

8. Environmental risk analysis

This section details how environmental issues for the project were identified through an environmental risk analysis process, and documents the findings of that process.

Director-General's Requirements	Where addressed
<i>An assessment of the key issues, with the following aspects addressed for each key issue (where relevant):</i> <ul style="list-style-type: none">Any residual impacts	<i>Chapter 8, Chapter 9, Technical Papers</i>
<i>Environmental risk analysis – notwithstanding the above key assessment requirements, the environmental assessment must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of the 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 environmental assessment.</i>	<i>Chapter 8</i>

8.1 Overview

An analysis has been undertaken which:

- Identified environmental issues, including key issues in the DGRs and other issues.
- Examined potential impacts and proposed mitigation measures in relation to the identified issues.
- Examined impacts likely to remain after application of mitigation measures.

Based on this analysis, an environmental risk category was assigned to each impact. This enabled the identification of matters that may be considered as additional key issues and established the basis for an appropriately detailed assessment of those additional key issues to be included in this environmental assessment.

8.2 Risk analysis

The environmental risk categories assigned to each impact are described in Table 14. The environmental risk analysis is summarised in Table 15. Impacts that have been assigned a risk category of 'A' are considered to indicate key issues.

Table 14 Environmental risk categories

Risk category	Description
A	May have high or moderate impacts. A detailed assessment is necessary to determine the level of potential impact and to develop appropriate measures to mitigate and manage the impacts.
B	May have high or moderate impacts. These impacts can be mitigated by the application of standard environmental management measures.
C	Has low level of impacts. These impacts are managed by standard environmental management measures.

8.3 Findings

The environmental risk analysis did not identify any key issues additional to those included in the DGRs.

Table 15 Environmental risk analysis – summary table

Issue	DGRs – key issue?	Potential impacts	Analysis – proposed mitigation measures and impacts remaining after their application	Risk category	Environmental assessment reference
Operational traffic and transport	Yes	<ul style="list-style-type: none"> Changed traffic patterns and flow, generating: Improved travel times. Reduced congestion. Potential increase in traffic volume. Localised changes in traffic flows at access points. Improved cycle access between CBD and Sydney's north west. Pedestrian access around intersections – potential impacts of increased traffic flows and additional crossings. Changes to bus lanes have the potential to affect travel efficiency and impact other commuters. Re-routing of buses to Macquarie Centre: Potential to impact local road network. Impact on businesses and institutions surrounding exiting bus route, including Epping interchange. 	<ul style="list-style-type: none"> Widening of local roads and intersection capacity improvements to reduce impact of increased traffic flows at new access points. There would be further investigation during detailed design into sequencing and performance of intersections at new access points and where local roads are to be widened. Community and stakeholder engagement plan: Inform community of changes to road network. Transport industry, government and stakeholder consultation with regards to permanent changes and access. Pedestrian access would be addressed in detailed design. Residual impacts are generally positive, including improved traffic flow, road safety conditions and cycle access. 	A	Section 9.1 and Technical Paper 1.
Construction traffic and transport	Yes	<ul style="list-style-type: none"> Impacts to traffic flow on the M2 Motorway through: Reductions in speed limits and incidents. Impacts on public transport (bus) services during construction. Temporary disruption to operational systems in tunnel may affect traffic flows. Emergency vehicle access disruption. Impacts to traffic flow on local roads during construction from: Avoidance of the M2 Motorway. Construction traffic accessing work 	<ul style="list-style-type: none"> Development of TMPs to control the overall staging of management and provide details of sub plans including: Vehicle Management Plans. Pedestrian Control Plans. Traffic Control Plans (including speed management). Management strategy for vehicles. Management of Operational systems in tunnel. Cyclist and pedestrian alternative route plans. Manage safety through: Inductions and toolbox briefings. Community and stakeholder engagement plan. 	A	Section 9.2 and Technical Paper 1.

Issue	DGRs – key issue?	Potential impacts	Analysis – proposed mitigation measures and impacts remaining after their application	Risk category	Environmental assessment reference
		<p>compounds. Potential safety impacts, including disorientation, affected traffic flows, increased signage, speed limit enforcement, narrow lanes.</p> <ul style="list-style-type: none"> Short term disruption to pedestrian paths and cycle route – M2 Motorway bypass required during construction, potential for incident on alternative route and impacts on local traffic. 	<ul style="list-style-type: none"> Driver education for bus drivers. No residual impacts anticipated after completion of upgrade. 		
Operational noise and vibration	Yes	<p>Potential exceedances of noise goals due to changed road traffic conditions on the M2 Motorway, including:</p> <ul style="list-style-type: none"> Increased speed. Increased number of carriageways, which brings noise closer to houses. Expanded traffic growth. New access ramps – cars and trucks braking to enter/exit Motorway. <p>Noise impacts from expansion joints and potential impact if pavement cracks.</p> <p>Mechanical noise emissions from the tunnel ventilation fan system.</p>	<p>Mitigation measures to minimise noise impact for sections where noise goals are exceeded, include:</p> <ul style="list-style-type: none"> Construction of new noise barriers. Modification of existing noise barriers. Property treatments. Improved signage to discourage compression braking. <p>Re-sheeting and improved maintenance, including:</p> <ul style="list-style-type: none"> Replacement of expansion joints. Improved strategy for pavement cracking. <p>Net benefit to community due to improved noise conditions than currently experienced. No negative residual impacts would remain.</p>	A	Section 9.3 and Technical Paper 2.
Construction noise and vibration	Yes	<p>Noise impacts from increased traffic and plant noise:</p> <ul style="list-style-type: none"> Loss of amenity. Health impacts. Temporary removal of existing noise walls. <p>Vibration impacts from construction activities:</p> <ul style="list-style-type: none"> Loss of amenity. Health impacts. Perceived structural damage. <p>Impact to existing noise walls during widening process.</p>	<p>A Construction Noise and Vibration Management Plan (CNVMP) would provide mitigation measures to minimise noise and vibration impacts, including:</p> <ul style="list-style-type: none"> Temporary noise walls. Appropriate scheduling of noise-intensive activities and respite periods. Location of noise-intensive activities away from sensitive receivers. Noise and vibration monitoring (impact validation). <p>Pre-construction activities that would be implemented to avoid or minimise impact from noise and vibration on the surrounding community, include:</p> <ul style="list-style-type: none"> Dilapidation surveys. 	A	Section 9.4 and Technical Paper 2.

Issue	DGRs – key issue?	Potential impacts	Analysis – proposed mitigation measures and impacts remaining after their application	Risk category	Environmental assessment reference
			<ul style="list-style-type: none"> Community consultation. Property treatments, where appropriate and feasible at this stage. <p>Relocation of existing noise walls during construction.</p> <p>Residual impacts unlikely due to noise and vibration modelling and mitigation.</p>		
Ecology	Yes	<ul style="list-style-type: none"> Clearing of approximately 21 hectares of native and exotic vegetation [including 18 hectares of permanent clearing and 3 hectares of temporary clearing]. Temporary loss of vegetation during construction would be rehabilitated. This vegetation supports communities <i>Epacris purpurascens</i> var. <i>purpurascens</i> which is listed as Vulnerable under the TSC Act. Potential impact to habitat of threatened species, populations or ecological communities, including Blue Gum High Forest. <p>Impact on fauna may include:</p> <ul style="list-style-type: none"> Light and noise impacts during construction. Permanent habitat loss from bush rock removal. Risk of introduction and spread of weeds and pest species and pathogens. Alteration to natural flow regimes of rivers and streams and impact to water quality which would affect aquatic flora and fauna and riparian vegetation. 	<p>Formulating management measures, which may include:</p> <ul style="list-style-type: none"> Vegetation clearing during construction would be minimised by retaining mature trees within compounds. Briefings to site personnel. <p>An Environmental Management Plan (EMP) would be developed to manage:</p> <ul style="list-style-type: none"> Vegetation removal. Vegetation rehabilitation, including local provenance seed collection. Revegetation in areas bordering natural bushland. Introduced species. Identification and marking of potentially hollow bearing trees. <p>Additional Surveys for threatened frog species (such as Green and Golden Bell Frog and Red Crowned Toadlet surveys) would be carried out in areas likely to support such species prior to clearing.</p> <p>Residual impact may arise as a result of permanent loss of vegetation and fauna habitat.</p> <p>To avoid impact to riparian vegetation and aquatic flora and fauna, works around waterways would be managed to protect bank stability, prevent sedimentation and minimise impacts to waterways.</p>	A	Section 9.5 and Technical Paper 3.
Urban design and landscaping	Yes	<p>Visual impacts due to:</p> <ul style="list-style-type: none"> Increased height and extent of noise walls and retaining walls. Increased proximity of noise walls to some 	<ul style="list-style-type: none"> Design treatment of noise and retaining walls with texture and colour to reduce bulk and scale. Screen planting to soften presence of noise and mitigation walls. Vegetation palette to respond to local 	A	Section 9.6 and Technical Paper 4.

Issue	DGRs – key issue?	Potential impacts	Analysis – proposed mitigation measures and impacts remaining after their application	Risk category	Environmental assessment reference
		<p>properties.</p> <ul style="list-style-type: none"> ▪ Loss of screening vegetation. ▪ Road moving closer to properties (Windsor Road and Talavera Road). <p>Positive visual impact due to removal of the bus bridge at Beecroft Road.</p> <p>A new high quality character and identity would be provided for the M2 Motorway.</p>	<p>plant communities.</p> <ul style="list-style-type: none"> ▪ The urban design strategy would integrate new and existing design features and the surrounding environment to provide consistency and a unique character. <p>The project would provide an overall benefit to landscape of M2 Motorway. No negative residual impacts would remain.</p>		
Aboriginal cultural heritage	Yes	<p>Potential to have direct and indirect impacts on sites of Aboriginal archaeological heritage significance, including objects, sites and landscapes during construction.</p>	<ul style="list-style-type: none"> ▪ Induction for all on site personnel outlining responsibilities under <i>National Parks and Wildlife Act 1974</i>. ▪ Protective devices would be installed to protect sites within 50 metres of the construction area. ▪ Consultation with identified stakeholders and Local Aboriginal Land Councils (LALC). ▪ Should items of Aboriginal origin or Aboriginal skeletal remains be identified during construction, work in that part of the study area would cease and DECCW and the relevant LALC would be contacted immediately. ▪ No residual impacts would remain. 	A	Section 9.7 and Technical Paper 5.
Construction surface water management and soils	Yes	<ul style="list-style-type: none"> ▪ Potential impacts to water quality and hydrology due to: ▪ Contamination from building and washing waste, chemical spills and disturbance of contaminated soils. ▪ Exposed soils create potential for increased erosion and sedimentation. ▪ Construction activity may obstruct flow and increase flood levels. 	<ul style="list-style-type: none"> ▪ Standard mitigation measures employed for to erosion control, bank stabilisation, bunding and contamination prevention. ▪ A Soil and Water Management Plan (SWMP) would be developed as part of the Construction Environmental Management Plan (CEMP). Mitigation measures would be in accordance with: ▪ RTA's Water Policy and Code of Practice for Water Management (1999). ▪ Managing Urban Stormwater – Soils and Construction (Landcom, 2004). ▪ No residual impacts would remain. 	A	Section 9.8 and Technical Paper 6.

Issue	DGRs – key issue?	Potential impacts	Analysis – proposed mitigation measures and impacts remaining after their application	Risk category	Environmental assessment reference
Non-Aboriginal heritage	No	<ul style="list-style-type: none"> 16 items of non-Aboriginal heritage significance within the vicinity of the M2 Motorway, 9 of which would be potentially impacted by the proposed works as a result of vibration. Works would take place in the immediate vicinity of two items of non-Aboriginal heritage significance, located at: <ul style="list-style-type: none"> Farmhouse at 266 Windsor Road. Sandstone causeway on Devlins Creek under the Beecroft Road bus ramp. 	<ul style="list-style-type: none"> Archival and dilapidation surveys would be undertaken. Should any non-Aboriginal heritage items be identified during construction works would cease and the appropriate authorities would be contacted. Impacts would be avoided and minimised through measures formulated and adopted during the detailed design and construction staging phases. Residual impacts are unlikely. 	A	Section 9.9 and Technical Paper 7.
Operational surface water management	No	<ul style="list-style-type: none"> Increased scouring potential from increased water flow. Impacts to water quality due to increases in pollutants washed off larger road surface. Potential stormwater impacts on waterways. 	<ul style="list-style-type: none"> Modifications to energy dissipaters and scour protection at the end of extended culverts. Existing water quality basins would be modified to account for changes in contributing catchment area. Stormwater treatment and outlet works and erosion and sedimentation measures along creeks. Residual impacts are unlikely. 	B	Section 10.1.
Groundwater management	No	<ul style="list-style-type: none"> Impacts on groundwater levels and quality are unlikely to be greater than impacts already sustained from the existing M2 Motorway. 	<ul style="list-style-type: none"> Existing surface water mitigation measures, combined with the method of installation of piles / footings, are considered adequate and would be sufficient for limiting the impacts of the upgrade works on the groundwater system. Residual impacts are unlikely. 	C	Section 10.2.
Contamination	No	<ul style="list-style-type: none"> Potential for contamination in areas of cut and fill along the corridor, detention and sedimentation basins, and point sources of contamination. 	<ul style="list-style-type: none"> Standard procedures would be implemented to address potential contamination, including development of an 'Unexpected Finds Protocol' and risk identification and management procedures. Collection and testing/classification of sediments in sediment basins would be undertaken and appropriate management strategies would be implemented prior to works in sediment basins. Residual impacts are unlikely. 	C	Section 10.3.

Issue	DGRs – key issue?	Potential impacts	Analysis – proposed mitigation measures and impacts remaining after their application	Risk category	Environmental assessment reference
Socio-economic	No	<ul style="list-style-type: none"> Impacts on the community through property acquisition, land use, access and accessibility. Impacts on amenity through noise and vibration, air quality, increased lighting and landscape and urban design. Improvement in traffic flows along M2 Motorway. Impacts on cyclist and pedestrian movement. Impacts on businesses and employment. Wider economic impacts such as improvements in economic welfare. 	<ul style="list-style-type: none"> Minimise disturbance where possible by managing and minimising vehicle movements, providing noise attenuation measures, providing screening to minimise visual intrusion. Minimise operational amenity by minimising light spill from interchanges and providing vegetative planting. Implement local traffic management. Restore cycling access to M2 Motorway breakdown lane. <p>Localised residual impacts offset by benefit to wider community.</p>	C	Section 10.4.
Greenhouse gas	No	<ul style="list-style-type: none"> Increases in greenhouse gas (GHG) emissions during construction. Reduction in GHG emissions during operation in comparison to existing scenario. 	<p>Responsibilities of construction personnel:</p> <ul style="list-style-type: none"> To reduce GHG emissions during construction To ensure that construction plant is maintained and repaired in accordance with requirements. Where possible, fuel efficiency would be considered when selecting vehicles and the use of solar powered devices would be considered. Where possible and feasible, preference would be given to materials sourced from local suppliers, containing recycled content or with lower carbon intensity. Residual impact from increase in GHG emissions during construction. Net benefit of a reduction in GHG emissions once the upgrade is operational due to improved traffic flow and encouraged use of bus travel. 	B	Section 10.10.
Land use and property	No	<ul style="list-style-type: none"> Permanent land use and property impacts on privately and publicly owned property. Temporary land use change and partial property acquisition of private and publicly owned land for construction compounds. 	<ul style="list-style-type: none"> Property inspection would be conducted on all structures within 50 metres of construction activities. Where liable, damage directly or indirectly caused by the construction of the Upgrade would be rectified. Property acquisition would be carried out in accordance with <i>Land Acquisition (Just Terms Compensation) Act 1991</i> and RTA Land Acquisition 	B	Section 10.5.

Issue	DGRs – key issue?	Potential impacts	Analysis – proposed mitigation measures and impacts remaining after their application	Risk category	Environmental assessment reference
			<p>Policy.</p> <ul style="list-style-type: none"> Property access would be maintained for the duration of construction. Residual impacts include partial property acquisition. 		
Air quality	No	<p>Adverse air quality impacts on the community from:</p> <ul style="list-style-type: none"> Dust generation during construction. Construction vehicle and plant emissions. Vehicle emissions during operation. 	<ul style="list-style-type: none"> Implementation of a Construction Dust Monitoring and Management Plan and would be reviewed and audited on a regular basis. Road design would improve flow of traffic, reduce queuing and promote integrated transport use, leading to reduced emissions. Residual impacts are unlikely. 	C	Section 10.6.
Construction lighting	No	<p>Increased light levels during night time work around construction compounds, has the potential to impact on:</p> <ul style="list-style-type: none"> Residential houses and public amenity. Transport system users. Transport signalling systems. Native flora and fauna. In some cases there is potential that lighting requirements set out in AS4282 may be exceeded particularly at the construction compounds. 	<ul style="list-style-type: none"> Mitigation measures drawn from AS4282-1997: Control of the Obtrusive Effects of Outdoor Lighting would be implemented to minimise adverse affects of the compounds. No residual impacts would remain. 	C	Section 10.7.
Waste management	No	<p>Waste that may be generated during the construction and operation phases of the project include:</p> <ul style="list-style-type: none"> Green waste. Demolition concrete. Inert spoil. Asbestos waste. Virgin excavated natural material (VENM). General office waste. Impact of litter and illegal dumping. 	<ul style="list-style-type: none"> Prevention and avoidance of waste creation and maximisation of reuse and recycling. A Waste Management and Reuse Sub Plan would form part of the Construction Environmental Management Plan (CEMP). This plan would address: <ul style="list-style-type: none"> Waste identification. Handling. Storage. Transportation. Disposal. 	C	Section 10.8.

Issue	DGRs – key issue?	Potential impacts	Analysis – proposed mitigation measures and impacts remaining after their application	Risk category	Environmental assessment reference
			<ul style="list-style-type: none"> Monitoring and auditing. Residual impacts unlikely. 		
Hazards and risks	No	<ul style="list-style-type: none"> Hazards and risks to environmental and human health through construction and operation. 	<ul style="list-style-type: none"> Identification of hazards and risks prior to commencement of construction. Potentially contaminating activities would be conducted in storage areas that are bunded and located an adequate distance away from watercourses and stormwater systems. Residual impacts are unlikely. 	C	Section 10.9.
Cumulative impacts	No	<ul style="list-style-type: none"> Combined impact of the M2 Upgrade project with the other projects being undertaken in the surrounding area, particularly at Macquarie Hospital and Macquarie University. These concurrent developments may specifically impact upon: Construction and operational traffic and transport, especially with regards to bus and vehicular traffic and parking in Macquarie Park. Noise and vibration. 	<ul style="list-style-type: none"> Management and avoidance of combined impacts by ensuring that all mitigation measures for all projects within the area are followed. No residual impacts remain. 	B	Section 10.11.