



Australian Government



**Sydney Metro –
Western Sydney Airport**

Appendix I

Environmental risk analysis results

Appendix I - Environmental Risk Analysis Results

Following the environmental risk analysis presented in the Sydney Metro – Western Sydney Airport Scoping Report, potential impacts of the project have been subjected to a further risk analysis as part of this Environmental Impact Statement.

The preliminary risk analysis presented in Section 7.4 of the Scoping Report was used as the starting point for the Environmental Impact Statement risk analysis. The Environmental Impact Statement risk analysis consisted of two main steps:

- updated risk analysis which involved:
 - consideration of the initial findings of the environmental impact assessments, and identification of any new risks arising from design development since the Scoping Report
 - splitting the grouped environmental issues into specific environmental risks
 - identification of the need for project-specific mitigation measures and performance outcomes
- residual risk analysis following the application of project-specific mitigation measures and performance outcomes.

Chapter 26 (Environmental risk analysis) of this Environmental Impact Statement provides the risk matrix and methodology used for this environmental risk analysis, as well as a summary of the outcomes of this environmental risk analysis. Further details regarding the existing environment and potential impacts associated with each environmental issue are provided in Chapters 9 to 24 of this Environmental Impact Statement.

Potential risk	Initial risk rating (unmitigated)			Effect of the project design, performance outcomes and mitigation measures	Residual risk rating			Additional discussion
	Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating	
Traffic and transport – construction								
Temporary impacts to roads, parking, pedestrian and cycling access or worsening of traffic performance network due to construction vehicles, road closures or lane closures	Major	Almost certain	Very high	Implement Construction Traffic Management Framework (CTMF) and transport mitigation measures. Alternative, legible parking arrangements would be provided at St Marys to minimise disruption.	Moderate	Almost certain	High	Construction activities would result in temporary road network modifications, road closures and/or street reconfiguration, removal of parking and relocation of bus facilities as well as some potential impacts to pedestrian and cycling access. Mitigation measures, including the implementation of the CTMF and provision of alternative parking arrangements would reduce risks.
Temporary delays or other temporary impacts on the reliability of public transport services including impacts to the T1 Western Line	Moderate	Almost certain	High	Provide replacement bus services when track possessions occur	Minor	Likely	Medium	Some construction activities within the rail corridor would require track possessions, where train services are temporarily suspended. Track possessions would generally occur over the weekend and at night and a replacement bus service would be provided for rail customers
Temporary altered access to private property and public land	Minor	Possible	Medium	Safe access to properties and businesses would be maintained during construction, as part of the performance outcomes for the project	Minor	Unlikely	Low	Temporary changes in access would occur during construction however achievement of performance outcomes and mitigation measures would reduce risks
Temporary traffic, pedestrian and cyclist safety issues from the introduction of heavy vehicles and diversions	Major	Possible	High	Implement CTMF, Overarching Community Communication Strategy (OCCS) and transport mitigation measures. Road Safety Audits would be carried out to address vehicular access and egress, and pedestrian, cyclist and public transport safety.	Minor	Unlikely	Low	Implementation of CTMF and OCCS would ensure duration and extent of diversions and heavy vehicles are communicated effectively and minimised where possible.
Traffic and transport – operation								
Local traffic network impacts from private vehicle and public transport movements to and from stations (including from park and ride facilities if proposed)	Minor	Possible	Medium	Consultation and coordination would be undertaken with Transport for NSW through the Traffic and Transport Liaison Group to align proposed road and intersection upgrades.	Insignificant	Unlikely	Low	The assessment indicates that the project scenario is not forecast to cause significant impacts to the study area road network compared with the without project scenario, except for a section of Great Western Hwy east of Queen Street.
Permanent severance of local movement corridors	Minor	Unlikely	Low	The project is designed to be compatible with existing infrastructure and future transport corridors.	Insignificant	Unlikely	Low	The project is not expected to result in severance of movement corridors.

Potential risk	Initial risk rating (unmitigated)			Effect of the project design, performance outcomes and mitigation measures	Residual risk rating			Additional discussion
	Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating	
Permanent changes to parking or pedestrian and cyclist routes.	Moderate	Likely	High	Transport interchange facilities would be provided at new metro stations, including new commuter parking and secure bicycle parking at some stations	Moderate	Possible	Medium	The project would impact existing parking arrangements at St Marys. There are no major changes to the walking and cycling network proposed during the future year 2026 without the project scenario and therefore no significant impacts are expected to the walking and cycling network. However, the project would permanently impact parking arrangements at St Marys during operation. The existing multi-storey parking on Harris St is proposed to be extended by two additional levels (subject to a separate approval) to minimise the impacts.
Noise and vibration – construction								
Temporary localised airborne noise impacts to sensitive receivers from construction works during and outside of standard construction hours	Major	Almost certain	Very high	Implement Construction Noise and Vibration Standard (CNVS) and noise and vibration mitigation measures, including acoustic shed to be constructed for 24/7 works to be undertaken at St Marys Station and Orchard Hills Station.	Moderate	Almost certain	High	Sensitive receivers in proximity to project construction activities include low density residential properties, medium density and multi-storey residential properties, industrial and commercial properties, open farmland and some community infrastructure such as parks, schools, places of worship.
Temporary perceived impacts to human health as a result of airborne noise	Moderate	Possible	Medium	Implement CNVS, noise and vibration mitigation measures and undertaking effective consultation regarding potential impacts would help minimise risks	Minor	Possible	Medium	
Temporary ground-borne noise impacts from tunnelling and other excavation activities, including blasting if required	Moderate	Likely	High	Implement CNVS, noise and vibration mitigation measures	Minor	Likely	Medium	Blasting is not proposed as part of the project. Receivers would experience ground-borne noise from tunnelling that exceeds management levels, however for a relatively short duration.
Temporary noise from the movement of construction traffic via the road network	Moderate	Almost certain	High	Implement CNVS and noise and vibration mitigation measures, including reducing the frequency of movements, especially during sensitive periods	Minor	Likely	Medium	The assessment indicates that construction road traffic noise levels are not predicted not to exceed relevant noise criteria at the majority of project affected roads.
Temporary vibration impacts from construction works exceeding human comfort or structural damage criteria.	Moderate	Almost certain	High	Where works occur within minimum safe working distances, reasonable and feasible mitigation would be considered in line with the CNVS	Minor	Possible	Medium	While there are some exceedances of ground-borne vibration criteria from a human comfort perspective, it is noted that ground-borne noise levels will drive the mitigation measures as the ground-borne noise targets are more stringent (ground-borne noise is related to the ground vibration). Therefore, mitigation measures developed for ground-borne noise will assist in managing potential vibration related issues.
Noise and vibration – operation								
Airborne noise impacts from the operation of train services	Moderate	Almost certain	High	Undertake Operational Noise and Vibration Review (ONVR) and confirm mitigation measures required	Minor	Likely	Medium	Road traffic noise exceedances are predicted at St Marys Station (Station Street and Phillip Street, St Marys).
Airborne noise impacts from the operation of stations	Minor	Almost certain	High	Undertake ONVR and confirm mitigation measures required	Minor	Likely	Medium	Noise levels for fixed facilities at the off-airport stations are predicted to comply with relevant noise criteria at the nearest receivers to all stations except St Marys. Minor exceedances of the limiting criterion are predicted at the nearest receivers to St Marys underground ventilation shafts.
Airborne noise impacts from fixed facilities such as the stabling and maintenance facility and substations	Major	Almost certain	Very high	Undertake ONVR and confirm mitigation measures required, and noise impacts at services facilities would be managed through conventional at source noise mitigation, for example acoustic silencers for ventilation paths.	Moderate	Likely	Medium	Noise levels at the nearest sensitive receivers to the St Marys underground ventilation shafts are predicted to be above project noise trigger levels. Noise levels at the nearest residences to the stabling and maintenance facility are also predicted to exceed the project noise trigger levels

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Potential ground-borne noise impacts from the operation of train services through tunnels.	Moderate	Likely	High	Undertake ONVR and confirm mitigation measures required	Minor	Likely	Medium	Ground-borne noise level exceedances are predicted at some sensitive receivers at the start of the St Marys to Orchard Hill tunnel adjacent to St Marys Station
Biodiversity – construction								
Impacts (including clearing) on endangered populations, threatened species and threatened ecological communities including riparian and aquatic habitats during construction	Major	Almost certain	Very high	The project has been designed to avoid biodiversity impacts where possible, by providing bridges and viaducts over key riparian and vegetated areas and ensuring these structures are designed to maintain fauna connectivity. Mitigation measures, including a Flora and Fauna Management Plan off-airport, and a Biodiversity Management Plan on-airport, have been proposed to minimise risks.	Moderate	Almost certain	High	Offsets strategy to be implemented for the project for clearing that hasn't been avoided during design. Clearing that hasn't already been avoided through design would continue to be minimised during further design development and construction planning.
Impacts on groundwater dependent ecosystems	Moderate	Possible	Medium	The performance outcomes for the project include that groundwater drawdown would be managed at Orchard Hills to avoid or minimise impacts on groundwater dependent ecosystems.	Minor	Possible	Medium	Potential groundwater drawdown impacts have been identified for native vegetation in Orchard Hills and Bringelly.
Indirect temporary impacts including light and noise impacts.	Minor	Likely	Medium	Implement noise and vibration, landscape and visual mitigation measures	Minor	Possible	Medium	Temporary edge effects may occur during construction due to noise and light impacts resulting in lack of suitability of habitat for fauna adjacent to construction sites
Biodiversity – operation								
Restriction of fauna movement across the rail corridor	Minor	Unlikely	Low	Fauna connectivity to existing waterways is already limited and viaducts, bridges and culverts have been designed into the project to promote fauna habitat connectivity.	Insignificant	Unlikely	Low	The design of the project and mitigation measures to avoid risks. Impacts to fauna connectivity would continue to be considered and minimised where possible during further design development and construction planning.
Indirect impacts including light and noise impacts.	Minor	Unlikely	Low	Implement noise and vibration and landscape and visual impacts	Insignificant	Unlikely	Low	Implementation of noise and vibration and landscape and visual mitigation measures would mitigate and minimise potential impacts to surrounding fauna
Non-Aboriginal heritage – construction								
Direct impacts to State listed heritage items, including St Marys Station	Major	Almost certain	Very high	Design and mitigation measures would minimise permanent direct impacts. * The Goods Shed associated with St Marys Railway Station Group would be retained and potential vibration and settlement impacts on this structure during construction would be managed. The jib crane would be temporarily relocated during construction and reinstated in consultation with a heritage advisor. A conservation management plan would be prepared for St Marys Railway Station during operation, in accordance with NSW Heritage Council guidelines. * Works in the vicinity of the Warragamba to Prospect Water Supply Pipelines would be managed in accordance with <i>Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines (WaterNSW 2020)</i>	Minor	Likely	Medium	Impacts to the St Marys Railway Station Group state heritage item would primarily be as a result of changes to visual setting and temporary vibration and settlement impacts during construction. Warragamba to Prospect Water Supply Pipelines is State heritage listed.

Potential risk	Initial risk rating (unmitigated)			Effect of the project design, performance outcomes and mitigation measures	Residual risk rating			Additional discussion
	Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating	
Direct impact to local and section 170 register listed heritage items (including archaeological items)	Moderate	Almost certain	High	Design and mitigation measures would minimise permanent direct impacts. Works in the vicinity of the Warragamba to Prospect Water Supply Pipelines would be managed in accordance with <i>Guidelines for Development Adjacent to the Upper Canal and Warragamba Pipelines (WaterNSW 2020)</i>	Minor	Likely	Medium	St Marys Railway Station Group is also section 170 heritage listed, where impacts would be primarily as a result of changes to visual setting and temporary vibration and settlement impacts during construction. Warragamba Supply Scheme (including Warragamba to Prospect Water Supply Pipelines) is section 170 heritage listed (WaterNSW).
Indirect damage to heritage items from construction vibration including from ground-borne noise	Insignificant	Rare	Low	Risks would be managed by implementing noise and vibration mitigation measures, including noise and vibration monitoring on heritage significant items in accordance with the Construction Noise and Vibration Standard for the project.	Insignificant	Rare	Low	There are a number of non-Aboriginal heritage items located within or in close proximity to the construction footprint which have the potential to be impacted by construction vibration
Direct impacts to unknown heritage items (e.g. archaeological items) during construction	Moderate	Likely	High	Risks would be minimised during further design and archaeological investigation would be conducted for archaeological sites which would be impacted by the project. Archaeological remains potentially affected by the project would be managed in accordance with an Archaeological Research Design prepared for the project.	Minor	Possible	Medium	There is moderate potential for the identification of subsurface archaeological remains related to the first railway station at St Marys, which may be of local heritage significance.
Indirect impacts to heritage items such as visual setting	Moderate	Likely	High	Implement non-Aboriginal heritage and landscape and visual mitigation measures	Minor	Likely	Medium	Impacts to the St Marys Railway Station Group state heritage item would primarily be as a result of changes to visual setting and temporary vibration and settlement impacts during construction.
Settlement impacts to heritage items	Minor	Unlikely	Medium	Implementation of groundwater and geology mitigation measures including adherence to settlement criteria	Minor	Unlikely	Low	Potential settlement impacts to the Goods Shed at would be minor while potential settlement impacts to the station platforms and Platform 3/4 building at St Marys Railway Station, as well as all other areas of the construction footprint, would be negligible.
Non-Aboriginal heritage – operation								
Direct impacts to heritage items such as settlement	Minor	Likely	Medium	Implementation of groundwater and geology mitigation measures	Minor	Unlikely	Low	Potential settlement impacts are expected to be negligible during operation.
Indirect impacts to heritage items such as visual setting or settlement.	Minor	Likely	Medium	Implement non-Aboriginal heritage and landscape and visual mitigation measures	Minor	Possible	Low	
Aboriginal heritage – construction								
Direct impacts on known Aboriginal heritage items, as well as areas of archaeological sensitivity along the construction footprint that are likely to contain as yet unidentified Aboriginal heritage items	Moderate	Possible	Medium	Implementation of Aboriginal heritage mitigation measures. Aboriginal Site Impact Recording (ASIR) forms would be submitted to the AHIMS register for all Aboriginal Heritage Information Management System (AHIMS) registered Aboriginal sites that are subjected to impacts as a result of the project. Risks would be minimised by undertaking test excavation in areas of archaeological sensitivity. Following the test excavation program an Aboriginal Cultural Heritage Management Plan would be prepared.	Moderate	Unlikely	Medium	There is a known AHIMS site within the construction footprint at Aerotropolis Core Station, as well as areas of archaeological sensitivity along the construction footprint which are considered likely to contain unidentified Aboriginal heritage items.

Potential risk	Initial risk rating (unmitigated)			Effect of the project design, performance outcomes and mitigation measures	Residual risk rating			Additional discussion
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Direct impacts to archaeologically sensitive landscapes including around creek lines which may contain unidentified Aboriginal heritage items	Major	Possible	High	Risks would be minimised by undertaking test excavation in areas of archaeological sensitivity. Following the test excavation program an Aboriginal Cultural Heritage Management Plan would be prepared. The Aboriginal Cultural Heritage Management Plan would identify management actions including conservation, protection and mitigation, and would authorise harm where appropriate.	Moderate	Unlikely	Medium	
Indirect impacts to Aboriginal heritage items such as visual setting or settlement.	Minor	Unlikely	Low	Following the test excavation program an Aboriginal Cultural Heritage Management Plan would be prepared. The Aboriginal Cultural Heritage Management Plan would identify management actions including conservation, protection and mitigation, and would authorise harm where appropriate.	Minor	Unlikely	Low	Potential indirect impacts associated with the project include risks to cultural heritage by settlement and vibration. Vibration from tunnelling is unlikely to impact artefact bearing deposits as the tunnels are deep enough as to not impact subsurface deposits. The most likely site types to be indirectly impacted are rockshelters, art sites and grinding grooves which can all be affected by cracking and breaking caused by vibration and settlement. None of these site types have been identified in surface contexts above the tunnel sections of the project alignment.
Aboriginal heritage – operation								
Indirect impacts to Aboriginal heritage items such as visual setting or settlement.	Minor	Unlikely	Low	The design of the project incorporates Aboriginal heritage interpretation and Aboriginal cultural design principles in consultation with Aboriginal stakeholders.	Minor	Unlikely	Low	AHIMS sites have been identified in close proximity to the project footprint (and one within the footprint), as well as areas of archaeological sensitivity.
Flooding, hydrology and water quality – construction								
Temporary water quality impacts due to spills, erosion, discharge of contaminated water or groundwater	Major	Possible	High	Risks would be effectively managed through the design of construction water treatment plants, along with standard mitigation measures.	Moderate	Rare	Low	Design and application of standard mitigation measures would minimise this risk
Temporary flooding impacts to construction activities would include: •Inundation and damage to construction sites, machinery, plant and equipment •Safety risks associated with high flow velocities and/or deep water, potentially restricting access to construction areas and constituting a hazard to construction workers and personnel.	Major	Possible	High	Construction sites are generally located outside of flood prone areas which would minimise potential flooding risks during construction. Construction activities would generally be carried out outside of the 1 in 20 year annual recurrence interval flood event, however there is the potential for inundation for larger events.	Moderate	Possible	Medium	Risks to the project during construction are generally limited to the stabling and maintenance facility. This risk will be mitigated by site planning.
Temporary impacts to flooding regime during construction including impacts to adjacent properties	Major	Possible	High	Construction sites have been selected to generally be located outside of flood prone areas which would minimise potential flooding risks during construction.	Minor	Possible	Medium	Risks are generally limited to the stabling and maintenance facility, however the risk is considered to be minor given construction activities would only partially block floodwaters.
Temporary impact on the geomorphology of the waterways and overland flow paths from construction activities as well as the removal of farm dams	Moderate	Likely	High	Risks would be effectively managed through the implementation of standard mitigation measures.	Moderate	Unlikely	Medium	Potential impacts to geomorphology would be short-term.
Flooding, hydrology and water quality – operation								
Potential water quality impacts due to spills or contaminated water discharge	Moderate	Possible	Medium	Risks are generally mitigated in the design of the project through the inclusion of Water Sensitivity Urban Design principles, operational sediment basins and operational water treatment plants.	Moderate	Rare	Low	Design and mitigation measures would minimise this risk.
Impact to the local flooding regime from permanent project infrastructure including impacts to adjacent properties and drainage infrastructure	Moderate	Possible	Medium	Risks are generally mitigated in the design of the project primarily through the inclusion of viaduct sections.	Moderate	Unlikely	Medium	Residual flooding risks for the project are generally limited to the stabling and maintenance facility and a few locations around Blaxland Creek. The detailed design of the project would further consider these risks.

Potential risk	Initial risk rating (unmitigated)			Effect of the project design, performance outcomes and mitigation measures	Residual risk rating			Additional discussion
	Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating	
Impact to flood evacuation routes	Moderate	Possible	Medium	Risks are generally mitigated in the design of the project primarily through the inclusion of viaduct sections.	Minor	Unlikely	Low	Flood hazard has been evaluated at key road locations and was found to be unlikely to affect the use of evacuation routes.
Potential flooding impacts on project infrastructure	Major	Possible	High	The project has been designed to locate operational infrastructure generally outside of the 1 in 100 year annual recurrence interval (ARI) flood event.	Moderate	Rare	Low	Design and mitigation measures would minimise this risk.
Scour and erosion impacts at the discharge points of drainage infrastructure (both for new infrastructure or where the project may increase the velocity of flows at an existing discharge point).	Moderate	Possible	Medium	Risks would be mitigated by the design of the project through the inclusion of appropriate scour protection.	Moderate	Rare	Low	Design and mitigation measures would minimise this risk.
Groundwater and geology – construction								
Temporary impacts to groundwater flows and drawdown during excavation and tunnelling works	Moderate	Possible	Medium	Potential risks would be temporary and would be mitigated once the construction of drained and undrained operational infrastructure is complete. The tunnel construction methodology would limit groundwater inflows given that tunnel lining is installed soon after tunnel excavation.	Minor	Unlikely	Low	Design and mitigation measures would minimise this risk.
Temporary impact to groundwater quality from spills or the disturbance of existing contaminated land	Moderate	Possible	Medium	Potential risks would be temporary and would be mitigated once the construction of drained and undrained operational infrastructure is complete. The tunnel construction methodology would limit potential contaminated groundwater movement given that tunnel lining is installed soon after tunnel excavation.	Minor	Unlikely	Low	Design and mitigation measures would minimise this risk.
Temporary ground movement impacts associated with tunnelling and groundwater drawdown	Minor	Likely	Medium	This risk would be further considered and mitigated during detailed design.	Minor	Unlikely	Low	Ground movement risks are primarily associated with the excavation of the St Marys station box and services facility shafts at Claremont Meadows and Bringelly.
Groundwater and geology - operation								
Groundwater drawdown associated with tunnels and station boxes.	Minor	Possible	Medium	Potential risks would be mitigated in the design of the project through the use of drained structures.	Minor	Unlikely	Low	Design and mitigation measures would minimise this risk.
Contamination and soils – construction								
Temporary disturbance of contaminated land and associated potential impacts to human and ecological receptors	Moderate	Possible	Medium	Additional site investigations would be carried out in high risk areas to provide greater detail on the extent of potential contamination and identify measures required to manage potential impacts.	Minor	Unlikely	Low	There are potential medium and high risk areas of potential contamination throughout the project footprint.
Contamination of land due to leaks and spills	Minor	Unlikely	Low	Risks would be managed through the implementation of standard mitigation measures related to the maintenance and operation of machinery and storage of chemicals.	Minor	Unlikely	Low	Design and mitigation measures (including adherence to <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005) and <i>Applying State Environmental Planning Policy No. 33 - Hazardous and Offensive Development</i> (Applying SEPP 33) (Department of Planning, 2011)) would minimise this risk.
Encountering acid sulfate soils and saline soils during excavation.	Minor	Possible	Medium	In areas identified as having potential for acid sulfate soils or saline soils, testing would be carried out and mitigation would be implemented accordingly	Minor	Unlikely	Low	Potential impacts from the disturbance of acid sulfate soils or saline soils are expected to be localised and not significant with the implementation of mitigation measures.
Contamination and soils – operation								
Contamination, spills etc from maintenance	Minor	Unlikely	Low	Risk would managed through the implementation of standard mitigation measures related to the maintenance and operation of equipment and storage of chemicals.	Minor	Rare	Low	Risks would be generally limited to activities at the stations and stabling and maintenance facility.

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Sustainability, climate change and greenhouse gas - construction								
Emissions of greenhouse gases from construction energy use, including embodied energy in construction materials	Minor	Likely	Medium	25 per cent of the greenhouse gas emissions would be offset from emissions associated with consumption of electricity during construction.	Insignificant	Possible	Low	Generation of greenhouse gases during construction would primarily be associated with the embodied emissions of construction materials, diesel fuel combusted onsite, removal of vegetation as well as electricity generated offsite to power construction.
Potential impacts of climate change on the project including increased intensity, duration and frequency of rainfall events.	Moderate	Possible	Medium	Potential climate change impacts (e.g. extreme/more frequent rainfall, extreme heat) would be considered in emergency management procedures for the construction of the project. Sensitive construction equipment would be protected from the effects of extreme weather and climate.	Minor	Unlikely	Low	Design and mitigation measures would minimise this risk.
Sustainability, climate change and greenhouse gas - operation								
Emissions of greenhouse gases from operational energy use.	Minor	Unlikely	Low	100 per cent of the project's greenhouse gas emissions associated with the consumption of electricity during operation would be offset.	Minor	Unlikely	Low	Generation of greenhouse gas during operation would primarily be associated with electricity generated offsite to power the operation of trains and station facilities. The project would encourage mode-shift towards public transport and would avoid the generation of greenhouse gas that would otherwise be associated with private vehicle movement
Potential impacts of climate change on the project including increased intensity, duration and frequency of rainfall events	Moderate	Possible	Medium	Climate change risk adaptation and mitigation measures would be incorporated during design development.	Minor	Unlikely	Low	Climate risks identified to present the most material risks to operational performance of the project includes increase in rainfall intensity leading to flooding, increase in extreme weather events (e.g. extreme heat, rain, lightning), urban heat effects.
Potential impacts associated with contributing to the urban heat island effect	Moderate	Possible	Medium	Mitigation measures would be implemented to: • ensure selection of materials considers reflectance and transmissivity values to reduce contribution to extreme heat and thermal load • ensure that the urban design considers extreme heat and thermal load in and around stations and stabling facilities	Minor	Unlikely	Low	Design and mitigation measures would minimise this risk.
Resource management - construction								
Management of waste during construction including the management of tunnel spoil	Minor	Unlikely	Low	A waste management plan would be prepared and implemented for the project in accordance with the Construction Environmental Management Framework (CEMF) for the project, and in accordance with the waste hierarchy.	Minor	Rare	Low	Risks are primarily associated with waste being directed to landfill due to inadequate handling/classification and not reusing suitable spoil, and lack of identification of feasible options for recycling/reuse of resources.
Resource management - operation								
Management of waste during operation	Minor	Unlikely	Low	Generation of operation phase waste would be minimised and reused where possible in line with the waste hierarchy and the sustainability objectives for the project.	Minor	Rare	Low	Generation of waste during operation would primarily be associated with waste generated at stations, wastewater and maintenance materials.

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Land use and property – construction								
Acquisition or temporary leasing of properties	Moderate	Almost certain	High	Sydney Metro manages property acquisition in accordance with the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> , and has appointed Personal Managers to support residents throughout the acquisition process, reducing the consequence and likelihood of impacts. However this would not change the extent of proposed acquisition.	Moderate	Almost certain	High	Property acquisition and temporary leases for the project would be required to accommodate construction and operation of the project and risk cannot be reduced through mitigation. The refinement of the design has also resulted in reduced property impacts with the extension of the tunnel alignment south of Western Sydney International as described in Chapter 6.
Temporary land severance within private land associated with the introduction of the project corridor	Moderate	Almost certain	High	The severance of private property is generally limited to where the project is at-grade north of Elizabeth Drive. The refinement of the design has also resulted in reduced property impacts with the extension of the tunnel alignment south of Western Sydney International as described in Chapter 6.	Minor	Likely	Medium	No property severance impacts are anticipated where the project would be in tunnel between St Marys and Orchard Hills and Western Sydney International and Bringelly. The severance of private property is generally limited to where the project is at-grade north of Elizabeth Drive.
Temporary impacts on other infrastructure, and risks of failing to co-ordinate and integrate with Western Sydney International and road projects.	Severe	Possible	High	Potential impacts to key infrastructure would be mitigated by the design of the project, utility investigations and through consultation with asset owners (including Western Sydney Airport). Design development has minimised risks to the Warragamba to Prospect Water Supply Pipelines and removing the need for additional protection works during construction of the project by increasing the height of the viaduct in this location. Planned power and utility interruptions would be scheduled to outside of typical business hours where feasible and reasonable, reducing the likelihood of impacts.	Moderate	Possible	Medium	Key infrastructure with the potential to be impacted by the project includes: <ul style="list-style-type: none"> • T1 Western Line • Warragamba to Prospect Water Supply Pipelines • Road infrastructure including Great Western Highway, M4 Western Motorway, Luddenham Road, Elizabeth Drive, Badgerys Creek, future M12 Motorway • Utilities throughout the study area • Western Sydney International. Further design development and construction planning would be undertaken with asset owners, minimising the risk of impacts to infrastructure and utilities, and the risk of failing to coordinate or integrate with other projects.
Land use and property – operation								
Incompatibility and lack of integration of the project with future land use	Major	Likely	High	The project has been designed to consider and be compatible with future land use planning. Consultation has been carried out and will continue during design development with relevant stakeholders responsible for ongoing land use planning to ensure the plans are aligned with the project.	Minor	Unlikely	Low	The project would also have a positive outcome for planned land uses by supporting planned urban growth in the Western Parkland City.
Land severance and sterilisation associated with the project corridor.	Moderate	Likely	High	Potential risks have generally been avoided through the acquisition of affected land or alternative access arrangements. The design of the project has also minimised severance impact through the inclusion of tunnel and viaduct sections.	Minor	Likely	Medium	Potential risks relate to at-grade sections of the project primarily between Cosgroves Creek and Elizabeth Drive. Potential risks have generally been avoided through the design of the project through the inclusion of tunnel and viaduct sections.

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Landscape and visual impact – construction								
Temporary adverse visual impacts from the presence of construction activities and construction sites	Moderate	Almost certain	High	A Visual Amenity Management Plan for temporary works would be developed in accordance with the CEMF. This plan would include measures to minimise impacts such as retaining street trees and finishing all structures (including potential acoustic sheds, site offices and workshop sheds) in a colour which aims to minimise their visual impact.	Moderate	Possible	Medium	Construction visual impacts would generally be reversible and temporary.
Temporary impact to landscape character associated with construction activities and construction sites	Major	Likely	High	A Visual Amenity Management Plan for temporary works would be developed in accordance with the CEMF. This plan would include measures to minimise impacts such as retaining street trees and finishing all structures (including potential acoustic sheds, site offices and workshop sheds) in a colour which aims to minimise their visual impact.	Moderate	Possible	Medium	Landscape character impacts from the removal of trees during construction would result in medium term but reversible impacts.
Temporary light-spill on sensitive receivers during night construction works.	Moderate	Likely	High	A Visual Amenity Management Plan for temporary works would be developed in accordance with the CEMF and include measures to provide shielding and directional lighting.	Minor	Unlikely	Low	Construction light spill would be temporary and generally well contained.
Landscape and visual impact – operation								
Visual impacts associated with the introduction of new station buildings, a stabling and maintenance facility, other permanent infrastructure and operational rail movements	Moderate	Almost certain	High	The project would be designed to integrate with its environment by developing the detailed design in accordance with the Sydney Metro - Western Sydney Airport Design Guidelines and Design Quality Framework to achieve the Sydney Metro design objectives and in consultation with relevant stakeholders	Moderate	Unlikely	Medium	Risks are primarily associated with above-ground sections of the project south of Orchard Hills. It is considered that only a minor number of receivers would experience a moderate impact. Potential impacts would reduce over time as the character of the existing environment changes in accordance with strategic land use planning.
Changes to landscape character.	Moderate	Almost certain	High	The project would be designed to integrate with its environment by developing the detailed design in accordance with the Sydney Metro – Western Sydney Airport Design Guidelines and Design Quality Framework to achieve the Sydney Metro design objectives and in consultation with relevant stakeholders	Moderate	Unlikely	Medium	Risks are primarily associated with above-ground sections of the project south of Orchard Hills. It is considered that only a minor number of receivers would experience a moderate impact. Potential impacts would reduce over time as the character of the existing environment changes in accordance with strategic land use planning.
Light spill associated with rail movements and new stations	Moderate	Almost certain	High	The project would be designed to minimise light spill by providing shielding and directional lighting	Minor	Unlikely	Low	Risks would be mitigated by the lighting design for the project.
Social and economic – construction								
Temporary amenity impacts on residential receivers and social infrastructure.	Major	Likely	High	Implement Construction Environmental Management Framework (CEMF), noise and vibration, landscape and visual mitigation measures	Minor	Likely	Medium	
Potential impacts on community values and lifestyle.	Moderate	Likely	High	Implement CEMF, OCCS, noise and vibration, transport, landscape and visual mitigation measures	Minor	Likely	Medium	

Potential risk	Initial risk rating (unmitigated)			Effect of the project design, performance outcomes and mitigation measures	Residual risk rating			Additional discussion
	Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating	
Potential impacts to agricultural assets such as dams	Moderate	Likely	High	Implement OCCS	Minor	Likely	Medium	Direct impacts to some dams, including on potential local heritage properties are currently proposed. Impacts could be minimised through further design development.
Temporary access restrictions or changes resulting from construction sites and activities	Moderate	Likely	High	Implement CEMF, CTMF, transport mitigation measures	Minor	Likely	Medium	Safe access to properties and businesses would be maintained during construction, as part of the performance outcomes for the project
Potential temporary cumulative impacts associated with concurrent project construction and construction of approved development considered as part of current strategic planning for the area	Minor	Likely	Medium	Implement CEMF, OCCS, noise and vibration, transport, landscape and visual mitigation measures	Minor	Possible	Medium	Sydney Metro would continue to coordinate with WSA and other projects to help minimise impacts during construction and operation
Social and economic impacts associated with property acquisition (including of businesses)	Major	Almost certain	Very high	Implement property acquisition process and OCCS	Moderate	Almost certain	High	Risks would be minimised by carrying out effective communication and property acquisition process in line with relevant guidelines
Temporary disruption to servicing, deliveries and access during construction from potential traffic network impacts	Moderate	Likely	High	Implement CEMF, OCCS, CTMF and transport mitigation measures	Minor	Likely	Medium	Risks would be minimised by implementing mitigation measures and effective consultation with businesses
Potential temporary impacts on business due to reduced visibility of businesses, changes to pedestrian and vehicle movements or reduction in amenity associated with construction sites	Moderate	Likely	High	Implement CEMF, CTMF and transport mitigation measures	Minor	Likely	Medium	Risks would be minimised by implementing mitigation measures and effective consultation with businesses. There would also be positive local and regional economic and employment outcomes (including increased local trade for businesses) supporting around 14,000 jobs during construction
Social and economic - operation								
Potential ongoing amenity impacts to residential receivers and social infrastructure	Moderate	Likely	High	Implement noise and vibration, transport, landscape and visual mitigation measures	Minor	Possible	Medium	Noise associated with the stabling and maintenance facility is predicted to result in exceedances against noise criteria, which represent noise levels substantially above the existing environment. Impacts elsewhere are expected to be low risk post implementation of mitigation measures
Potential ongoing impacts on community values, lifestyle and access to/use of infrastructure and services	Minor	Likely	Medium	Implement noise and vibration, transport, landscape and visual mitigation measures	Minor	Possible	Medium	Permanent impacts to lifestyle and community values are possible with the project and the future development which may be associated with station catchment areas. However, the Project would also result in positive outcomes for the community and local businesses, including improved employment connectivity, development uplift around station precincts and increased trade catchments.
Social impacts associated with the severance of the local road network as a result of the project corridor	Minor	Unlikely	Low	Design has been designed to be elevated over major road corridors e.g. Luddenham Road and Elizabeth Drive	Minor	Unlikely	Low	Design of the project would minimise the risk of severance of the local road network
Air quality – construction								
Temporary, localised impacts to local air quality due to dust generation from construction activities including during bulk earthworks.	Minor	Likely	Medium	Potential risks would be minimised through the implementation of standard mitigation measures.	Minor	Unlikely	Low	Potential dust generation risks during construction are well understood and would be minimised through the implementation of standard mitigation measures.
Temporary air quality impacts from emissions other than dust that would be generated during construction including emissions from the combustion of diesel fuel by heavy vehicles, mobile construction equipment and stationary equipment such as diesel generators.	Minor	Likely	Medium	Potential risks would be minimised through the implementation of standard mitigation measures.	Minor	Unlikely	Low	Potential emissions other than dust would be minor for the construction of the project.

Potential risk	Initial risk rating (unmitigated)			Effect of the project design, performance outcomes and mitigation measures	Residual risk rating			Additional discussion
	Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating	
Air quality – operation								
Operation of metro trains would generate minor quantities of particulate matter (PM10), carbon monoxide, volatile organic compounds and oxides of nitrogen	Insignificant	Possible	Low	Potential impacts during operation are considered to be negligible and would be managed by the implementation of standard mitigation measures and design of ventilation systems.	Insignificant	Unlikely	Low	The project would encourage a mode-shift to public transport in the area and would avoid emissions that would otherwise be associated with private vehicles making the same journey.
Commuter traffic to new metro stations which would result in a increase in associated vehicle emissions	Minor	Unlikely	Low	No air quality mitigation measures proposed specifically for this risk	Minor	Unlikely	Low	The project would encourage a mode-shift to public transport in the area and would avoid emissions that would otherwise be associated with private vehicles making the same journey.
Hazard and risk – construction								
Transport and storage of hazardous substances and dangerous goods.	Moderate	Rare	Low	Potential risks would be managed in accordance with NSW guidelines including the <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005) and Applying SEPP 33 (Department of Planning, 2011).	Moderate	Rare	Low	Hazardous materials and dangerous goods are required to be transported and stored on-site during construction.
Bushfire risks to the construction of the project, or the potential for the project to provide sources of ignition including sparks from the use of construction equipment.	Moderate	Rare	Low	Further construction planning and a bushfire management plan would minimise bushfire risks during construction. A bushfire management plan would be prepared and implemented to manage current bushfire risk and identify response actions during construction of the project. The Plan would be prepared in consultation with the NSW Rural Fire Service and Western Sydney Airport. For project areas within Western Sydney International the plan would be prepared having regard to the existing Western Sydney Airport Site at Badgerys Creek Bushfire Risk Management Plan (Western Sydney Airport Corporation, 2019).	Minor	Unlikely	Low	Bushfire prone land is located within and in the vicinity of the project footprint.
Hazard and risk – operation								
Transport and storage of hazardous substances and dangerous goods.	Moderate	Rare	Low	Potential risks would be managed in accordance with NSW guidelines including the <i>Storage and Handling of Dangerous Goods Code of Practice</i> (WorkCover NSW, 2005) and Applying SEPP 33 (Department of Planning, 2011).	Moderate	Rare	Low	Design and mitigation measures would minimise this risk.
Aviation risks, including obstruction of protected airspace by physical structures or other impacts including from lighting, smoke and emission, and crossing of the public safety areas associated with Western Sydney International.	Moderate	Rare	Low	The project alignment within Western Sydney International is considered to be optimal and no physical risk mitigation (such as barriers) is considered necessary as part of the design.	Minor	Rare	Low	The project would not obstruct protected airspace and would therefore not require separate approvals.
Bushfire risks during operation of the project.	Moderate	Rare	Low	A bushfire management plan would be prepared and implemented to manage bushfire risk and identify response actions during operation of the project.	Minor	Rare	Low	The design and bushfire management plan would minimise bushfire risk during operation. The bushfire management plan for the on-airport component would be prepared to ensure it is consistent with, and contributes to, the existing bushfire plan for the airport site.
Cumulative impacts - construction								
Cumulative impacts from the construction of multiple projects (including the construction of Western Sydney International and future M12 Motorway), including construction fatigue from other projects.	Major	Almost certain	Very high	Cumulative impacts are minimised through coordination of construction activities and communication processes with nearby projects.	Moderate	Almost certain	High	Further construction planning would be undertaken in consultation with other projects.

Potential risk	Initial risk rating (unmitigated)			Effect of the project design, performance outcomes and mitigation measures	Residual risk rating			Additional discussion
	Consequence	Likelihood	Risk rating		Consequence	Likelihood	Risk rating	
Cumulative impacts - operation								
Cumulative impacts from the operation of multiple projects (including Western Sydney International and future M12 Motorway) e.g. traffic congestion, noise, visual amenity, land use, biodiversity, social and business impacts.	Moderate	Almost certain	High	Cumulative impacts are minimised through further design development being undertaken in consultation with asset owners and proponents for other projects.	Moderate	Possible	Medium	Further design development would be undertaken in consultation with other projects.