels from the eastern portal due to overland flows discharging to the rail cutting from either the Yarra Street Outfall Drain or Prahran Main Drain (from near Chapel Street) during construction could result in injury to construction workers	C	8 - Eastern portal		Low		Major	Rare	Medium	As per SW001	Negligible	Rare	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Surface Water	SW016	Rainfall/overland flow event in drain system adjacent to West Footscray	Potential minor increase in flood levels north of the track and platform works	C	9 - Western turnback		High	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event..	Minor	Unlikely	Low	As per SW004	Minor	Unlikely	Low
Surface Water	SW017	Rainfall/overland flow event in early works catchments	Potential minor increases in flood levels during construction	C	All		Low	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event.	Minor	Unlikely	Low	As per SW004	Negligible	Unlikely	Very Low
Surface Water	SW018	Flood event on Yarra River	Potential flooding of Melbourne Metro tunnels from the existing City Loop tunnels could potentially compromise the safety of commuters or rail staff, and result in serious long disruption of rail operations	O	1 - Tunnels		Low	Protect against 1% AEP riverine flood, with 600 mm freeboard	Severe	Unlikely	High	As per SW001	Negligible	Rare	Very Low
Surface Water	SW019	Flood event on Maribyrnong River	Potential flooding of the Melbourne Metro tunnels, from the western portal could potentially compromise the safety of commuters or rail staff, and result in serious long disruption of rail operations. Lesser consequences could arise due to inundation caused by runoff from the decline structure	O	2 - Western portal		Low	Protect against 1% AEP riverine flood, with 600 mm freeboard	Severe	Possible	High	As per SW001	Negligible	Rare	Very Low
Surface Water	SW020	Flood event on Maribyrnong River or Moonee Ponds Creek	Minor potential increase in flood levels to surrounding properties, due to loss of flood storage	O	2 - Western portal 3 - Arden		Medium	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event..	Minor	Unlikely	Low	As per SW004	Negligible	Unlikely	Very Low
Surface Water	SW021	Rainfall event on tunnel decline structure	Pumped discharge may overload the local drainage system resulting in minor increase in flood levels to surrounding properties	O	2 - Western portal		Medium	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event..	Minor	Unlikely	Low	As per SW004	Negligible	Unlikely	Very Low
Surface Water	SW022	Flood event on Moonee Ponds Creek	Potential flooding of Arden and tunnels could potentially compromise the safety of commuters or rail staff, and result in serious long disruption of rail operations	O	3 - Arden		Medium	Protect against 1% AEP riverine flood, with 600 mm freeboard	Severe	Unlikely	High	As per SW001	Negligible	Rare	Very Low
Surface Water	SW023	Flood event on Moonee Ponds Creek	Potential minor increases in flood levels due to sub infrastructure	O	3 - Arden		High	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event.	Minor	Unlikely	Low	As per SW004	Negligible	Unlikely	Very Low
Surface Water	SW024	Flood event on Moonee Ponds Creek	Potential flooding of sub, resulting in loss of power to the rail system and disruption to service	O	3 - Arden		High		Major	Likely	High	As per SW001	Negligible	Unlikely	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Surface Water	SW025	Rainfall/overland flow event in Parkville, CBD North or Domain local catchments	Potential flooding of Parkville, CBD North and Domain stations, and tunnels, from station entrances at ground level could result in injury to commuters or rail staff, and disruption of rail operations	O	4 - Parkville 5 - CBD North 7 - Domain		Low	Protect against 1% AEP overland flow, with 300 mm freeboard	Major	Unlikely	Medium	As per SW001	Negligible	Rare	Very Low
Surface Water	SW026	Rainfall/overland flow event in Parkville, CBD North or Domain local catchments	Minor potential increase in flood levels to surrounding properties, due to station infrastructure (raised entrances)	O	4 - Parkville 5 - CBD North 7 - Domain		Low	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event	Minor	Unlikely	Low	As per SW004	Minor	Unlikely	Low
Surface Water	SW027	Rainfall/overland flow event in CBD South local catchment	Potential flooding of CBD South station and tunnels, from station entrances at ground level could potentially compromise the safety of commuters or rail staff, and result in disruption of rail operations.	O	6 - CBD South		Low	Protect against 1% AEP overland flow, with 300 mm freeboard	Severe	Unlikely	High	As per SW001	Minor	Rare	Very Low
Surface Water	SW028	Rainfall/overland flow event in CBD South local catchment	Minor potential increase in flood levels to surrounding properties, due to station infrastructure (raised entrances).	O	6 - CBD South		Low	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event..	Minor	Unlikely	Low	As per SW004	Minor	Unlikely	Low
Surface Water	SW029	Flood event on Yarra River	Potential flooding of CBD South station and tunnels, from station entrances at ground level could potentially compromise the safety of commuters or rail staff, and result in serious long-term disruption of rail operations	O	6 - CBD South		Low	Protect against 1% AEP riverine flood, with 600 mm freeboard	Negligible	Rare	Very Low	As per SW001	Negligible	Rare	Very Low
Surface Water	SW030	Flood event on Yarra River	Potential flooding of Domain station and tunnels, from station entrances at ground level could potentially compromise the safety of commuters or rail staff, and result in serious long-term disruption of rail operations	O	7 - Domain		Low	Protect against 1% AEP riverine flood, with 600 mm freeboard	Negligible	Rare	Very Low	As per SW001	Negligible	Rare	Very Low
Surface Water	SW031	Rainfall/overland flow event in eastern portal local catchments	Potential flooding of the tunnels from the eastern portal due to overland flows discharging to the rail cutting from either the Yarra Street Outfall Drain or Prahran Main drains (from nearby Chapel Street) during operation. This could result in minor disruption of rail operations. Similar consequences could arise due to inundation resulting from runoff from the decline structure.	O	8 - Eastern portal		Low	Protect against 1% AEP overland flow, with 300 mm freeboard	Minor	Rare	Very Low	As per SW001	Minor	Rare	Very Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Surface Water	SW032	Flood event on Yarra River	Potential flooding of the tunnels, from the eastern portal during operation. The level of the high point on the existing rail line between the Yarra River and the eastern portal in the current design is approximately the same as the Year 2100 (i.e. including allowance for climate change) 0.1 per cent AEP flood level. If flood waters were to enter the tunnels from the portal, this could potentially compromise the safety of commuters or rail staff and result in serious long-term disruption of rail operations.	O	8 - Eastern portal		Low	Protect against 1% AEP riverine flood, with 600 mm freeboard	Severe	Unlikely	High	As per SW001	Negligible	Rare	Very Low
Surface Water	SW033	Rainfall event on tunnel decline structure	Pumped discharge may overload the local drainage system resulting in minor increases in flood levels to surrounding properties	O	8 - Eastern portal		Medium	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event	Minor	Unlikely	Low	As per SW004	Negligible	Unlikely	Very Low
Surface Water	SW034	Rainfall/overland flow event in drain system adjacent to West Footscray	Potential minor increase in flood levels north of the track and platform works, and potential short-term disruption to rail services	O	9 - Western turnback		High	Maintain flood storage in 1% AEP event, and no increase in flood levels in 1% AEP event	Minor	Unlikely	Low	As per SW004	Minor	Unlikely	Low
Terrestrial Ecology	TE001	Undertaking early works: removal and/or installation of underground services	Removal or impact to street trees in close proximity to utilities (gas, electrical water supply, sewer, telecommunications) that may require alteration in preparation for construction	C	2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain 8 - Eastern portal	Arboriculture	Medium	Minimise removal of existing vegetation.	Minor	Possible	Low	As per TE002; and Prior to construction commencing of main works or shafts in affected areas, prepare and implement Tree Protection Plans for each Precinct in accordance with AS4970-2009 Protection of Trees on Development Sites, addressing the detailed design and construction methodology of the project. Within precincts 1, 4 and 7 a Tree Protection Plan must be developed for each heritage place as relevant to the satisfaction of Heritage Victoria or the responsible authority.	Negligible	Possible	Low
Terrestrial Ecology	TE002	Construction activity within Fawkner Park	Removal of existing healthy, mature trees (indigenous and exotic) from the proximity of Fawkner Park tunnel boring machine (TBM) launch site	C	1 - Tunnels	Arboriculture	Medium	Minimise removal of existing vegetation.	Minor	Possible	Low	Re-establish trees to replace loss of canopy cover and achieve canopy size equal to (or greater than) healthy, mature examples of the species in Melbourne. Consult with the City of Melbourne, the City of Post Phillip, the City of Stonnington, the Shrine of Remembrance and Shrine Trustees and Heritage Victoria as applicable. Policy documents that must be followed to re-establish trees and valued landscape character include: • The City of Melbourne's Tree Retention and Removal Policy and Urban Forest Strategy • The City of Port Phillip's Community Amenity Local Law No. 1 and Greening Port Phillip – An Urban Forest Approach • The City of Stonnington's General Local Law 2008 (No 1) and City of Stonnington Street Tree Strategy • Any associated precinct plans • Specific policies of the Domain Parklands Conservation	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												Management Plan (CMP), for trees within Domain Parklands • Shrine of Remembrance: Shrine of Remembrance CMP (Lovell Chen, 2010) or any future review and the Shrine of Remembrance Landscape Improvement Plan (rush Wright Associates, 2010) • South African Soldiers Memorial Reserve: Any relevant CMP for the South African Soldiers Memorial • Fawkner Park Conservation Analysis (Hassell, 2002) and the Fawkner Park Masterplan (City of Melbourne, 2005) • The preferred future character of the University of Melbourne, for trees in the grounds of the University of Melbourne. Prior to site clearance for construction, all vegetation being removed is to be inspected by a suitably experienced and qualified environmental officer for habitat features and fauna occupancy. Where non-listed species (native and exotic) are encountered, any individuals will be encouraged to leave the tree or vegetation. Where nests/young are encountered, they will be relocated to a similar tree (or habitat) in close proximity. Prior to site clearance for construction, develop a translocation plan for the management of listed fauna species if encountered. Develop and implement measures to avoid the spread or introduction of weeds and pathogens during construction, including vehicle hygiene.			
Terrestrial Ecology	TE003	Construction activity within Fawkner Park	Potential impact to existing trees (indigenous and exotic) that may provide habitat for the grey-headed flying-fox from the proximity of Fawkner Park TBM launch site and emergency access shaft	C	1 - Tunnels	Arboriculture	Medium	Minimise removal of existing vegetation.	Minor	Possible	Low	As per TE001	Negligible	Possible	Low
Terrestrial Ecology	TE004	Removal of landscaping elements within the proposed western portal and eastern portal precincts	Loss of, or impact to, landscaping elements (containing a mix of indigenous and native species, including some mature trees). This could result in loss of or impact to non-critical habitat for roosting birds	C	2 - Western portal 8 - Eastern portal	Arboriculture	Low	Minimise removal of existing vegetation.	Minor	Possible	Low	As per TE001	Negligible	Possible	Low
Terrestrial Ecology	TE005	Removal of planted indigenous amenity trees from throughout the alignment	A total of 41 indigenous planted trees established with public funding are considered 'unavoidable' throughout the impact areas associated with construction (Refer Technical Appendices R and S)	C	1 - Tunnels 2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain	Arboriculture	Medium	Minimise removal of existing vegetation.	Minor	Possible	Low	As per TE002; and Where 'unavoidable' native vegetation (as defined under relevant policy) needs to be removed, meet the requirements of the Permitted Clearing of Native Vegetation – Biodiversity Assessment Guidelines.	Negligible	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Terrestrial Ecology	TE006	Construction activity throughout the study area	Loss of or impact to habitat due to the potential removal of a number of exotic street trees from throughout the study area, some of which may provide roosting habitat for a variety of bird species	C	2 - Western portal 3 - Arden 4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain	Arboriculture	Medium	Minimise removal of existing vegetation	Minor	Possible	Low	As per TE001	Negligible	Unlikely	Very Low
Transport	T001	Construction activities impeding traffic flow	Increased congestion and reduced connectivity for transport modes within the vicinity of the project area and across the broader transport network	C	1 - Tunnels 8 - Eastern portal	Business Land Use & Planning Social	Medium	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Moderate	Possible	Medium	**Road Transport (Construction Phase)** Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction, including but not limited to: • Management of any temporary or permanent full or partial closure of traffic lanes including (but not limited to): – Linlithgow Avenue, Melbourne – Toorak Road at Fawkner Park – Osborne Street, William Street in South Yarra • Monitoring of travel behaviour changes caused by construction works, including pre-construction baseline data and periodic reporting on behaviour change. Use this data as an input to the design of transport networks following construction • Traffic management plan(s) must be developed recognising other projects operating concurrently, where relevant • Potential routes for construction vehicles travelling to and from all Melbourne Metro construction work sites, recognising sensitive receptors • Provision of complementary improvements to Kings Way, Canterbury Road and other roads to accommodate additional traffic that may use these roads and to assist traffic flow in St Kilda Road for the duration of the works • In consultation with emergency services, develop suitable measures to ensure emergency service access is not inhibited as a result of Melbourne Metro construction worksites • Special arrangements for delivery or removal of large loads. **Public Transport (Construction Phase)** • Develop and implement a plan for occupying railway land and tracks at the eastern portal that minimises the disruption to railway services during construction. Plan to be developed to the satisfaction of VicTrack and MTM • Develop and implement measures to minimise disruption to the tram and bus networks resulting from the construction of Melbourne Metro in consultation with the relevant road management authorities and to the satisfaction of PTV, including (but not limited to): – Tram operations on Toorak Road and the diversion of the No. 8 tram route	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												- Tram routes on St Kilda Road - Bus replacement services for disrupted rail customers. **Active Transport (Construction Phase)** • Develop and implement transport management measures in consultation with relevant road management authorities for cyclists and pedestrians to maintain connectivity throughout construction for road and shared path users including (but not limited to): St Kilda Road, Toorak Road, Fawkner Park, Osborne Street, William Street and Chapel Street • Implement active control at construction work site access points to maintain safety by avoiding potential conflicts between trucks, pedestrians and cyclists **Travel Demand Strategy** In advance of construction works, MMRA to develop and implement a travel demand management strategy and appropriate tools to promote specific transport behaviour changes in response to road, bicycle and pedestrian paths closures/modifications and to reduce traffic congestion around construction sites. The strategy must be consistent with the MMRA Community and Stakeholder Engagement Plan.			
Transport	T002	Construction activities impeding traffic flow	Increased congestion and reduced connectivity for transport modes within the vicinity of the project area at the western portal and diverted traffic impacts on local residents	C	2 - Western portal	Business Land Use & Planning Social	Medium	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Moderate	Possible	Medium	**Road Transport (Construction Phase)** Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction, including but not limited to: • Management of any temporary or permanent full or partial closure of traffic lanes including (but not limited to): Childers Street, Kensington • Monitoring of travel behaviour changes caused by construction works, including pre-construction baseline data and periodic reporting on behaviour change. Use this data as an input to the design of transport networks following construction • Traffic management plan(s) must be developed recognising other projects operating concurrently, where relevant • Potential routes for construction vehicles travelling to and from all Melbourne Metro construction work sites, recognising sensitive receptors • Provision of alternative routes for trucks accessing the 50 Lloyd Street Business Estate, Kensington • Provision of alternate parking where possible to replace parking lost from Childers Street during construction and preventing parking at undesignated locations on local roads • Provision of car parking for construction workers where possible	Moderate	Possible	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												• Provision of suitable routes for cyclists and pedestrians to maintain connectivity and safety for roads and shared paths to provide continued access, including (but not limited to): Childers Street, JJ Holland Park and South Kensington station • In consultation with emergency services, develop suitable measures to ensure emergency service access is not inhibited as a result of Melbourne Metro construction worksites • Special arrangements for delivery or removal of large loads. **Public Transport (Construction Phase)** • Provide suitable routes for pedestrians to maintain connectivity, including DDA access for users of South Kensington station and around all construction sites generally **Active Transport (Construction Phase)** • Develop and implement transport management measures in consultation with relevant authorities for cyclists and pedestrians to maintain connectivity throughout construction for road and shared path users including (but not limited to): JJ Holland Park and South Kensington station • Implement active control at construction work site access points to maintain safety by avoiding potential conflicts between trucks, pedestrians and cyclists In consultation with the City of Melbourne, provide suitable routes for cyclists and pedestrians throughout construction to and maintain connectivity for road and shared path users around JJ Holland Park and South Kensington station. **Travel Demand Strategy** – as per T001			

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Transport	T003	Construction activities impeding traffic flow	Increased congestion and reduced connectivity for transport modes within the vicinity of the project area at Arden	C	3 - Arden	Business Land Use & Planning Social	Medium	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Minor	Possible	Low	**Road transport (Construction Phase)** Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction, including but not limited to: • Management of any temporary or permanent full or partial closure of traffic lanes • Monitoring of travel behaviour changes caused by construction works, including pre-construction baseline data and periodic reporting on behaviour change. Use this data as an input to the design of transport networks following construction • Traffic management plan(s) must be developed recognising other projects operating concurrently, where relevant • Provision for a minimum of one lane for traffic in each direction on St Kilda Road to be maintained throughout the construction within the Domain station precinct • Potential routes for construction vehicles travelling to and from all Melbourne Metro construction work sites, recognising sensitive receptors • Provision of suitable routes for vehicles to maintain connectivity for road users to JJ Holland Park, South Kensington station and to the medical and educational facilities adjacent to the Parkville construction work site **Public Transport (Construction Phase)** Develop and implement measures to minimise disruption to the tram and bus networks resulting from the construction of Melbourne Metro in consultation with the relevant road management authorities and to the satisfaction of PTV, including (but not limited to): - Options to divert the 401, 402, 403, 505 and 546 bus services - Bus replacement services for disrupted rail customers. **Active Transport (Construction Phase)** • Develop and implement transport management measures in consultation with relevant road management authorities for cyclists and pedestrians to maintain connectivity throughout construction for road and shared path users including (but not limited to): Laurens Street • Implement active control at construction work site access points to maintain safety by avoiding potential conflicts between trucks, pedestrians and cyclists **Travel Demand Strategy** – as per T001	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Transport	T004	Construction activities impeding traffic flow	Increased congestion and reduced connectivity for transport modes within the vicinity of Melbourne Metro	C	5 - CBD North 6 - CBD South	Business Land Use & Planning Social	High	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Major	Likely	High	**Road transport (Construction Phase)** Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction, including but not limited to: • Management of any temporary or permanent full or partial closure of traffic lanes including (but not limited to):– Franklin Street, A'Beckett Street and Little La Trobe Street at CBD North– Flinders Street and Flinders Lane at CBD South • Monitoring of travel behaviour changes caused by construction works, including pre-construction baseline data and periodic reporting on behaviour change. Use this data as an input to the design of transport networks following construction • Traffic management plan(s) must be developed recognising other projects operating concurrently, where relevant • Potential routes for construction vehicles travelling to and from all Melbourne Metro construction work sites, recognising sensitive receptors • Provision of car parking for construction workers where possible • Provision of suitable routes for cyclists and pedestrians to maintain connectivity and safety for roads and shared paths that provide continued access, including (but not limited to): Swanston Street, Franklin Street, Flinders Street and St Kilda Road • In consultation with emergency services, develop suitable measures to ensure emergency service access is not inhibited as a result of Melbourne Metro construction worksites • Special arrangements for delivery or removal of large loads. **Public Transport (Construction Phase)** • Provide suitable routes for pedestrians to maintain connectivity, including DDA access for users of Melbourne Central Station, Flinders Street Station and around all construction sites generally • Develop and implement measures to minimise disruption to the tram and bus networks resulting from the construction of Melbourne Metro in consultation with the relevant road management authorities and to the satisfaction of PTV, including (but not limited to): - Tram routes on La Trobe Street and Swanston Street - Tram routes on Flinders Street and Swanston Street - Bus replacement services for disrupted rail customers. **Active Transport (Construction Phase)** • Develop and implement transport management measures	Moderate	Likely	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												in consultation with relevant road management authorities for cyclists and pedestrians to maintain connectivity throughout construction for road and shared path users including (but not limited to): Franklin Street (including RMIT facilities), Swanston Street, Flinders Street and St Kilda Road • Implement active control at construction work site access points to maintain safety by avoiding potential conflicts between trucks, pedestrians and cyclists			
Transport	T005	Construction activities impeding traffic flow	Increased congestion and reduced connectivity for transport modes within the vicinity of Melbourne Metro as a result of road closures	C	4 - Parkville 7 - Domain	Business Land Use & Planning Social	High	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Major	Likely	High	**Road transport (Construction Phase)** Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction, including but not limited to: • Management of any temporary or permanent full or partial closure of traffic lanes including (but not limited to): - Royal Parade, Grattan Street and Barry Street, Parkville - St Kilda Road, Domain Road, Albert Road at Domain • Monitoring of travel behaviour changes caused by construction works, including pre-construction baseline data and periodic reporting on behaviour change. Use this data as an input to the design of transport networks following construction • Traffic management plan(s) must be developed recognising other projects operating concurrently, where relevant • Provision for a minimum of one lane for traffic in each direction on St Kilda Road to be maintained throughout the construction within the Domain station precinct • Potential routes for construction vehicles travelling to and from all Melbourne Metro construction work sites, recognising sensitive receptors • Provision of suitable routes for vehicles to maintain connectivity for road users to the medical and educational facilities adjacent to the Parkville construction work site • Provision of alternate parking where possible to that lost from Grattan Street, Domain Road, St Kilda Road and Albert Road during construction and preventing parking at undesignated locations on local roads • Provision of car parking for construction workers where possible • Provision of suitable routes for cyclists and pedestrians to maintain connectivity and safety for roads and shared paths that provide continued access, including (but not limited to): Grattan Street, St Kilda Road, Albert Road and Domain Road • Provision of complementary improvements to Kings Way, Canterbury Road and other roads to assist traffic flow in St Kilda Road for the duration of the works to	Moderate	Likely	Medium

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												accommodate additional traffic that may use these roads • In consultation with emergency services, develop suitable measures to ensure emergency service access is not inhibited as a result of Melbourne Metro construction worksites • Special arrangements for delivery or removal of large loads. **Public Transport (Construction Phase)** • Develop and implement measures to minimise disruption to the tram and bus networks resulting from the construction of Melbourne Metro in consultation with the relevant road management authorities and to the satisfaction of PTV, including (but not limited to): - Options to divert the 401, 402, 403, 505 and 546 bus services - Periodic closures of Royal Parade tram route - Tram routes on St Kilda Road - Disruption to other tram routes through Domain tram stop - Bus replacement services for disrupted rail customers. **Active Transport (Construction Phase)** • Develop and implement transport management measures in consultation with relevant road management authorities for cyclists and pedestrians to maintain connectivity throughout construction for road and shared path users including (but not limited to): Grattan Street, St Kilda Road, Domain Road, Domain Parklands and Albert Road • Implement active control at construction work site access points to maintain safety by avoiding potential conflicts between trucks, pedestrians and cyclists			

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Transport	T006	Trucks removing tunnel spoil increase congestion levels in key parts of the network	Increased levels of heavy trucks on city streets across day and night would affect amenity and traffic operations - across all precincts where spoil is to be removed.	C	1 - Tunnels 3 - Arden 7 - Domain	Business Noise & Vibration Social	Medium	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Moderate	Possible	Medium	**Road transport (Construction Phase)** Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction, including but not limited to: • Management of any temporary or permanent full or partial closure of traffic lanes including (but not limited to): - Linlithgow Avenue, Melbourne - St Kilda Road, Domain Road, Albert Road at Domain - Toorak Road at Fawkner Park - Osborne Street, William Street in South Yarra • Potential routes for construction vehicles travelling to and from all Melbourne Metro construction work sites, recognising sensitive receptors • Traffic management plan(s) must be developed recognising other projects operating concurrently, where relevant **Travel Demand Strategy** – as per T001	Moderate	Possible	Medium
Transport	T007	Trucks removing tunnel spoil increase congestion levels in key parts of the network	Increased levels of heavy trucks on local streets and associated road closures around South Yarra across day and night will affect amenity of local residents.	C	8 - Eastern portal	Business Noise & Vibration Social	Medium	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase - initial analysis based on use of local streets for truck movements	Moderate	Possible	Medium	**Road transport (Construction Phase)** Develop and implement a transport management plan(s) in consultation with the relevant road management authorities to minimise disruption to traffic, car parking, pedestrian and bicycle movements during construction, including but not limited to: • Management of any temporary or permanent full or partial closure of traffic lanes including (but not limited to): Osborne Street, William Street in South Yarra • Potential routes for construction vehicles travelling to and from all Melbourne Metro construction work sites, recognising sensitive receptors • Traffic management plan(s) must be developed recognising other projects operating concurrently, where relevant • Provision of suitable routes for vehicles, cyclists and pedestrians to maintain connectivity for road and shared path users of Osborne Street, Toorak Road and other local roads. **Travel Demand Strategy** – as per T001	Minor	Possible	Low
Transport	T008	Construction activities impeding traffic flow	Increased congestion and reduced connectivity for transport modes within the vicinity of the project area at the western turnback.	C	9 - Western turnback	Business Land Use & Planning Social	Medium	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Minor	Unlikely	Low	**Public Transport (Construction Phase)** • Develop and implement a plan for occupying railway land and tracks at the western turnback that minimises the disruption to railway services during construction. Plan to be developed to the satisfaction of VicTrack and MTM • Provide suitable routes for pedestrians to maintain connectivity, including DDA access for users of West Footscray station and around all construction sites generally	Minor	Unlikely	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
Transport	T009	Legacy transport network outcomes reduce network connectivity or increase congestion	Increased congestion and reduced connectivity for transport modes within the vicinity of Melbourne Metro	O	2 - Western portal 3 - Arden	Business Land Use & Planning Social	Medium	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Minor	Possible	Low	**Road transport (Operational Phase)** • Design all roadworks and shared path works to relevant design standards to maintain safety of movement in consultation with the relevant road management authorities as required • Develop and implement a plan to reinstate car parking on Childers Street, Kensington and Laurens Street, North Melbourne in consultation with the relevant road management authorities that: - Minimises the permanent loss of parking where possible - Ensures re-instated car parking does not encroach on JJ Holland Park - Considers opportunities for re-provision of any net loss of parking at nearby locations - Reduces the risk of overflow parking in local streets from South Kensington station and activities at JJ Holland Park - Replaces loading zones to service the needs of the existing businesses in the precinct where disrupted during construction **Public Transport (Operational Phase)** Review, with PTV, the bus services in the areas around Arden station including a review of the route 401 bus frequency that will have reduced demand following implementation of Melbourne Metro **Active Transport (Operational phase)** • Develop and implement a permanent shared use path along the northern side of Childers Street, Kensington in conjunction with the relevant road management authority and the land manager prior to the removal of the shared use path on the southern side • Where practicable to do so, re-instate on-road bicycle lanes and bicycle parking provisions removed during construction in cooperation with the relevant road management authority and the local council • Review the provision of safe and effective bicycle lanes in and around construction sites in cooperation with the road authority and the local council • Provide wayfinding information to enhance connectivity for pedestrians and public transport users	Minor	Unlikely	Low
Transport	T010	Legacy transport network outcomes reduce network connectivity or increase congestion	Increased congestion and reduced connectivity for transport modes within the vicinity of Melbourne Metro and across the broader transport network	O	4 - Parkville 5 - CBD North 6 - CBD South 7 - Domain	Business Land Use & Planning Social	High	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Moderate	Possible	Medium	**Road transport (Operational Phase)** • Design all roadworks and shared path works to relevant design standards to maintain safety of movement in consultation with the relevant road management authorities as required • Develop and implement a plan for the re-instatement of Grattan Street, Parkville in consultation with the relevant road management authorities that includes:	Minor	Possible	Low

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												- Optimal replacement of car parking spaces along Grattan Street to service the needs of the hospitals and the university, including the retention or replacement of specific short-term and DDA compliant parking - Optimal design of the road network around Grattan Street associated with the changed demands and network changes on Grattan Street and Royal Parade/Elizabeth Street • Develop and implement a plan for the future use of the Franklin Street road reserve in consultation with the relevant road management authorities that includes: - Optimising the design of the road network following the closure of Franklin Street between Swanston Street and Bowen Street - Monitoring the change in travel patterns around the area associated with the closure of Franklin Street • Optimise the design of the re-instated St Kilda Road and apply the road users hierarchy in consultation with the relevant road management authorities to: - Reduce delays and congestion - Maintain safe operations through the precinct - Determine the optimal parking provision in the area and replace any lost parking where possible. **Public Transport (Operational Phase)** • Review, with PTV, the bus services in the areas around Parkville, CBD North, CBD South and Domain s including a review of the route 401 bus frequency that will have reduced demand following implementation of Melbourne Metro • Optimise the design of Melbourne Metro s to ensure integration with existing and planned future uses and so that they will provide connections: - Between the new Parkville station and the new tram stop on Royal Parade - For interchange between the new CBD North station and the existing tram and bus services along La Trobe Street and Swanston Street - For interchange between the new CBD South station and the existing tram services along Flinders Street and Swanston Street - Between the new Domain station and the new island platform trams stop in the centre of St Kilda Road and connections to the tram services along Domain Road • Review, with PTV and Yarra Trams, the bus and tram services in the area to optimise the functionality of the CBD North and South stations and to reduce the reliance on the Swanston Street tram corridor. **Active Transport (Operational phase)** • Where practicable to do so, re-instate on-road bicycle			

Discipline	Risk No.	Impact Pathway		Project Phase	Precinct	Linkages	Data availability	Existing performance requirements	Initial Risk			Recommended Environmental Performance Requirements	Residual Risk		
		Category	Event						C	L	Risk		C	L	Risk
												lanes and bicycle parking provisions removed during construction in cooperation with the relevant road management authority and the local council • Review the provision of safe and effective bicycle lanes in and around construction sites in cooperation with the road authority and the local council • Provide wayfinding information to enhance connectivity for pedestrians and public transport users including (but not limited to) the following locations: - Between Melbourne Central Station and the new CBD North station - The underground connection between Flinders Street Station and the new CBD South station.			
Transport	T011	Legacy transport network outcomes reduce network connectivity or increase congestion	Increased congestion and reduced connectivity for transport modes within the vicinity of the project area at eastern portal (South Yarra).	O	8 - Eastern portal	Business Land Use & Planning Social	Medium	Design and transport management plans expected to address identified concerns and mitigate risks through design development phase	Negligible	Unlikely	Very Low	**Road transport (Operational Phase)** • Design all roadworks and shared path works to relevant design standards to maintain safety of movement in consultation with the relevant road management authorities as required	Negligible	Unlikely	Very Low

Appendices

Appendix A – Specific Consequence Criteria

Table A-1 Aboriginal Heritage - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	Nil impact to Aboriginal archaeological objects or sites. No impact to intangible cultural heritage values such as contemporary sites or Dreaming Places.
Minor	Partial disturbance or removal of Aboriginal archaeological objects from one archaeological site. Intrusion on one of the following values of an intangible site – aesthetic, social, religious, historic or cultural.
Moderate	Complete removal of one or more Aboriginal archaeological site or removal of numerous objects at a number of site locations. Intrusion on more than two of the following values of an intangible site – aesthetic, social, religious, historic or cultural.
Major	Complete removal of a large number of Aboriginal objects or complete removal of Aboriginal sites at many locations. Disturbance/removal of an Aboriginal archaeological/burial site(s) of high significance to the Aboriginal community or of high scientific significance. Intrusion to multiple values (e.g. aesthetic, social, religious, historic or cultural) of more than one intangible site.
Severe	Widespread removal of Aboriginal archaeological objects and/or sites/burials across all locations. Complete destruction of numerous sites or objects of high Aboriginal significance or high scientific significance. Complete destruction of all values (e.g. aesthetic, social, religious, historic or cultural) relating to one or more intangible sites.

Table A-2 Air Quality - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	Undetected changes to ambient air quality, beyond the site boundaries.
Minor	Detected changes to air quality, but no exceedances of Melbourne Metro Air Quality Criteria detected beyond the site boundaries. Changes can be managed by mitigation measures (i.e. reversible).
Moderate	Detected changes to air quality, emissions from site cause limited exceedances of Melbourne Metro Air Quality Criteria beyond the site boundaries e.g. 24h PM10 > Criteria <= 5 times in 1 year (using the current NEPM exceedance goal for PM10).
Major	Detected changes to air quality, emissions from site cause exceedances of Melbourne Metro Air Quality Criteria beyond the site boundaries e.g. 24h PM10 > Criteria > 5 times in 1 year (using current NEPM goal for PM10).
Severe	Detected changes to air quality, emissions from site cause exceedances of Melbourne Metro Air Quality Criteria beyond the site boundaries e.g. 24h PM10 > Criteria > 5 times in 1 year (using NEPM goal for PM10) Emissions from Melbourne Metro cause clearly observed air pollution that causes air quality impacts leading to increased hospital admissions.
Severe	Undetected changes to ambient air quality, beyond the site boundaries.

Table A-3 Arboriculture (John Patrick Pty Ltd and Tree Dimensions) - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	Within a single precinct, no loss or significant disturbance to Mature Long Term Viable (MLTV) trees in the public realm.
Minor	Within a single precinct, limited removals or significant disturbance to MLTV trees in the public realm with scope within the affected project area to re-establish healthy replacement trees within 5 years of project completion.
Moderate	Within a single precinct, significant removals or disturbance to Mature Long Term Viable trees in the public realm with scope within the affected project area to re-establish healthy replacement trees within 5 years of project completion.
Major	Within a single precinct, significant removals or disturbance Mature Long Term Viable trees in the public realm with limited scope within the affected project area to re-establish healthy replacement trees within 5 years of project completion.
Severe	Within a single precinct, near complete removal or significant disturbance to Mature Long Term Viable trees in the public realm with significant permanent loss of canopy cover.

Table A-4 Aquatic Ecology and River Health - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	No detectable change in water quality No impact/disturbance to riverbed or banks No loss of ecosystem structure or function No downstream impacts.
Minor	Minor disturbance to riverbed or bank Transient/ephemeral/short-term (days to weeks) impact to riverbed, banks and downstream environments with sufficient resilience retained by the ecosystem to fully bounce back from minor disturbance Small and short-term (days to weeks) degradation of water quality. Water quality remains within the long-term historical background range and returns to pre-impact conditions quickly.
Moderate	Moderate disturbance of river-bed or bank resulting in some diminished capacity of moderate value moderate condition instream habitat Environment stress observed, short-term (days to weeks) disruption to breeding cycles for aquatic biota and ecological processes Ecosystem resilience is reduced and moderately difficult or expensive rehabilitation is required Water quality impact that exceeds background conditions for an extended period of time (weeks to months) and extends downstream beyond the immediate impact zone.
Major	Major disturbance to bed and banks resulting in significantly diminished capacity of high value stream segment to maintain habitat and support of flora/fauna Significant harm to instream habitat, uncertain whether enough resilience retained to allow restoration to pre-disturbance conditions Water quality exceeds background conditions and exceeds SEPP guidelines for an extended period of time and area downstream of the immediate impact zone.
Severe	Widespread habitat destruction, irreversible damage, potential loss of species/functional groups/guilds, catastrophic shift in ecosystem processes Extinction of rare or threatened aquatic flora/fauna, habitat lost for spawning/nesting/roosting/critical refuge Loss of recruitment/regeneration ability (e.g. through construction of barrier to fish passage) Total loss of biological functions and processes, possibly irreversible, long-term harm to native flora and fauna. Ecosystem is unable to recover and rehabilitation to previous condition is not possible.

Table A-5 Business - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	The net change in real annual business income in the precinct is in the range of 0-5 per cent. On average, that would result in only the most very marginal businesses in the precinct being unprofitable.
Minor	The net change in real annual business income in the precinct is in the range of 5-10 per cent. On average, that would result in only the marginal businesses in the precinct being unprofitable.
Moderate	The net change in real annual business income in the precinct is in the range of 10-15 per cent. On average, that would result in many businesses in the precinct being on the verge of being unprofitable.
Major	The net change in real annual business income in the precinct is in the range of 15-20 per cent. On average, that would likely result in most businesses being unprofitable.
Severe	The net change in real annual business income in the precinct is greater than 20 per cent. On average, that would likely result in all businesses being unprofitable.

Table A-6 Contaminated Land and Spoil Management - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	No disturbance of contaminated soils, acid sulfate soils/rock, or contaminated groundwater. Or Contamination levels are above background but below ecological investigation levels.
Minor	Potential disturbance of small volumes of contaminated soil able to be contained and treated on-site and/or disposed of as clean fill or Category C waste with no risk to human health and/or the environment. Or Potential disturbance of small volumes of acid sulfate soils able to be contained and treated on-site and/or disposed of as prescribed waste with and EPA approved Environmental Management Plan (here referred to as an acid sulfate soil and rock management plan) and no risk to human health and/or the environment. Or Small volumes of contaminated groundwater that can be readily treated and or disposed of to sewer under a trade waste agreement. Or Contamination levels exceed Health Investigation Levels (HILs) or EILs as defined by the National Environment Protection Measure 2013. Or Minor impacts on Client's ability to manage the environment in a sustainable manner. Or Poses aesthetic impacts as defined in the SEPP (Prevention and Management of Contaminated Land).
Moderate	Potential disturbance of moderate volumes of contaminated soil, able to be contained and treated on-site and/or disposed as prescribed waste and that can be managed locally with limited risk to human health and/or environment.

Level of consequence	Consequence criteria
	Or Potential disturbance of moderate volumes of acid sulfate soil able to be contained and treated on-site and/or disposed as prescribed waste with no risk to human health and/or environment. Or Contamination levels exceed site specific risk based investigation levels developed in accordance with National Environment Protection Measure or other guidelines. Or Possible impact on Client's ability to manage the environment in a sustainable manner.
Major	Potential disturbance of large volumes of contaminated soil resulting in risks to human health and/or environment across and outside the proposed project boundary. Or Disturbance of large volumes of acid sulfate soil resulting in localised (across the proposed project boundary) risks to human health and/or environment. Or Users of the site exposed to a hazard that results in major or permanent adverse health effects Or Impact on Client's ability to manage the environment in a sustainable manner.
Severe	Potential disturbance of large volumes of contaminated soil resulting in widespread irreversible risks to human health and/or environment. Or Disturbance of large volumes of acid sulfate soil resulting in widespread (outside the proposed project boundary) risks to human health and/or environment. Or Irreversible and extensive damage is caused to the environment. Or Users of the site exposed to a severe, adverse long-term health impact or life-threatening hazard that may result in acute toxicity to receptors (as defined in the National Environment Protection Measures). Or Contamination levels constitute an Imminent environmental hazard in accordance with EPA Environmental auditing as per Publication 759.2. Or Severe impact on Client's ability to manage the environment in a sustainable manner.

Table A-7 Greenhouse Gas - consequence rating criteria

Level of Consequence	Consequence criteria
Construction	
Negligible	Annual Scope 1 and Scope 2 GHG emissions for the construction of the project are below 5,000 t CO_2-e p.a. No obligation to monitor and report emissions and no financial liability for GHG emissions.
Minor	Annual Scope 1 and Scope 2 GHG emissions for the construction of the project are below the threshold required to report as a separate facility in NGER Scheme (25,000 t CO_2-e p.a.). No change in reporting obligations and no increased financial liability for GHG emissions (costs associated with reporting by the contractor are absorbed in current reporting activities).
Moderate	Annual Scope 1 and Scope 2 GHG emissions for the construction of the project are greater than the threshold required to report as a separate facility in NGER Scheme (25,000 t CO_2-e p.a.). The potential for some additional financial liability (new or additional costs associated with reporting by the contractor are experienced) and requirement to monitor and report emissions.
Major	A major level of GHG emissions associated with construction of the project as defined by Scope 1 and Scope 2 emissions representing a non-negligible proportion of Australia's total emissions (> 0.01 per cent but <0.1 per cent), or a non-negligible proportion of Victoria's total GHG emissions (> 1 per cent but < 5 per cent), excluding LULUCF[#]. A major estimated financial liability (e.g. offsetting of Scope 1 and Scope 2 emissions).
Severe	A significant level of GHG emissions associated with construction of the project as defined by Scope 1 and Scope 2 emissions representing > 0.1 per cent of Australia's total annual GHG emissions, or > 5 per cent of Victoria's total GHG emissions, excluding LULUCF[#]. A significant estimated financial liability (e.g. offsetting of Scope 1 and Scope 2 emissions).
Operation	
Negligible	No change or a decrease in GHG emissions compared to the 'no Melbourne Metro' operational scenario. No additional financial liability (compared to existing reporting requirements of operator) for reporting of operational Scope 1 and Scope 2 GHG emissions.
Minor	An increase in annual Scope 1 and Scope 2 GHG emissions compared to the 'no Melbourne Metro' operational scenario, with operational emissions below the threshold required to report as a separate facility in NGER Scheme (25,000 t CO_2-e p.a.). Some additional financial liability (compared to existing reporting requirements of operator) for reporting of operational Scope 1 and Scope 2 GHG emissions.
Moderate	An increase in annual Scope 1 and Scope 2 GHG emissions compared to the 'no Melbourne Metro' operational scenario, with operational emissions greater than the threshold required to report as a separate facility in NGER Scheme (25,000 t CO2-e p.a.). The potential for material financial liability (greater than ten per cent increase in reporting workload) and requirement to monitor and report emissions under NGER Scheme.
Major	A major increase in operational GHG emissions compared to the 'no Melbourne Metro' operational scenario and a major estimated financial liability. The increase in Scope 1 and Scope 2 GHG emissions represent a non-negligible proportion of Australia's total emissions (> 0.01 per cent but <0.1 per cent), or a non-negligible proportion of Victoria's total GHG emissions (> 1 per cent but < 5 per cent), excluding LULUCF#.
Severe	A significant increase in operational GHG emissions compared to the 'no Melbourne Metro' operational scenario and a significant and irrecoverable estimated financial liability. The increase in Scope 1 and Scope 2 GHG emissions represent > 0.1 per cent of Australia's total annual GHG emissions, or > 5 per cent of Victoria's total GHG emissions, excluding LULUCF[#].

[#] Land Use, Land Use Change and Forestry

Table A-8 Ground Movement and Land Stability – impact ratings*

** The impact evaluation criteria used in the Ground Movement risk assessment study are shown in the tables below, and are directly related to the consequences ratings. These criteria are consistent with industry practice for projects of this type and are based on criteria adopted in previous tunnelling projects.*

Impact ratings for buildings (after Burland, 1995 and Boscardin & Cording 1989)

Potential Impact	Category of damage and Normal degree of severity**	Description of typical damage*	Limiting tensile strain** %	Broad category grouping
Negligible	0 – Negligible	Hairline cracks less than about 0.1 mm wide.	Less than 0.05	Aesthetic Damage
Minor	1 – Very Slight	Fine cracks that are easily treated during normal decoration. Damage generally restricted to internal wall finishes. Close inspection may reveal some cracks in external brickwork or masonry. Typical crack widths up to 1 mm.	0.05 to 0.075	
	2 – Slight	Cracks easily filled. Redecoration probably required. Recurrent cracks can be masked by suitable linings. Cracks may be visible externally and some repointing may be required to ensure weather-tightness. Doors and windows may stick slightly. Typical crack widths up to 5 mm.	0.075 to 0.15	
Moderate	3 – Moderate	The cracks require some opening up and can be patched by a mason. Repointing of external brickwork and possibly a small amount of brickwork to be replaced. Doors and windows sticking. Service pipes may fracture. Weather-tightness often impaired. Typical crack widths are 5–15 mm or several >3 mm.	0.15 to 0.3	Serviceability Damage
Major	4 – Severe	Extensive repair work involving breaking out and replacing sections of walls, especially over doors and windows. Windows and door frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing beams. Service pipes disrupted. Typical crack widths are 15–25 mm, but it also depends on the number of cracks.	Greater than 0.3	
Severe	5 – Very Severe	Irreversible, significant changes resulting in widespread risks to human health and/or the functioning of the building. This requires a major repair job involving partial or complete rebuilding. Beams lose bearing; walls lean badly and require shoring. Windows broken with distortion. Danger of instability. Typical crack widths are greater than 25 mm, but it also depends on the number of cracks.	Greater than 0.3	Stability Damage

* Note: Crack width is only one factor in assessing category of building damage and is not used as a direct measure of damage. Ease of repair is the key factor in development of this table, based on a large number of other studies

**Relationship between Category of Damage and Limiting Tensile Strain for Buildings (After Burland (1995), and Mair et al (1996))

Impact ratings for road pavements*, tram ways, kerbs and footpaths (Hudson-Smith & Grinceri)

Potential Impact	Max Slope And Settlement Induced	Maximum Induced Slip (Mm) Or Strain (Mm/M)	Description Of Potential Damage
Negligible	< 1/750 Settlement 10 mm	5 mm/m	Negligible effects, superficial damage unlikely
Minor	1/500 to 1/750 Settlement 10 mm	5 mm/m	Negligible effects, superficial damage unlikely
Moderate	1/500 to 1/150 Settlement 15 mm	10 mm/m	Possible superficial damage, which is unlikely to have significant effect to the structure
Major	1/150 to 1/50 Settlement 25 mm	20 mm/m	Expected superficial damage to structures, possible structural damage to structures
Severe	>1/50 Settlement 50 mm	30 mm/m	Expected structural damage to structure

*For roads identified as potentially exceeding the serviceability limiting criteria or locations considered sensitive to ground movements, a risk assessment would be developed that takes into account features such as the road surfacing material, the existing road condition and traffic levels.

Impact ratings for Utilities (Attewell et al. (1986) and Bracegirdle et al. (1996))

Potential Impact	Max slope induced	Maximum induced slip (mm) or strain (mm/m)	Description of potential damage
Negligible	< 1/750	Concrete pipe/culvert: 10 mm Water Steel & Iron: 10 mm Cable in PCV duct: 2 mm/m Cable buried in the ground: 1 mm/m Gas Pipes PVC: 5 mm Gas Steel & Iron: 5 mm	Negligible effects, superficial damage unlikely
Minor	1/500 to 1/750	Concrete pipe/culvert: 10 mm Water Steel & Iron: 10 mm Cable in PVC duct: 2 mm/m Cable buried in the ground: 1 mm/m Gas Pipes PVC: 5 mm Gas Steel & Iron: 5 mm	Negligible effects, superficial damage unlikely
Moderate	1/500 to 1/150	Concrete pipe/culvert: 15 mm Cable in PVC duct 4 mm/m Cable buried in the ground: 2 mm/m Gas Pipes PVC: 10 mm	Possible superficial damage, which is unlikely to have significant effect to the structure or function of the utility
	1/500 to 1/250	Water Steel & Iron: 15 mm Gas Steel & Iron: 10 mm	
Major	1/150 to 1/50	Concrete pipe/culvert: 25 mm Cable in PVC duct 6 mm/m Cable buried in the ground: 3 mm/m Gas Pipes PVC: 20 mm	Expected superficial damage to structures, possible damage to structures, possible damage to rigid utilities
	1/250 to 1/130	Water Steel & Iron: 25 mm Gas Steel & Iron: 15 mm	
Severe	>1/50	Concrete pipe/culvert: 30 mm Cable in PVC duct 8 mm/m Cable buried in the ground: 4 mm/m Gas Pipes PVC: 25 mm	Expected structural damage to structure and function of utility
	>1/130	Water Steel & Iron: 30 mm Gas Steel & Iron: 20 mm	

*Consequence ratings depend on utility construction type, construction method, function, and condition and asset owner requirements, further discussion required to confirm appropriate criteria with relevant stakeholder(s)

Table A-9 Groundwater - consequence rating criteria

Level of consequence	Consequence criteria
Impacts to existing infrastructure caused by groundwater drawdown or increased recharge (other than subsidence) **Impact on CityLink Recharge wells (increased recharge required at CityLink wells due to drawdown)**	
Negligible	No discernible change in groundwater levels (near infrastructure of concern) compared to baseline / background levels.
Minor	Minor decline in groundwater levels (near infrastructure of concern) compared to baseline during and shortly after construction. Decline may be difficult to differentiate from climatic and other influences.
Moderate	Moderate decline in groundwater levels (near infrastructure of concern) compared to baseline during construction phase and long term. Decline clearly differentiated from climatic and other influences.
Major	Large decline in groundwater levels (near infra-structure of concern) compared to baseline during construction phase and long term.
Severe	Large decline in groundwater levels (near infrastructure of concern) compared to baseline during construction phase and long term leading to major settlement and associated infrastructure damage.
Groundwater drawdown impacts on surface waters **Pumping groundwater from excavations can sometimes lead to stream flow depletion (either by decreasing baseflow or increasing streamflow losses to groundwater) and potentially adversely impact on health of aquatic ecosystems.** **The consequence criteria are based on changes compared to background conditions, and potential for long term impacts. They are broadly consistent with the Ministerial Guidelines for Groundwater Licensing and the Protection of GDEs (2015), which describes a significant impact as a 10 per cent reduction in flow (at the 90th percentile flow rate). The Guidelines reference Copestake and Young (2008) who propose that at flows of between 70th to 95th percentile, 10-20 per cent of flow can be taken before breaching "good ecological status", and the criteria below are also consistent with that assessment.**	
Negligible	No detectable impact on river/creek flows.
Minor	Reduction in river/creek flows by up to ~ 5 per cent compared with background). Likely to be difficult to differentiate impact from normal intra and inter-seasonal variability (e.g. climatic and other influences). No detectable impact on river/creek ecosystems.
Moderate	Reduction in river/creek flows by 5 – 20 per cent compared with background. Decline in flow clearly measurable and differentiated from climatic and other influences. Long term local effects (i.e. immediately) on downstream river/creek ecosystems.
Major	Reduction in river/creek flows by 20 – 50 per cent compared with background. Long term effects for local and downstream river/creek ecosystems.
Severe	Loss of majority of streamflow (50 – 100 per cent) leading to major and irreversible changes in local and/or downstream aquatic ecosystems.

Level of consequence	Consequence criteria
Groundwater drawdown impacts on vegetation Groundwater Dependent Ecosystems (GDEs) **Pumping groundwater from excavations leads to drawdown in the watertable, which can impact GDEs reliant on groundwater (the particular focus here is on groundwater dependent vegetation).** **The criteria adopted here are consistent with the Ministerial Guidelines for Groundwater Licensing and the Protection of GDEs (2015). The Ministerial guidelines refer to depth to watertable as an appropriate management indicator for terrestrial vegetation and wetlands, and refer to drawdown numbers - minor (0.1 m), moderate (0.1 – 2 m) and significant impact (>2 m). The criteria below refer to changes compared to typical natural variation; however, based on typical natural variation for the study area, the two sets of criteria are broadly compatible.**	
Negligible	No / negligible drawdown at potential GDEs.
Minor	Minor groundwater drawdown at potential GDEs, but within range of typical natural variation (i.e. GDEs resilient to change).
Moderate	Drawdown is greater than typical natural variation of groundwater levels at GDEs - potential long term isolated impacts are possible (e.g. occasional tree death) if not managed, e.g. via watering or drawdown mitigation.
Major	Drawdown is significantly greater than typical natural variation of GDEs - long term impacts are likely (e.g. many tree deaths) and ability to manage impacts is not certain.
Severe	GDEs cannot adapt to changed groundwater levels, widespread long term impacts are likely (e.g. tree deaths over wide area) and low likelihood of managing impacts.
Groundwater drawdown impacts on groundwater users **Pumping groundwater from excavations leads to drawdown in the watertable, which can impact on other users of groundwater (i.e. other bores, including CityLink recharge bores). The consequence criteria draw on Southern Rural Water bore interference guidelines, which indicate 10 per cent of available drawdown in existing bores as an acceptable drawdown impact for new bores.**	
Negligible	No / negligible drawdown at bores.
Minor	Decline in groundwater levels is less than 10 per cent of available drawdown.
Moderate	Temporary decline in groundwater levels during construction of between 10 per cent – 50 per cent of available drawdown. Compensation (e.g. deepening bore, supplying water) easily implemented and not costly.
Major	Permanent decline in groundwater levels of between 10 per cent - 100 per cent of available drawdown. Compensation (e.g. deepening bore, supplying water) is difficult and/or expensive.
Severe	NA
Groundwater drawdown oxidising Potential Acid Sulfate Soils (PASS) resulting in increased groundwater acidity Groundwater drawdown may expose PASS to air causing oxidiation of sulfide minerals and impacts on groundwater quality, including increased acidity and heavy metal content.	
Negligible	No detectable change in groundwater quality
Minor	Some measurable change in groundwater quality but no impacts to beneficial uses of groundwater
Moderate	Measurable change in groundwater quality that precludes some beneficial uses of groundwater in the area. Management is simple and inexpensive.
Major	Change in groundwater quality that significantly reduces beneficial uses such that expensive management would be required.
Severe	The change in groundwater quality would preclude all current and future beneficial uses of groundwater in the area. Would require very expensive management.

Level of consequence	Consequence criteria
Groundwater drawdown causing migration of contaminant plumes **Groundwater drawdown causing existing contaminant plumes to migrate to areas previously unaffected by contamination, precluding the beneficial uses of groundwater for neighbouring properties and potentially causing vapour ingress to underground structures (e.g. basements) at those properties. Pumping groundwater from excavations leads to drawdown that could cause contaminated groundwater to migrate to third party properties, and reduce current and future beneficial uses of groundwater at those properties, If the contaminant plume consists of volatile substances, there is also the potential for vapour to enter structures on neighbouring properties as a result of the migration of contamination.**	
Negligible	No / negligible drawdown and no / negligible plume movement.
Minor	Some movement of plume possible over long timeframes, enabling dispersion and natural attenuation to minimize impacts to beneficial uses of groundwater at neighbouring properties. Underground structures at neighbouring properties are not susceptible to vapour intrusion.
Moderate	Movement of plume which is likely to intersect third party properties and preclude some beneficial uses that would require management. Prevention of vapour intrusion into underground structures is possible without additional construction works (such as sealing basements).
Major	Plume would intersect third party properties and significantly reduce beneficial uses such that expensive management would be required. Significant legal risk.
Severe	Plume would intersect third party properties and preclude all current and future beneficial uses of groundwater at these properties. Vapour intrusion to underground structures results in permanent restrictions to use due to potential for major impacts to human health. Would require very expensive management.
Melbourne Metro structures blocking aquifer flow and causing a groundwater 'damming' effect **Where Melbourne Metro structures block groundwater flow through aquifers that are not laterally extensive (i.e. in palaeovalleys), groundwater levels may increase upstream, and decrease levels downstream of the structure. The change in groundwater levels as a result of aquifer damming can impact beneficial uses in those areas, such as bore owners and groundwater dependent vegetation and surface water features.**	
Negligible	Change in groundwater levels upstream and downstream of structure is within the range of natural variation.
Minor	Upstream groundwater mounding and downstream fall in groundwater levels that is measurable, but impacts on CityLink injection bores, existing groundwater users, vegetation health and/or the water balance in rivers, creeks and lakes, and existing below ground infrastructure are within operational criteria.
Moderate	Upstream groundwater mounding that affects recharge bores and inflows to existing infrastructure. Downstream fall in groundwater levels that has a measurable effect on CityLink injection bores, existing groundwater users, vegetation health and/or the water balance in rivers, creeks and lakes. Management required.
Major	Upstream groundwater mounding that affects recharge bores and inflows to existing infrastructure. Downstream fall in groundwater levels that has a measurable effect on CityLink injection bores, existing groundwater users, vegetation health and/or the water balance in rivers, creeks and lakes. Management is expensive. Significant legal risk.
Severe	NA

Table A-10 Historical Cultural Heritage - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	No detectable impact on the values of a heritage place or heritage object.
Minor	Detectable impact on the heritage values of a heritage place or object of local significance with limited reduction in those heritage values. Detectable impact on the heritage values of a heritage place or heritage object of State, Commonwealth or National significance but with heritage values overall retained intact.
Moderate	Complete loss of the heritage values of a heritage place or heritage object of local significance and which may be subject to a site-specific Heritage Overlay (HO), or loss of the heritage values of several contributory places within an HO precinct but with the precinct heritage values retained substantially intact. Loss of the heritage values of an archaeological site or sites not included in the VHR (included in the VHI or previously unknown). Partial reduction in the heritage values of a heritage place or object of State, Commonwealth or National significance.
Major	Loss of the heritage values of several heritage places which are included within a heritage precinct resulting in substantial reduction or complete loss of the heritage values of the precinct. Substantial reduction in the heritage values of a heritage place or object of State, Commonwealth or National significance
Severe	Complete loss of heritage values of a heritage place or object of State, Commonwealth or National significance.

Table A-11 Land Use and Planning - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	No impact on existing land uses and does not require any property acquisition OR The project element complies fully with all relevant legislative requirements and is consistent with government strategic planning studies
Minor	Potential short term disruption to existing land use OR Temporary limited access to properties but properties still able to be used for existing purpose OR Minimal property acquisition that results in no land use changes OR The project element has minor inconsistencies with local planning policies
Moderate	Land use changes that would result in some inconsistencies with local planning policies OR Moderate property acquisition that results in minimal land use changes OR Temporary disruption of access to properties resulting in land use changes
Major	Land use changes that would result in significant inconsistencies with local and State planning policies OR Major property acquisition required that results in some land use changes. OR Permanent disruption of access to properties resulting in some land use changes
Severe	The project cannot comply with all relevant legislative requirements and land use changes result in extensive conflict with state and local planning policies OR Extensive property acquisition that results in significant land use changes OR

Level of consequence	Consequence criteria
	Permanent disruption of access to properties resulting in complete land use changes

Table A-12 Landscape and Visual - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	The proposal would have an indiscernible effect on views and will not affect the composition, the appreciation of the landscape character, or the ability to take in or enjoy the view.
Minor	The proposal would cause a low degree of visual change, but would not materially affect the composition, the appreciation of landscape character or the ability to take in or enjoy the view.
Moderate	The proposal would cause a complete temporary change or clearly noticeable permanent change to the view that would affect the composition, the appreciation of landscape character or the ability to take in or enjoy the view.
Major	The proposal would cause a complete permanent change to the composition of the view, the appreciation of landscape character, or the ability to take in or enjoy the view.
Severe	The proposal would result in a substantial permanent alteration to a view of recognised national importance and the appreciation of landscape character, the ability to take in or enjoy the view.

Table A-13 Noise and Vibration - consequence rating criteria

Level of consequence	Consequence criteria
Construction	
Airborne Noise: High levels of airborne construction noise can adversely impact on noise sensitive receivers	
Negligible	Just audible.
Minor	Construction noise audible but within project noise criteria.
Moderate	Construction noise occasionally above applicable project noise criteria at sensitive receptors.
Major	Extended period(s) during which construction noise would be greater than project noise criteria at sensitive receptors.
Severe	Not applicable as noise would not result in regional-scale impacts.
Ground-borne noise: Construction activity can result in ground-borne noise inside noise sensitive buildings that can cause disturbance	
Negligible	Not audible.
Minor	Ground-borne construction noise audible but within project guideline targets.
Moderate	Ground-borne construction noise occasionally above project guideline targets.
Major	Extended period(s) during which ground-borne construction noise would be greater than project guideline targets.
Severe	Not applicable as noise would not result in regional-scale impacts.
Vibration: Damage to buildings. High levels of vibration can cause damage to heritage or other property assets	
Negligible	Construction vibration is within project vibration Guideline Targets and no damage to buildings.
Minor	Construction vibration is marginally greater than the project vibration Guideline Targets for cosmetic damage but not structural damage to buildings.
Moderate	Construction vibration is greater than the project vibration Guideline Targets for cosmetic damage but not structural damage to buildings.
Major	Construction vibration is greater than the project vibration Guideline Targets for cosmetic damage and for structural damage to buildings.

Level of consequence	Consequence criteria
Severe	Construction vibration is greater than the project vibration Guideline Targets for structural damage to buildings and would result in widespread structural damage
Vibration: Damage to pipework. Vibration damage to pipework can result in major environmental impact or can adversely impact on the use of infrastructure	
Negligible	Construction vibration is within project vibration Guideline Targets and no damage to underground infrastructure.
Minor	Construction vibration is greater than project vibration Guideline Targets but no damage no damage to underground infrastructure.
Moderate	Construction vibration is greater than project vibration Guideline Targets and causing superficial damage to underground infrastructure.
Major	Construction vibration is greater than project vibration Guideline Targets and causing structural damage to underground infrastructure.
Severe	Construction vibration is greater than project vibration Guideline Targets and causing structural damage to underground infrastructure.
Vibration: Human comfort	
Negligible	Construction vibration is within project vibration Guideline Targets.
Minor	Isolated exceedances of project construction vibration Guideline Targets.
Moderate	Extended period of exceedances to project construction vibration Guideline Targets.
Major	Long-term exceedances of project construction vibration Guideline Targets.
Severe	Not applicable
Vibration-sensitive equipment: Vibration (even at very low levels) can disturb the performance of vibration-sensitive equipment	
Negligible	Construction vibration is within project vibration guideline targets.
Minor	Isolated exceedances of project construction vibration guideline targets.
Moderate	Extended period of exceedances to project construction vibration guideline targets.
Major	Long-term exceedances of project construction vibration Guideline Targets and inability to use equipment.
Severe	Not applicable
Operation	
Airborne noise from trains: train noise can cause disturbance at noise sensitive receptors	
Negligible	No increase in noise level.
Minor	Airborne noise levels increase but comply with project criteria.
Moderate	Airborne noise levels increase and are greater than project criteria.
Major	Airborne noise levels significantly increase and are greater than project criteria.
Severe	Not applicable
Airborne noise from fixed infrastructure: noise from fixed infrastructure can adversely impact on noise sensitive receivers	
Negligible	No increase in fixed plant and equipment noise level.
Minor	Compliant with SEPP N-1.
Moderate	Noise from fixed plant and equipment is greater than SEPP N-1 criteria by 2 to 5 dB at sensitive receptors.
Major	Noise from fixed plant and equipment is greater than SEPP N-1 criteria by more than 5 dB at sensitive receptors.

Level of consequence	Consequence criteria
Severe	Noise from fixed plant and equipment is greater than SEPP N-1 criteria by more than 5 dB, intrudes into internal areas within buildings and strongly affects the function and utility of the premises.
Ground-borne noise from trains: underground railway movements can result in ground-borne noise inside sensitive buildings that can cause disturbance	
Negligible	Not audible.
Minor	Ground-borne noise potentially audible during quiet times and does not exceed ground-borne noise project guideline targets.
Moderate	Ground-borne noise audible and exceeding ground-borne noise project Guideline Targets by up to 5 dB.
Major	Ground-borne noise likely to be clearly audible and greater than ground-borne noise project Guideline Targets by up to 10 dB.
Severe	Ground-borne noise audible, intrusive and more than 10 dB above than ground-borne noise project guideline targets.
Vibration: Human Comfort – When occupants of a building can detect vibration it can impact upon their quality of life or working efficiency.	
Negligible	Operational Vibration is within vibration Guideline Targets.
Minor	Isolated exceedances of vibration Guideline Targets.
Moderate	Extended period of exceedances.
Major	Long-term exceedances of applicable vibration Guideline Targets at sensitive receptors.
Severe	Not applicable
Vibration: Damage to buildings: High levels of vibration can cause damage to heritage or other property assets	
Negligible	Operational vibration is within Guideline Targets and no damage to buildings.
Minor	Exceedance of project vibration Guideline Targets but no damage to buildings.
Moderate	Superficial damage to < 3 buildings.
Major	Widespread superficial damage to > 3 buildings. Widespread structural damage to < 3 buildings. Damage to heritage structures / buildings.
Severe	Widespread superficial damage to > 3 buildings. Widespread structural damage to > 3 buildings. Structural damage to heritage structures / buildings.
Vibration: Disturbance to vibration-sensitive equipment Vibration (even at very low levels) can disturb the performance of vibration-sensitive equipment	
Negligible	Operational vibration is within Guideline Targets, no disturbance to equipment.
Minor	Isolated exceedances of vibration Guideline Targets.
Moderate	Extended period of exceedances.
Major	Inability to use essential vibration-sensitive equipment due to construction vibration over a long-term period.
Severe	Not applicable

Table A-14 Social and Community - consequence rating criteria

Level of consequence	Consequence criteria
Access	
Negligible	Local, small-scale, easily reversible change in access to residences, social infrastructure or social networks and the communities of interest can easily adapt or cope with change.
Minor	Short-term (less than 1 year), recoverable changes to in access to residences, social infrastructure or social networks and community has substantial capacity to adapt and cope with change.
Moderate	Medium-term (1-5 years), recoverable changes in access to residences, social infrastructure or social networks and community has substantial capacity to adapt and cope with change.
Major	Long-term (5-25 years), recoverable changes in access to residences, social infrastructure or social networks and community has limited capacity to adapt and cope with change.
Severe	Irreversible changes in access to residences, social infrastructure or social networks and community has no capacity to adapt and cope with change.
Activities in proximity to social infrastructure and recreational assets	
Negligible	Local, small-scale, easily reversible change to social infrastructure or recreational assets and the communities of interest can easily adapt or cope with change.
Minor	Short-term (less than 1 year), recoverable change to social infrastructure or recreational assets and community has substantial capacity to adapt and cope with change.
Moderate	Medium-term (1-5 years), recoverable changes to social infrastructure or recreational assets and community has substantial capacity to adapt and cope with change.
Major	Long-term (5-25 years), recoverable change to social infrastructure or recreational assets and community has limited capacity to adapt and cope with change.
Severe	Irreversible change to social infrastructure or recreational assets and community has no capacity to adapt and cope with change.
Acquisition of residential property or social infrastructure	
Negligible	No displacement of residents or no displacement of social infrastructure.
Minor	Temporary localised displacement of tenanted dwellings in an area with sufficient alternative accommodation available or acquisition of social infrastructure with an alternative available within the precinct.
Moderate	Permanent displacement of tenanted dwellings or displacement of owner occupier households with the ability to source alternative equivalent accommodation in the precinct or acquisition of important social infrastructure with an alternative reasonably accessible to current users.
Major	Displacement of owner / occupier households with constrained ability to source alternative equivalent accommodation in the precinct or acquisition of important social infrastructure with an alternative difficult to access for current users.
Severe	Displacement of owner / occupier households with almost no ability to source alternative equivalent accommodation in the precinct or loss of access to important social infrastructure.
Activities in proximity to valued places	
Negligible	Local, small-scale, easily reversible actual or perceived change to a site valued by the wider community.
Minor	Short-term (less than 1 year), recoverable actual or perceived changes to a site valued by the wider community and community has substantial capacity to adapt and cope with change.
Moderate	Medium-term (1-5 years), recoverable actual or perceived changes to a site valued by the wider community and community has some capacity to adapt and cope with change.
Major	Long-term (5-25 years), recoverable actual or perceived changes to a site valued by the wider community and community has limited capacity to adapt and cope with change.

Level of consequence	Consequence criteria
Catastrophic	Irreversible actual or perceived changes to a site valued by the wider community.
Activities in proximity to residences	
Negligible	Local, small-scale, easily reversible change in amenity for an area and the communities of interest can easily adapt or cope with change.
Minor	Short-term (less than 1 year), recoverable change in amenity for an area and community has substantial capacity to adapt and cope with change.
Moderate	Medium-term (1-5 years), recoverable change in amenity for an area and community has some capacity to adapt and cope with change
Major	Long-term (5-25 years), recoverable change in amenity for an area and community has limited capacity to adapt and cope with change.
Catastrophic	Irreversible changes amenity for an area.
Changes in amenity for residences	
Negligible	Local, small-scale, easily reversible change in amenity for an area and the communities of interest can easily adapt or cope with change.
Minor	Short-term (less than 1 year), recoverable change in amenity for an area and community has substantial capacity to adapt and cope with change.
Moderate	Medium-term (1-5 years), recoverable change in amenity for an area and community has some capacity to adapt and cope with change.
Major	Long-term (5-25 years), recoverable change in amenity for an area and community has limited capacity to adapt and cope with change.
Activities inconsistent with community values	
Negligible	Local, small-scale, easily reversible change to the perceived health and safety or locally inconsistent with community expectations or values and communities can easily adapt or cope with change.
Minor	Short-term (less than 1 year), recoverable changes to the perceived health and safety or short-term inconsistency with community expectations or values and the community has substantial capacity to adapt and cope with change.
Moderate	Medium-term (1-5 years), recoverable changes to the perceived health and safety or medium-term inconsistency with community expectations or values and the community has some capacity to adapt and cope with change.
Major	Long-term (5-25 years), recoverable changes to the perceived health and safety or long-term inconsistency with community expectations or values and the community has limited capacity to adapt and cope with change.
Severe	Irreversible changes to the perceived health and safety or permanent inconsistency with community expectations or values and the community has no capacity to adapt and cope with change.

Table A-15 Surface Water - consequence rating criteria

Level of consequence	Consequence criteria
Negligible	Minor public nuisance No disruption of operational rail activity No increase in flood damage to property, infrastructure or the environment.
Minor	Moderate public nuisance Minimal disruption of operational rail activity Negligible increase in flood damage to property, infrastructure or the environment.
Moderate	Major public nuisance Short term disruption of operational rail activity (hours) Minor increase in flood damage to small numbers of property or infrastructure, or the environment (small and/or short-term increase in flood levels/velocities).
Major	Injury to one or more people (construction workers, commuters, rail staff, other) Moderate increase in flood damage to property, major infrastructure or the environment (moderate and/or medium-term increase in flood levels/velocities) Longer-term disruption of operational rail activity (days).
Severe	Death of one or more people (construction workers, commuters, rail staff, other) Serious injury to multiple people (construction workers, commuters, rail staff, other) Major increase in flood damage to multiple properties, major infrastructure, or significant environmental assets (major and/or long-term increase in flood levels/velocities) Major long-term disruption of operational rail activity (weeks or more).

Table A-16 Terrestrial Flora and Fauna- consequence rating criteria

Level of consequence	Consequence criteria
Negligible	No measurable impacts on the extent of remnant vegetation and/or habitat
Minor	Loss of less than 1 ha of remnant vegetation Permanent loss of habitat that is greater than 1 per cent of the site extent of a habitat, but less than 1 per cent of the local, regional or state extent of a habitat, and/or permanent loss of connectivity of a wildlife corridor that is important at the site level, but not higher.
Moderate	Loss of 1 – 5 ha of remnant vegetation Permanent loss of habitat that is greater than 1 per cent of the local extent of a habitat, but less than 1 per cent of the regional or state extent of a habitat, and/or permanent loss of connectivity of a wildlife corridor that is important at the local level, but not higher
Major	Loss of 5 – 10 ha of remnant vegetation Permanent loss of habitat that is greater than 1 per cent of the regional extent of a habitat, but less than 1 per cent of the state extent of a habitat, and/or permanent loss of connectivity of a wildlife corridor that is important at the regional level, but not higher
Severe	Loss of greater than 10 ha of remnant vegetation Permanent loss of habitat that is greater than 1 per cent of the state extent of a habitat, and/or permanent loss of connectivity of a wildlife corridor that is important at the state level

Table A-17 Transport - consequence rating criteria

Level of Consequence	Consequence criteria
Negligible	No detectable change in a local transport operational setting
Minor	Short term, reversible changes in a local transport operational setting
Moderate	Long term but limited changes to transport operational setting that are able to be managed
Major	Long term, significant changes resulting in risks to human health and/or the functioning of the transport network beyond the project area
Severe	Irreversible, significant changes resulting in widespread risks to human health and/or the functioning of the transport network at a regional scale

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