

29 Environmental risk analysis

A detailed environmental risk analysis was conducted as part of this environmental impact statement (EIS). This chapter outlines the environmental risk analysis process and identifies the key environmental issues.

Table 29-1 sets out the Secretary's Environmental Assessment Requirements (SEARs) as they relate to risk analysis and where the SEARs are addressed in the EIS.

Table 29-1 SEARs – environmental risk analysis

SEAR	Where addressed
The EIS must include an environmental risk analysis to identify potential environmental impacts associated with the proposal (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of this additional key environmental impact must be included in the EIS.	Chapter 29 Environmental risk analysis. Section 29.4 Risk analysis summary.

29.1 Environmental risk analysis process

An environmental risk analysis was carried out to identify the potential environmental issues associated with the project. Issues were categorised as 'key' or 'other', with key issues being those where the project may have moderate or major impacts (actual or perceived).

Key issues require detailed assessment to determine the severity of potential impacts and to identify suitable mitigation and management measures.

The environmental risk analysis process carried out for the project included:

- A preliminary environmental assessment, carried out as part of the State significant infrastructure application report (AECOM, 2015a), to allow early identification of the key environmental issues and to inform the State significant infrastructure application
- An assessment of the key issues identified in the SEARs for the project (**Appendix A**)
- An environmental risk review undertaken to confirm the key environmental issues based on the results of the detailed investigations presented in this EIS.

As required by the SEARs, the process of environmental risk analysis continued during the course of preparing the EIS. Emphasis was placed on using the detailed information gathered for the project to review the environmental aspects of the project. More specifically, the analysis:

- Identified environmental issues, including key issues in the SEARs, and any other issues
- Examined potential impacts and proposed mitigation measures in relation to the identified issues
- Identified the nature and extent of impacts likely to remain after mitigation measures are applied.

Based on this analysis, an environmental risk category was assigned to each potential impact. This enabled the identification of any matters that might be considered as additional key issues, and provided a basis for an appropriately detailed assessment of these additional key issues in this environmental assessment. The environmental risk categories are described in **Table 29-2**.

Table 29-2 Environmental risk categories

Risk category	Description
Key issue	High or moderate impact (actual and perceived) requiring further investigation to identify specific management and mitigation measures
Other	Moderate or low impact that can be managed effectively with standard and best practice management and mitigation measures

29.2 Preliminary environmental assessment

A preliminary environmental assessment was undertaken to inform the State significant infrastructure application for the project. The outcomes of this preliminary assessment identified the following key environmental issues for the project:

- Traffic and transport
- Air quality
- Human health
- Noise and vibration
- Biodiversity
- Visual impacts and urban design
- Land use and property
- Social and economic
- Geology and groundwater
- Soils, surface water and flooding
- Non-Aboriginal heritage
- Resource management and waste minimisation.

The outcomes of the preliminary environmental assessment were documented in the State significant infrastructure application report (AECOM, 2015a), which was submitted to the Secretary of the Department of Planning and Environment under section 115X of the *Environmental Planning and Assessment Act 1979* (NSW) to assist with the formulation of SEARs for the project.

29.3 Assessment of the key issues identified in the SEARs

The key issues identified in the SEARs were largely consistent with the key issues identified in the State significant infrastructure application report. The SEARs added a few key issues to be assessed. The SEARs identified the following as the key issues to be addressed in the EIS for the project:

- Traffic and transport
- Air quality
- Human health
- Noise and vibration
- Biodiversity
- Urban design and visual amenity
- Land use, social and economic
- Soil, water and hydrology
- Contaminated sites
- Non-Aboriginal heritage
- Aboriginal heritage.

These identified issues have been assessed in detail and the results have been presented in **Chapter 9** to **Chapter 23** of this EIS.

29.4 Risk analysis summary

A summary of the environmental risk analysis is provided in **Table 29-3**. Two additional environmental issues that were not specified as key issues in the SEARs were identified through the environmental risk analysis:

- Greenhouse gas
- Hazard and risk

These issues have been addressed in this EIS.

Table 29-3 Environmental risk analysis

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Traffic and transport	Yes				
Construction risks					
Public safety		Potential for reduced safety to pedestrians, cyclists and road users.	Implement measures to address safety risks as part of the traffic management and safety plan.	Safety measures will address safety risks for construction workers and motorists. With mitigation, residual safety impacts are considered to be low.	Section 9.3
Changes to local traffic movements due to increased construction traffic		Temporary disruptions and delays to traffic due changes to access, reduction in speed zones, alterations to traffic conditions at construction compound locations, the St Peters interchange, tie-ins and local roads.	Implement measures to address construction related delays as part of the traffic management and safety plan.	Moderate residual impacts are likely to remain with periodic delays associated with temporary road closures, lane occupancy and heavy vehicle movements.	Section 9.3
Impacts to bus routes		Temporary disruptions to bus/public infrastructure due to deterioration in network performance (construction traffic) or potential direct impacts on bus infrastructure (eg bus stops along Canal Road and Euston Road, St Peters).	Changes in bus stops would be undertaken in consultation with Transport for NSW and bus operators, with the community to be informed of any potential changes in advance.	Moderate residual impact due to increase in bus service travel times as a result of slower travel speeds and increased intersection delays.	Section 9.3
Changes to pedestrian and cycle routes		Temporary disruptions to pedestrian and cycle routes in the vicinity of construction works, requiring re-routing/diversions.	Pedestrian and cyclist access to be maintained where possible throughout construction. Where not feasible, alternative routes are to be provided and communicated to the community	Low residual impacts are likely to remain with minor delays expected for pedestrians and cyclists and potentially longer journeys.	Section 9.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Operational risks					
Impacts to existing road network and surrounding areas		Impacts at the St Peters interchange and western surface works resulting in additional traffic and changes in current movements.	A review of existing Sydney Co-ordinated Adaptive Traffic System (SCATS) infrastructure at key intersections in the study area, including detectors, would be undertaken and upgrades would be implemented where appropriate to mitigate any impacts resulting from the project.	Active mitigation would result in low residual impacts.	Section 9.3
		Impacts to the traffic performance on local and regional roads.			
		Impacts of the project on performance at key intersections relevant to the project.			
		Impacts of additional east-west traffic movements (which would be introduced by the project) along local roads.			
		Impacts from land use change (eg Mascot Station Precinct, Green Square Town Centre and Ashmore Precinct).			
		Generation of additional traffic on the local road network as a result of the project.			
		Impacts from staging of delivery of the wider WestConnex program of works.			

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Air Quality	Yes				
Construction risks					
Fugitive dust emissions from construction activities including emissions from construction plant and equipment.		Potential health impacts for workforce and nearby sensitive receivers.	A dust management plan would be produced and implemented to cover all construction phases of the project. This plan would contain details of site-specific mitigation measures to be applied, including ensuring that all construction vehicles comply with their relevant emission standards.	Even with a rigorous dust management plan being implemented, it is not possible to guarantee that the dust mitigation measures would be effective all of the time. However, any effects would be temporary and relatively short-lived, and would only arise during dry weather with the wind blowing towards a receptor. With mitigation the effects would be low and not significant.	Sections 10.6 and 10.7
Operational risks					
In-tunnel air quality exceeds limits.		Potential health impacts for tunnel users and nearby sensitive receivers.	In-tunnel air quality would be managed through appropriate tunnel design, ventilation design and control, air treatment systems; and emission controls (including continuous in tunnel monitoring).	Model simulations of traffic scenarios have demonstrated that in-tunnel pollution concentrations could be maintained at levels below the required limits, under all conditions with mitigation measures implemented. Residual impacts are therefore considered to be low and not significant.	Section 10.8

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Ambient air quality exceeds limits.		Potential health impacts at nearby sensitive receivers.	Ventilation outlets have been designed and sized to ensure compliance with criteria. Air quality monitoring would be undertaken to demonstrate that emissions from the ventilation outlets will have no significant impact on local air quality.	Emissions from the project ventilation outlets, even in the regulatory worst case scenarios, would be unlikely to result in adverse impacts on local air quality. The effects of the project on surface road emissions would be similar to the projected reductions in emissions with time without the project. Residual impacts are therefore considered to be low and not significant.	Section 10.8
Human health	Yes				
Construction risks					
Property acquisition		Potential short term impacts on the health of individuals induced by stress resulting from property acquisition.	Provision of access for affected households to a counselling service, WestConnex Assist. This would support affected households in negotiating the land acquisition process and relocation.	Even with the application of mitigation, short term adverse residual impacts are expected to remain.	Section 11.3
Noise and vibration	Yes				
Construction risks					
Construction activities		Noise and vibration from road construction activities within the corridor and from the operation of construction site compounds.	A construction noise and vibration management plan would be prepared and implemented in accordance with the <i>Interim Construction Noise Guideline</i> (DECC, 2009).	Mitigation would reduce impacts, but intrusive construction noise and vibration is still likely to occur at some locations. Residual impacts are considered to be moderate with the application of a construction noise and vibration management plan.	Section 12.4

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Operational risks					
Increase in road traffic noise		There would be an increase in noise impacts around the proposed interchanges as a result of the roads moving closer to properties, increased traffic numbers and the removal of structures which previously provided screening.	Noise barriers and low noise pavement would be considered during detailed design to maximise the number of receivers which receive a reduction in exceedances of noise criteria. At-property acoustic treatments would be considered for sensitive receivers where low noise road surfaces and noise barriers do not reduce noise impacts. Active noise monitoring would also be undertaken to determine whether additional mitigation is required.	The implementation of mitigation measures is expected to reduce the number of impacted receivers. Residual impacts are therefore considered to be moderate.	Section 12.4
Ancillary facilities		Noise from operational ancillary facilities.	Operational ancillary facilities would be designed to meet project specific noise criteria derived in accordance with the <i>NSW Industrial Noise Policy</i> .	Adherence to operational noise criteria would result in low residual noise impacts to nearby sensitive receivers.	Section 12.4

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Biodiversity	Yes				
Construction risks					
Native flora and fauna		Potential to impact threatened flora and fauna species protected by the <i>Threatened Species Conservation Act 1995</i> (NSW), <i>Fisheries Management Act 1994</i> (NSW) or <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth).	A flora and fauna management plan would be developed for the construction phase. Biodiversity offset options would be explored to mitigate the impacts of habitat loss from construction works.	Engaging a suitably qualified ecologist to assist managing any unexpected flora or fauna would mean that the potential for residual impacts is low. If fauna handling is undertaken according to this guideline, the potential for residual impacts would be low.	Section 21.3
Green and Golden Bell Frog		Potential impacts to Green and Golden Bell Frog Key population and habitat located within the proposed project footprint. Potential to impact an important Green and Golden Bell Frog population located in the vicinity of the lower Cooks River estuary immediately west of Sydney's Kingsford Smith Airport. The population consists of one main population within the Kogarah Golf Course as well as the wetlands and recreation corridor at Arncliffe.	The Green and Golden Bell Frog Management Plan would be implemented to minimise and manage impacts to the Arncliffe key population. The Green and Golden Bell Frog Management Plan would be approved by the Commonwealth Department of the Environment and OEH. Biodiversity offset options would be explored to mitigate the impacts of habitat loss from construction works.	With the Green and Golden Bell Frog Plan of Management Plan in place, the potential for residual impacts to this species would be low.	Section 21.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Groundwater dependent ecosystem		Groundwater drawdown impacting groundwater dependent ecosystems.	A groundwater monitoring program would be prepared and implemented to monitor groundwater impacts during construction. The program would be developed in consultation with the EPA, DPI (Fisheries), NoW and relevant councils.	With mitigation, residual impacts are expected to be low.	Section 21.3
Land use and property	Yes				
Construction risks					
Property acquisition		Impacts on residents, businesses and public as a result of the total, partial or temporary acquisition and relocation of properties.	Early and on-going consultation with impacted individuals and businesses. Acquisition would be undertaken in accordance with the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> and the Land Acquisition Information Guide (Roads and Maritime, 2014b).	Even with the application of mitigation, adverse residual impacts are expected to be high.	Section 13.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Property access		Changes and disruption of access to properties located adjacent to the project.	Where property access is to be impacted (either long or short term), consultation with the landowners or occupiers would be undertaken to determine their requirements and to discuss alternative access to be provided.	Residual impacts would occur for property owners / public space and road users whose properties / transport routes are temporarily affected in this manner. However, when combined with the mitigation measures outlined in Chapter 9 (Traffic and transport), residual impacts resulting from restricted access to private properties are considered to be low.	Section 13.3
Settlement		Potential impacts to buildings and other structures such as cracks, leaning, etc.	A settlement monitoring plan would be prepared, including building condition surveys as well as a settlement monitoring program.	Given the range of contingencies that would be provided for in the settlement monitoring plan, the potential for residual risks not covered by the plan is considered to be low.	Section 13.3
Operational risks					
Altered property use and access		The operation of the project may impact on the access to and from some properties (eg realigned driveways or partially acquired garden / reserve areas).	Property accesses that are affected as a result of the project would be reinstated in consultation with the affected landowners including relocation if required.	Residual impacts may occur for property owners whose properties are permanently altered in this manner. However, these impacts are expected to be low.	Section 13.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Visual impacts and urban design	Yes				
Construction risks					
Site compounds / construction works		Visual changes due to motorway, tunnel and bridge construction. Visual impacts associated with construction site compounds.	Site compounds and work areas would be screened, organised and managed to minimise visual impacts. Vegetation clearance would be minimised where possible. Built structures would be designed to minimise impacts and to integrate into the surrounding area. Landscaping of the project footprint in line with the urban design to minimise impacts.	Some receivers would experience moderate to high visual impacts during the construction of the project. However, construction impacts are temporary and therefore the overall residual impacts are considered to be low.	Section 14.3
Temporary lighting		Impacts to sensitive receivers from temporary lighting within/surrounding construction areas and compounds.	Use of cut-off and direction lighting to ensure glare and light spill is minimised. Lighting would only be used when sites are in use.	Residual impacts would vary depending on the location of the sensitive receiver. Some receivers would experience moderate to high night lighting impacts during the construction of the project. However, overall residual impacts on sensitive receivers is considered to be low to moderate.	Section 14.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Shared pathway diversion		Visual impacts to users of parks, cycleways and pedestrian pathways due to the temporary diversion of shared pathways.	Separation distances would be maximised as far as is reasonable and feasible between the Kingsgrove North construction compound to the adjoining residential areas to improve sight lines and safety for path users. A signage strategy would be developed during detailed design for temporary wayfinding.	Shared path users at the M5 Linear Park would experience moderate to high visual impacts during the construction of the project.	Section 14.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Operational risks					
Structures (tunnels, interchanges, retaining walls, surface infrastructure etc).		Impacts to views and vistas from the introduction of built project elements including tunnel portals, bridges, noise barriers, retaining walls and ancillary surface infrastructure.	The visual impact of noise barriers would be reduced through high quality urban design treatments in accordance with the <i>Noise Wall Design Guideline</i> (RTA, 2006). Street tree plantings and landscaping would be used to visually soften operational motorway complexes.	Residual impacts would vary depending on the location of the sensitive receiver. Some receivers would experience moderate to high visual impacts during the operation of the project.	Section 14.3
Operational lighting		Impacts to receivers from the introduction of operational lighting, including residences and Sydney Airport.	Lighting design to minimise light spill on to adjacent properties.	Some receivers would experience moderate to high night lighting impacts during the operation of the project. However, operational lighting impacts would occur in areas generally already subject to lighting impacts due to existing roads and buildings. With careful design the residual impacts are considered to be low.	Section 14.3
Visual impacts to localities		Impacts of views and vistas to and from the project in visual catchments.	Where relevant, a landscaping strategy would consider the use of larger screening shrubs and increasing the width of the band of plantings in this location.	Residual impacts would vary depending on the location of the sensitive receiver. Some receivers would experience moderate to high visual impacts during the operation of the project. However, overall residual impacts on sensitive receivers would be low to moderate.	Section 14.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Social and economic	Yes				
Construction risks					
Acquisition of businesses		Disruption to local businesses.	Acquisitions would be under the terms of the <i>Land Acquisition (Just Terms Compensation) Act 1991</i> (NSW). A business management plan would also be developed to effectively communicate with businesses during the construction of the project.	Residual impacts to businesses after the application of mitigation are considered to be low.	Section 15.3
Operational risks					
Access		Reduced community cohesion and connectedness due to new infrastructure which alters access around the community.	Opportunities for providing increased pedestrian and cyclist connectivity would be explored.	Residual impacts following mitigation are considered to be low.	Section 15.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Soils and water quality	Yes				
Construction risks					
Modifying waterways		The geomorphology of receiving waterways may be altered by temporary water treatment plant discharges.	Construction work activities within and / or adjacent to waterways would be minimised using appropriate drainage and discharge outlet infrastructure.	Standard construction management measures would minimise any residual impacts to waterway geomorphology. Residual impacts are therefore considered to be negligible.	Section 16.3
Water quality		Construction spills, exposed contamination or erosion and sedimentation may enter waterways and alter the surface water quality of the receiving environment. Temporary water treatment plant discharges would also enter into waterways.	A soil and water management plan would be developed in accordance with 'The Blue Book' and in consultation with the EPA and NSW Office of Water. A water quality monitoring program would be undertaken for the duration of the construction, commencing six months prior to construction. Temporary water treatment plant discharges would be in accordance with the water quality reference criteria developed for the project.	With mitigation, residual impacts are expected to be low.	Section 16.3
Soil exposure		Removal of vegetation and soil exposure during construction may cause erosion, sedimentation, and mass movement within and around watercourses.	An erosion and sedimentation management plan would be prepared as outlined in Erosion and Sedimentation Risk Assessment Procedure (RTA, 2004).	With the implementation of standard Roads and Maritime policies to manage soil and erosion, the potential for residual impacts is considered negligible.	Section 16.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Leachate		Runoff within the Alexandria Landfill site may be contaminated leachate.	Runoff from the Alexandria Landfill would be directed to a leachate treatment plant and discharged to sewer under a trade waste agreement with Sydney Water. Finalising and implementing the draft landfill closure management plan for the Alexandria Landfill would ensure that the project complies with the <i>Contaminated Land Management Act 1997</i> and the <i>Protection of the Environment (Operations) Act 1997</i> .	With mitigation, residual impacts are expected to be low.	Section 16.3
Acid sulfate soils		Disturbing acid sulfate soils during construction works could cause: • Weakening of concrete and steel infrastructure • Damage to aquatic environments • Mobilisation of aluminium, iron and manganese from soils.	Acid sulfate soils would be stored temporarily in a bunded area, treated and disposed of off-site at a licensed facility. Management of acid sulfate soils would be in accordance with the <i>Guideline for the Management of Acid Sulfate Materials</i> (RTA, 2005c).	Following the <i>Guideline for the Management of Acid Sulfate Materials</i> (RTA, 2005) would mean that any residual impacts related to encountering acid sulfate soils would be low.	Section 16.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Operational risks					
Surface runoff		Operational spills and maintenance erosion and sedimentation may enter waterways and alter the surface water quality of the receiving environment.	The operational water treatment plant would be designed with the aim of meeting the project's water quality reference criteria, the pollution reduction targets from the <i>Botany Bay and Catchment Water Quality Improvement Plan</i> (SMCMA, 2011), and the project's Environment Protection Licence. Measures to prevent runoff, stormwater or spillage being directed onto other roadways outside of the project footprint would be implemented.	With mitigation, residual impacts are expected to be low.	Section 16.3
Modifying waterways		New and existing drainage outlets have the potential to cause scouring and sediment suspension.	Operational water treatment plant discharge volume and velocity would be regulated and managed to ensure impacts to the receiving environment are as anticipated.	Residual impacts to waterway geomorphology are expected to be negligible.	Section 16.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Contamination	Yes				
Construction risks					
Landfill closure		Inappropriate disturbance of the Alexandria Landfill site (ie otherwise than in accordance with the <i>Contaminated Land Management Act 1997</i>) has the potential to expose contaminated soil and groundwater, as well as allow leachate and landfill gas to migrate offsite.	A site specific management plan would be prepared for the Alexandria Landfill to manage the exhumation of parts of the landfill during construction. The closure and ongoing management of the Alexandria Landfill would be undertaken in line with the draft landfill closure management plan, the <i>Contaminated Land Management Act 1997</i> and the <i>Protection of the Environment (Operations) Act 1997</i>.	With mitigation, residual impacts are expected to be low.	Section 17.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Unearthing, disturbing or spreading contaminated soil		Disturbance and disposal of contaminated land potentially resulting in environmental pollution.	Procedures to manage unexpected contamination finds and hazardous materials identified during site preparation and/or construction works would be prepared. Potentially contaminated areas directly affected by the project would be investigated and managed in accordance with the requirements of the <i>Contaminated Land Management Act 1997</i> (NSW) and <i>Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites</i> (Office of Environment and Heritage, 2011).	Adherence to the nominated mitigation measures would result in limited exposure of contaminated land. Residual impacts are therefore expected to low.	Section 17.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Hazardous materials		Management of demolition waste including asbestos containing material.	Demolition works would be undertaken in accordance with Australian and NSW WorkCover Standards. Stockpiling and management of potentially contaminated material would be undertaken at building demolition sites to prevent movement of material into receiving waters. Asbestos management (handling, stockpiling, transport and disposal) would be undertaken in accordance with an asbestos management plan and relevant State legislation, government policies and Australian Standards.	Residual impacts are expected to be low and not significant as a result of the controls that would be established during demolition.	Section 17.3
Operational risks					
Ongoing management of the previous Alexandria Landfill site		Inappropriate disturbance of the Alexandria Landfill site (ie otherwise than in accordance with the <i>Contaminated Land Management Act 1997</i>) has the potential to expose contaminated soil and groundwater, as well as allow leachate and landfill gas to migrate offsite.	The closure and ongoing management of the Alexandria Landfill will be undertaken in line with the draft landfill closure management plan. Finalising and implementing the draft landfill closure management plan for the Alexandria Landfill would ensure that the project complies with the <i>Contaminated Land Management Act 1997</i> and the <i>Protection of the Environment (Operations) Act 1997</i> .	With mitigation, residual impacts are expected to be low.	Section 17.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
General contamination		Contamination caused by spills, leaks and tunnel washing etc. during operations.	Procedures to address spills, leaks and tunnel washing would be developed and implemented during operation of the project.	Standard operational management measures would be adequate to ensure any residual contamination impacts are negligible.	Section 17.3
Flooding and drainage	Yes				
Construction risks					
Flooding impacts to construction works		Flooding impacts to construction compounds and tunnel drive shafts.	A flood and stormwater management plan would be prepared to manage flooding and stormwater related issues.	The potential for the project to result in residual impacts is considered to be low.	Section 18.3
Flooding impacts on new drainage infrastructure		Exacerbated flooding impacts during the changeover to new drainage infrastructure during construction works.	Where transverse drainage structures are to be upgraded or replaced, any existing transverse drainage structures would be left in place for operation during construction. If this is not feasible, temporary drainage would be adopted.	With this proposed construction sequencing in place, the potential for residual impacts is considered to be low.	Section 18.3
Operational risks					
Flooding		Flooding during operation of the project resulting in damage to infrastructure or impacts to environment.	The project design includes measures to prevent and mitigate flooding during operation that would achieve the hydrologic standard requirements for key components of the project.	With the proposed management measures in place, residual impacts would be low.	Section 18.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Groundwater	Yes				
Construction risks					
Groundwater flow and quality		Altered groundwater flow and quality potentially impacting registered boreholes users and sensitive environmental receptors.	A groundwater monitoring program would be prepared and implemented to monitor groundwater impacts during construction. The program would be developed in consultation with the EPA, DPI (Fisheries), DPI Water and relevant councils.	With mitigation, residual impacts are expected to be low.	Section 19.3
Leachate		Failure of the leachate pumping system for the Alexandria Landfill causing groundwater levels to rise above the construction levels.	Contingency measures to address leachate management at the Alexandria Landfill during construction and prior to the commissioning of the new leachate treatment plant would be explored during detailed design. Identified measures would be detailed in the Construction Environmental Management Plan and implemented during construction.	Implementation of the mitigation measures would make the potential for residual risks from leachate at the Alexandria Landfill negligible.	Section 19.3
Release of groundwater		Unsustainable release of groundwater resources.	Treated waste water would be stored and re-used for project purposes wherever possible. Groundwater reuse would be in accordance with the policies of sustainable water use of the Office of Water, such as dust suppression and earthworks.	With mitigation, residual impacts are expected to be low	Section 19.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Excessive inflows		Excessive inflows during construction may exceed the design inflow criterion.	Sections of the tunnel would be grouted and reinforced with rock bolts where saturated faults and fractures are intersected. In some cases, where higher than expected inflows are experienced, longer rock bolts or an increased density may be required in combination with an increased shotcrete thickness.	With the proposed management measures in place, the potential for residual impacts as a result of excessive inflows would be low.	Section 19.3
Aggressive groundwater chemistry		Aggressive groundwater chemistry such as elevated sodium, chloride, ammonia, low pH conditions that are aggressive to concrete and steel.	Building materials that are resistant to aggressive groundwater conditions would be selected.	The selection of suitable building materials would be sufficient to prevent risks occurring as a result of aggressive groundwater chemistry. Residual impacts are therefore considered to be low.	Section 19.3
Registered bores		Licensed bore drawdown and impacts to groundwater users.	Management of licensed bores identified as being at risk of drawdown would include monitoring and, where appropriate, modifications, compensation, redrilling or provision of an alternative water supply.	As the proposed management measures contain contingency procedures, the potential for unforeseen residual risks is considered to be low.	Section 19.3
Operational risks					
Tunnel groundwater inflows		Groundwater inflow into tunnels exceeding project requirements.	A tunnelling procedure detailing when and what type of waterproofing is required to be installed during construction would be implemented during construction.	With mitigation, residual impacts are expected to be low.	Section 19.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Sandstone slaking		Build-up of precipitated iron (slimes) and silt and sand due to slaking of the sandstone.	The drainage system would be regularly maintained in accordance with the Operational Environmental Management Plan.	With mitigation, residual impacts are expected to be low.	Section 19.3
Groundwater quality		Impact on surface and groundwater quality, resources and wetlands as a result of operation.	A groundwater quality monitoring program would be prepared and implemented to monitor groundwater impacts during tunnel operations.	With mitigation, residual impacts are expected to be low.	Section 19.3
Non-Aboriginal heritage	Yes				
Construction risks					
Unexpected finds		Impacts to items of non-Aboriginal heritage which are discovered during demolition or earthworks.	Protocols would be developed for anticipated categories of unexpected non-Aboriginal heritage finds. In the event of an unexpected cultural heritage find outside of these specific protocols, in line with the Roads and Maritime <i>Standard Management Procedure – Unexpected Archaeological Finds</i> .	The purpose of these management measures is to mitigate residual impacts, and as such, the risk of further unforeseen residual impacts occurring is low.	Section 20.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Direct impacts to heritage structures		Removal of heritage listed structures.	Prior to demolition consideration would be given as to whether elements of the buildings could be salvaged and used to maintain or restore other properties of similar type within the area. Consideration would also be given as to whether the portion of the Bond Store not within the direct footprint of the St Peters, could be preserved <i>in situ</i> as mitigation. In the event that neither of these options is feasible, other management measures to record the historical and archaeological significance of the building would be considered. Prior to the commencement of construction works, full archival recordings would be undertaken following the NSW Heritage Division guidelines <i>How to Prepare an Archival Recording</i> (NSW Heritage Office, 2003) and <i>Photographic recording of heritage items using film or digital capture</i> (NSW Heritage Office, 2006).	Residual impacts would be high, and could not be effectively mitigated.	Section 20.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Construction of stormwater discharge points		Impacts to the heritage values of the Alexandra Canal due to construction of stormwater discharge points.	The detailed design of discharge locations would incorporate appropriate mitigation and management measures to minimise potential impacts.	Where the application of management measures would mitigate impacts to heritage values, residual impacts would occur as mitigation measures would not be able to replicate any impacted heritage values to the same state they were in prior to construction works.	Section 20.3
Heritage listed vegetation		Construction works may require the removal of heritage listed vegetation.	The removal of heritage listed vegetation would be avoided. Where it is not practical to do so, vegetation removal would be minimised and feasible and reasonable options for vegetation relocation would be investigated where appropriate.	Where removal of heritage listed vegetation is necessitated, high residual impacts would occur despite the application of mitigation measures, as mitigation measures would not be able to replicate the heritage values of the heritage listed vegetation which is removed.	Section 20.3
Impact to geological and palaeontological values		Earthworks and the placement of new infrastructure have the potential to impact on existing geological and palaeontological values.	An archival recording of the St Peters brickpit geological site would be undertaken prior to the commencement of works. A palaeontologist would be engaged to assess the potential for further specimens of scientific interest at the site, and to provide further management measures if required.	Where the impacts to areas of existing geological and palaeontological values are anticipated, residual impacts would occur despite the undertaking of archival recordings, as such measures would not completely replicate the geological or palaeontological values of sites prior to their disturbance.	Section 20.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Heritage conservation areas		Impacts to the heritage values of heritage conservation areas.	Landscaping of ancillary infrastructure sites would be undertaken with consideration of the heritage values of the heritage conservation areas within the project area.	The proposed management measures are considered sufficient to mitigate the impacts to heritage values of heritage conservation areas to an acceptable level. Residual impacts are considered to be negligible.	Section 20.3
Operational risks					
Changes in operational views		Impacts to heritage values due to changes in operational views.	The heritage values of items (including views and vistas from the items) would be considered during the detailed design of built elements of the project and the development of a landscaping plan.	With mitigation, residual adverse impacts are expected to be low and beneficial impacts could be achieved through appropriate development and landscaping.	Section 20.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Aboriginal heritage	Yes				
Construction risks					
Disturbance or potential destruction of Aboriginal objects and places		Potential impacts to or destruction of Aboriginal objects and places. Seven previously recorded AHIMS sites are within the project corridor, focused along riparian corridors of Wolli Creek, Alexandra Canal and the Cooks River.	Vibration generating activities, including blasting, are to be conducted in a manner that would not result in vibration levels greater than three millimetres per second at potential Aboriginal heritage site SR-OVH-1. A baseline condition assessment would be completed by a qualified structural engineer for Aboriginal site SR-OVR-1 prior to construction commencing. At the completion of construction a condition assessment would be completed with recommendations for remediation measures if required.	Unforeseen impacts associated with unexpected discoveries are likely to be manageable to an acceptable level of impact in consultation with the Registered Aboriginal Parties and the OEH. Residual impacts are therefore expected to be low.	Section 23.3
		Potential for disturbance or destruction of previously unidentified objects and/or places.	If an Aboriginal object(s) or human remains are discovered during construction, this would be managed in line with the <i>Roads and Maritime Standard Management Procedure – Unexpected Archaeological Finds</i> .		Section 23.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Greenhouse gas	No				
Construction risks					
Emissions		Increase in greenhouse gas emissions from construction fuel use and energy embodied in construction materials.	Reuse and recycling would be maximised throughout the construction period. Energy efficiency measures would be implemented and materials would be sourced locally where possible to reduce transport emissions. The project aims to source six per cent of energy from renewable energy sources.	Despite considering measures to reduce construction greenhouse gas generation, the construction of the project would nevertheless generate greenhouse gas emissions.	Section 22.3
Operational risks					
Emissions		Increased emission of greenhouse gases from the operation of road infrastructure.	Low carbon energy generation options would be investigated as part of the design process in order to reduce the demand on mains electricity and generate renewable energy onsite, where feasible. The project aims to source six per cent of power from renewable sources.	Despite considering measures to reduce operational greenhouse gas generation, the operation of the project would nevertheless generate greenhouse gas emissions.	Section 22.3

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Construction resource use and waste minimisation	No				
Construction risks					
Generating spoil		Generation of large quantities of excess spoil due to tunnelling that cannot be reused in the project or adjacent projects.	A Spoil Management Strategy would be developed prior to the commencement of construction and implemented during construction. The strategy would identify spoil disposal sites and describe the management of spoil on-site and during off-site transport. Where possible and fit for purpose, spoil would be beneficially reused within the project before off-site reuse or disposal options are pursued.	Residual waste would be disposed of to a suitably licensed landfill or waste management facility where there are no other feasible and reasonable options for waste avoidance, reuse or recycling. Waste materials requiring removal from the site would be classified, handled and stored in accordance with the <i>Waste Classification Guidelines: Part 1 Classifying Waste</i> (EPA, 2014a) until collection by a contractor for disposal.	Section 24.1
Use of general building materials including concrete, steel, asphalt, fill and other miscellaneous materials.		Use of resources and the generation of waste.	A waste management plan would be prepared for the construction phase of the project, detailing appropriate procedures for waste management and pre-construction surveys (ie asbestos). Residual waste would be classified, handled, stored on site and disposed of, in accordance with the <i>Waste Classification Guidelines: Part 1 Classifying Waste</i> (EPA, 2014a), State legislation and government policies.	It may not be possible to source all construction resources and reuse / recycle all of the identified materials as part of the project. While construction resource requirements for the project are typical for a tunnelling project of this scale, they may have an impact on resource availability within the local area over the construction period. The impact would be limited to the construction period.	Section 24.1

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Water extraction/supply		The use of water during construction activities would be required.	Feasible and reasonable opportunities for wastewater reuse on-site or for construction purposes would be pursued (such as dust suppression both in the tunnels and for surface works). Wastewater not used on-site would be discharged into the local stormwater system in accordance with the requirements of an environment protection licence issued for the project.	The project is not anticipated to have any unforeseen impacts relating to the use of water resources during construction. Residual impacts are therefore considered to be low.	Section 24.1

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Power supply		Around 130,000 Megawatt hours of electricity and up to around 30,500 kilolitres of fuel (diesel and petrol) would be used to construct the project.	At least six per cent of construction energy would be sourced where possible from an accredited GreenPower energy supplier. Around two per cent of construction phase power requirements would be offset according to the Commonwealth Government's National Carbon Offset Standard. This and other offset options would be reviewed during detailed design. Further construction energy consumption initiatives such as sourcing local materials, selection of energy efficient plant, use of recycled materials, and efficient site practices would also reduce a portion of the construction energy requirements.	Despite considering offset measures to reduce the impacts of construction power usage, the project would nevertheless require the use of electricity and fuels.	Section 24.1

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Operational risks					
Operational water requirements		Around four mega litres of water per annum would be required for the operation of the project. The primary source of water during operation would be potable water.	Rainwater harvesting would be explored as an alternative resource during detailed design. In order to reduce demand on local water supplies, options would be investigated for providing water required for operation of the deluge system from wastewater produced through the tunnel drainage system where it meets appropriate quality parameters.	With mitigation, residual impacts are expected to be low.	Section 24.1
Operational power requirements		During operation, the project would consume around 30,000 megawatt hours of electricity per year.	The vertical alignment of the main alignment tunnels would be designed to allow consistent vehicle speeds to be maintained, thereby minimising fuel use. Low carbon energy generation options would be investigated as part of the design process in order to reduce the demand on mains electricity where feasible.	Despite considering operational management measures to reduce operational power requirements, the operation of the project would nevertheless require the consistent use of electricity.	Section 24.1
Operational waste generation		Wastes generated by the operation of the project would be limited. Routine maintenance, repair activities, and operation of the motorway control centre would contribute to the majority of operational waste for the project.	No additional measures would be required to accommodate operational waste as it would be managed by standard work practices and existing metropolitan waste management facilities.	Waste generation and management during operation of the project would be minimal.	Section 24.1

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Hazard and risk	No				
Construction risk					
Storage of dangerous goods and hazardous substances		Inappropriate storage of dangerous goods and hazardous substances could result in a workplace safety or environmental incident, with potential offsite implications.	Storage of dangerous goods and hazardous materials, including adequate bunding, would occur in accordance with applicable legislation, Australian standards and guidelines Material Safety Data Sheets would be obtained for dangerous goods and hazardous substances stored onsite prior to their arrival.	With the appropriate mitigation measures in place, the risk of residual impacts occurring through dangerous and hazardous goods storage is considered to be low.	Section 26.1
Transportation of dangerous goods		Releases of hazardous substances from vehicles transporting dangerous goods and hazardous substances to and from the construction sites in the event of an accident.	Transport of dangerous goods and hazardous substances would be conducted in accordance with relevant legislation and codes, including the <i>Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998</i> and the Australian Code for the Transport of Dangerous Goods by Road and Rail (National Transport Commission, 2008).	With the appropriate transport strategies in place, the risk of residual impacts occurring through dangerous and hazardous goods storage is considered to be low.	Section 26.1
Aviation hazards		Cranes and lighting during construction.	The project would be constructed in line with CASA requirements, to the satisfaction of the Secretary of the Commonwealth Department of Infrastructure and Regional Development.	If the project is constructed in accordance with the relevant CASA requirements, residual impacts are expected to be negligible.	Section 26.1

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Operational risk					
Fire and life safety		Potential risks to the safety of users, and structural integrity of the project in the event of an accident or spill that results in fire or other hazardous releases.	The fire and safety systems and measures adopted for the project would be equivalent to or exceed the fire safety measures recommended by NFPA502 (American), PIARC (European), AS4825 (Australian) and Roads and Maritime standards.	With the appropriate fire systems and measures in place, the risk of residual impacts occurring as a result of fire safety is considered to be low.	Section 26.1
Accident, spill, fire or other incident within the tunnel		Crashes and incidents within the mainline tunnels, on- and off-ramps, and surface roads.	The project would be designed to provide efficient, free flowing traffic with physical capacity to accommodate predicted traffic volumes. An incident response plan would also be developed and implemented in the event of an accident or incident. The design of the project includes a motorway control centre and emergency response. Emergency access is provided via cross passages and longitudinal passages to allow egress from the tunnels during an emergency.	With the appropriate incident response strategies in place, the risk of residual impacts occurring through inadequate response to incidents is considered to be low.	Section 26.1

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Storage of dangerous goods and hazardous substances		Inappropriate storage of dangerous goods and hazardous substances could result in a workplace safety or environmental incident, with potential offsite implications.	Storage of dangerous goods and hazardous materials, including adequate bunding, would occur in accordance with applicable legislation, Australian standards and guidelines Material Safety Data Sheets would be obtained for dangerous goods and hazardous substances stored onsite prior to their arrival.	With the appropriate mitigation measures in place, the risk of residual impacts occurring through dangerous and hazardous goods storage is considered to be low.	Section 26.1
Electric and magnetic fields		Receiver exposure to electric and magnetic fields from operational project substations.	The detailed design of the project substations would ensure that the exposure limits for the general public suggested by the <i>Draft Radiation Standard</i> (Australian Radiation Protection and Nuclear Safety Agency, 2006) would not be exceeded at the boundary of the substation sites.	With the appropriate mitigation measures in place, the risk of residual impacts occurring through exposure to electric and magnetic fields is considered to be low.	Section 26.1
Aviation hazards		Impacts of the velocity of emissions on Sydney Airport flight paths.	The project would be operated in line with CASA requirements, to the satisfaction of the Secretary of the Commonwealth Department of Infrastructure and Regional Development.	If the project is constructed in accordance with the relevant CASA requirements, residual impacts are expected to be negligible.	Section 26.1

Issue	SEAR Key Issue?	Potential impacts	Proposed mitigation measures	Potential residual impacts	Where discussed
Cumulative impacts	No				
Construction risk					
Cumulative construction impacts associated with the total WestConnex program of works		Construction related impacts, depending on interfaces of construction activities with King Georges Road interchange and M4-M5 Link, (noise, traffic, groundwater, air, visual, noise heritage, ecology, socio-economic and human health including construction fatigue).	Project Managers of other WestConnex projects would be consulted during the preparation of the construction traffic management plan and other environmental management documentation.	Cumulative impacts during construction would potentially occur, however the level of impacts to environmental values is considered to be low. Beneficial impacts to traffic including freight, and businesses would occur along the alignment of WestConnex.	Section 27.4
Cumulative impacts associated with other projects in the project corridor		Construction related impacts associated with construction of the project concurrently/consecutively with other proposed projects in the vicinity of the New M5.	Proponents of other projects would be consulted during the preparation of the construction traffic management plan and other environmental management documentation.	With mitigation, residual cumulative impacts resulting from other known projects are expected to be low. Beneficial impacts to traffic including freight, and businesses would occur along the alignment of WestConnex.	Section 27.5