

12. Conclusion

This section summarises the strategic need and justification for the project and presents a conclusion for the environmental assessment.

Director-General's Requirements	Where addressed
<i>Project justification – the environmental assessment must justify the project and its components taking into consideration the objects of the Environmental Planning and Assessment Act 1979.</i>	Chapter 12

12.1 Strategic justification

The need and justification for the M2 Upgrade project relates to the need to service Sydney's north west. Upon opening over a decade ago, the M2 Motorway provided much needed accessibility and capacity for commuter, commercial and freight traffic, and road-based public transport to and from the north west, thereby reducing travel times and peak hour congestion.

Today, land use density has increased within the M2 Motorway catchment and the ongoing expansion of the wider motorway network has resulted in further traffic growth. To this end, the need and justification for the proposed upgrade is focused on five key strategic themes, which are identified in NSW State Plans and strategies. These themes and the project's response to them are:

- *To address existing constraints and traffic congestion* – The project would alleviate significant existing congestion along the M2 Motorway and provide relief to surrounding sub-arterial and arterial routes.
- *To support economic growth* – The project would provide better access to the employment hubs in Sydney's west and north west and improved accessibility of the specialised centre at Macquarie Park to the Sydney Orbital motorway network..
- *To provide for population growth* – The project would facilitate access between residential and employment lands and educational and recreational facilities. In particular, the proposed new west facing ramps at Windsor Road would enhance the accessibility to the Rouse Hill town centre.
- *To enhance accessibility* – Key benefits of the enhanced accessibility that would be provided by the new ramp connections proposed as part of the project include:
 - Reduced congestion on surrounding arterial roads.
 - Reduced vehicle kilometres travelled (VKTs).
 - Increase accessibility to Sydney Orbital motorway network.
 - Reduced travel times.
- *To enhance public transport* – The project provides an opportunity to increase the public transport accessibility of the Macquarie Business Park precinct by providing more efficient access via Christie and Herring Roads to Macquarie Centre Bus Interchange. The provision of rear access ramps at Windsor Road as well as those at Macquarie Park provides an opportunity for new public transport services.

12.2 Project justification

The following critical capacity constraints have been identified on the M2 Motorway:

- Westbound, Lane Cove Road to Pennant Hills Road in the PM peak.
- Eastbound, M7 Motorway/Abbott Road to Christie Road in the AM peak.

Currently, midblock traffic volumes (traffic travelling on motorway between interchanges) often exceed theoretical motorway lane capacities leading to congestion and increased travel times, particularly during peak periods. Adverse impacts are also experienced on the surrounding arterial road network as traffic seeks alternative routes. As planned development of the north west growth centre progresses, existing congestion problems would increase in severity, further reducing the level of service provided by the M2 Motorway.

The M2 Upgrade project would provide additional lane capacity where analysis of traffic demand and traffic conditions demonstrates it is necessary. This would:

- Alleviate the existing congestion along the M2 Motorway.
- Provide relief to surrounding arterial routes.
- Provide future M2 Motorway and wider network users with improved accessibility to a greater number of destinations.
- Improve travel conditions during peak periods.

Without these improvements, traffic conditions in the corridor would deteriorate significantly and delays to users would increase.

An environmental risk analysis was undertaken to identify the key risks of the project. A summary of this analysis is provided in Chapter 8. The results of that analysis, in conjunction with the DGRs, guided the assessment of the project's potential impacts.

Key environmental issues have been addressed in Chapter 9 and other issues have been addressed in Chapter 10. Justification of the project in the context of the identified key environmental, social and economic issues is provided below.

12.2.1 Key issues

Consideration of impact on the natural and cultural environment has been fundamental to the design process for the project. As far as possible, impacts have been avoided.

Operational traffic and transport

Detailed analysis of the potential operational transport and traffic impacts in Section 9.1 has determined that standard mitigation measures could be implemented to manage impacts during operation.

Construction traffic and transport

Construction traffic impacts would be incurred throughout the 24 month construction period as indicated in Section 9.2. A number of measures would be implemented to minimise the impacts of construction to both traffic flow and nearby residents and business owners. These include road occupancies, road closures, speed reductions and contra flow configurations along both the M2 and the

surrounding road network. To maintain the existing capacity of the M2 Motorway during peak hours, most of the network changes would be applicable during off-peak periods. Further details of construction traffic management and mitigation would be included in a Traffic Management Plan.

Operational noise and vibration

Operational noise would largely be managed through the modification or relocation of existing noise walls and the installation of new noise walls as indicated in Section 9.3. At locations where this is not viable and residual impacts remain after all feasible and reasonable approaches have been exhausted, noise mitigation in the form of architectural acoustic treatment for existing individual dwellings would be required. Solutions for other sensitive receivers would be determined in consultation with these receivers and the RTA.

Vibration generated from increased traffic levels is not anticipated to have a significant impact on adjacent land uses.

Construction noise and vibration

Construction noise during the daytime period is generally predicted to be in line with the NMLs, although a number of small exceedances are predicted during road widening bridgeworks as indicated in Section 9.4.3. During the evening and night-time periods, varying levels of exceedance of the project NMLs are predicted for most of the construction scenarios assessed.

Prior to undertaking significant 'out of hours' works, reasonable and feasible noise mitigation and management measures would be determined in consultation with affected stakeholders and implemented where required to minimise the potential impacts at nearby noise sensitive receivers.

Residences in the vicinity of the proposed works may be exposed to the impacts of vibration from some construction activities. Where deemed necessary, pre-construction building condition surveys and vibration monitoring would be carried out.

Ecology

A total of approximately 21 hectares of vegetation, including ten hectares of native vegetation and approximately 20 individuals of the species *Epacris purpurascens* var. *purpurascens*, would be removed as indicated in Section 9.5. The loss of native vegetation would also lead to loss of fauna habitat, some severance of fauna movement corridors and increased edge effects. Notwithstanding, no significant impact on *Epacris purpurascens* var. *purpurascens* or any threatened species or community is anticipated.

Urban design and landscape

Visual change resulting from the M2 Upgrade project would be experienced by both surrounding land users and by road users. Key changes would result from interchange construction, modifications to noise walls and vegetation removal. Some impacts would be unavoidable and these changes would be mitigated through the architectural design. The integration of new higher standard design elements would provide a new desired character and identity for the M2 Motorway. Further detail is provided in Section 9.5.

Aboriginal heritage

There are 15 sites of Aboriginal cultural heritage within 100 metres of the site. An Aboriginal Heritage Management Plan would be prepared to providing guidance on the management of these sites during the construction phase of the M2 Upgrade project as indicated in Section 9.7. Subject to implementation of this plan, there is potential for three only of these sites to be impacted by the proposal. Potential impact would be by way of ground disturbance, sedimentation and vibration. Measures to minimise or avoid impact to these sites would be identified during the detailed design phase of the project.

Construction surface water management and soils

Potential impacts to surface water flows as a result of the proposed widening works could be caused during site establishment and preparation works, earthworks and drainage works. A soil and water management plan would be prepared as part of a CEMP and would contain measures to manage and mitigate potential flooding, erosion, sedimentation or contamination of surface water that may result from altered surface conditions during construction. Further detail is provided in Section 9.8.

Non-Aboriginal heritage

There are 16 items of non-Aboriginal heritage significance within the vicinity of the M2 Motorway, nine of which have the potential to be impacted by the proposed works as a result of vibration. Measures to be implemented to minimise impacts to heritage items within the vicinity are identified in Section 9.9.

12.3 Objects of the EP&A Act

The objects of the EP&A Act provide a framework within which the justification of the project can be considered. Table 126 outlines those objects and provides comment on their relevance to the project.

Table 126 Objects of the EP&A Act and relevance to the project

EP&A Act Object	Comment
To encourage the proper management, development and conservation of natural and artificial resources, including agricultural land, natural areas, forests, minerals, waters, cities, towns and villages for the purpose of promoting the social and economic welfare of the community and a better environment.	The project design and impact mitigation and management measures detailed in this environmental assessment allow for the proper management, development and conservation of natural and artificial resources. The main objective of the project is to improve accessibility to economic growth areas in Sydney's north west and measures would be implemented to ensure the impact of this development on the natural and built environs is minimised.
To encourage the promotion and co-ordination of the orderly economic use and development of land.	Over the next 25 to 30 years, the Sydney Metropolitan Strategy, titled <i>City of Cities: A Plan for Sydney's Future</i> , predicts that 99,000 jobs will be created in Sydney's north west, with over 55,000 new jobs being created in the immediate vicinity of the M2 corridor. The project would provide better access to these areas, thereby supporting the planned economic use and development of land
To encourage the protection, provision and co-ordination of communication and utility services.	Communication and utility services would not be affected by the project.
To encourage the provision of land for public purposes.	This project is designed to meet the transport needs of the public.
To encourage the provision and co-ordination of community services and facilities.	The project provides improved access to communities along the length of the M2 Motorway through better traffic movement and increased number of access ramps to the M2 Motorway. Consequently, access to community services and facilities in the north west would be improved as a result of the project.

EP&A Act Object	Comment
To encourage the protection of the environment, including the protection and conservation of native animals and plants, including threatened species, populations and ecological communities and their habitats.	The project has been designed to minimise or mitigate significant identified impacts on the environment, including impacts to native flora and fauna, threatened species, populations and ecological communities and their habitats.
To encourage ecologically sustainable development.	Ecologically sustainable development has been considered in Section 12.4
To encourage the provision and maintenance of affordable housing.	Not relevant to the project
To promote the sharing of responsibility for environmental planning between different levels of government in the State.	The responsibility for environmental planning and approval in relation to the project rests with the State Government. Consultation has however occurred across all levels of government.
To provide increased opportunity for public involvement and participation on environmental planning and assessment.	The project development process has involved extensive consultation with relevant parties and this would continue in the detailed design, construction and operation phases.

12.4 Ecologically Sustainable Development

The EP&A Act, in part, encourages Ecologically Sustainable Development (ESD). In justifying the carrying out of a development in the manner proposed, the *Environmental Planning and Assessment Regulation 2000* sets out the principles of ESD that should be considered. In this regard, the following addresses each of the ESD principles as they relate to the project.

12.4.1 The precautionary principle

"If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation."

No threats of serious or irreversible environmental damage have been identified as being directly attributable to the undertaking of the project. Precaution has nevertheless been exercised in the following ways:

- Precaution has been exercised in regard to impacts on climate change by taking measures to reduce emissions associated with construction and operation. Although emissions would be generated during construction, the project would achieve long-term operational emission savings compared with the 'do-nothing' option. Furthermore, the flood impact assessment assumes an increase of 20 percent rainfall to accommodate climate change impacts within the engineering timeframes for flooding.
- Precaution has been exercised in the protection of aboriginal and non-aboriginal heritage items such as the Model Farms 'Farm house' and three sites of Aboriginal cultural heritage that may be impacted by construction of the project.
- The project would involve clearing (some permanent and some temporary) of native vegetation that is potential habitat for a number of threatened and migratory species. However, no impacts to threatened ecological communities are anticipated as a result of the project. Approximately ten hectares of native vegetation would be removed and three hectares would be subsequently revegetated.

12.4.2 Inter-generational equity

"The present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations."

A major benefit of the project would be improved travel time, reduced traffic congestion leading to improved air quality and a better quality road for motorists. The upgrade would also enhance the welfare of future generations in a variety of other ways, which are:

- The upgrade would reduce local traffic congestion, improving air quality.
- The upgrade would reduce long-term operational emissions through improved grades and faster travel times for motorists.
- The upgrade would improve amenity for local road users by decongesting local roads.
- The upgrade would improve access for markets and labour force and therefore improve economic outcomes for local businesses.
- Revegetation of disturbed areas adjacent to the construction areas and bordering natural bushland would improve connectivity and providing wildlife corridor links.
- Revegetation would be conducted under bridge structures and measures would be implemented (for example, lighting and moisture) to improve growth conditions for plants in these locations, thereby improving their potential functioning of these areas as fauna movement corridors.
- Noise walls are to be retained and/or revised to address the new impacts experienced by the widened roadway. The design of these elements would be in accordance with the current design standards applicable to road development.
- Inert spoil, demolition concrete and other building materials would be reused as much as practically possible, thus reducing demand on raw materials and associated costs and energy.

12.4.3 Conservation of biological diversity and ecological integrity

"Conservation of biological diversity and ecological integrity should be a fundamental consideration."

Much of the area surrounding the M2 corridor is highly urbanised and consists mainly of residential properties, parkland, weed-infested areas and riparian vegetation. The project design, construction and operation would incorporate a number of net benefits to biological diversity and ecological integrity including:

- A bushland regeneration program would be implemented (subject to agreement) throughout the core bushland areas within the M2 corridor.
- Providing habitat connectivity to larger areas of bushland through vegetation rehabilitation in areas suffering from habitat modification and high levels of weed invasion.
- Net improvements to degraded vegetation along the corridor through:
 - Intensive treatment of environmental weeds.
 - Introducing planting under bridges where none currently exists by installing a system of gravity fed perforated stormwater pipes to distribute water during rainfall and an artificial lighting system under bridges to provide sufficient additional light at suitable wavelengths for plant growth. This system would be designed to provide light to plants during daylight hours such that it augments existing light and does not impact on nocturnal animal species.
 - Revegetation strategy that reinstates the natural plant communities which would have existed along the corridor prior to construction disturbance.
- Net improvements to habitat opportunities for fauna species along the corridor through:
 - Intensive treatment of environmental weeds.

- Installation of nest boxes in order to replace hollows that may be lost through vegetation clearing works.
- Installation of bat boxes suitable for cave-dwelling bat species would be retro-fitted to overbridges adjacent to bushland along the route (for example, Terrys Creek and Darling Mills Creek).
- Installation of boulders and large woody debris underneath existing bridge structures to increase the structural complexity of habitats in these locations and provide suitable cover for species which may use these areas as movement corridors.
- Creation of rough surface finishes on the underside and inner surface of bridge structures over Terrys Creek and Darling Mills Creek that would enable Fairy Martins *Hirundo ariel* to create their bottle-shaped mud nests. A wide variety of native fauna species (including the threatened Large-eared Pied Bat *Chalinolobus picatus* have been recorded using the abandoned nests of Fairy Martins attached to artificial structures such as bridges and culverts.
- Flood and water quality treatments to ensure no additional impacts on the aquatic environment.

12.4.4 Improved valuation, pricing and incentive mechanisms

“Environmental factors should be included in the valuation of assets and services.”

The improved amenity, increased speed limit and reduced congestion provide improved value for money for motorists on the M2 Motorway. The project’s asset valuation, construction costs, operation costs and product charges would include environmental factors and externalities such as:

- A minimum waste policy recognising that waste discharge, whether solid, liquid or gaseous represents a cost to production and an opportunity loss to income.
- Landscape rehabilitation using native species to create low maintenance vegetated areas. Ongoing management of vegetation would be undertaken including one year maintenance for establishment after construction, then integration into existing maintenance regimes. The vegetated back drop is identified as a key asset within the urban design framework for instilling a distinct character for the route.
- Appropriate compensation for acquired properties and temporary leases during construction.

12.5 Conclusion

The project addresses DGRs, which include issues raised by key state government agencies. The environmental assessment also includes consideration of the issues raised by the community and stakeholders during the development of the project.

If approved and implemented, the project would fulfil its design intent of:

- Addressing existing constraints and traffic congestion.
- Supporting the economic development of the region by facilitating commercial activity.
- Providing for population growth in the north western corridor.
- Enhancing accessibility between residential areas and centres of commercial activity.
- Enhancing public transport.

There are some anticipated impacts on the local environment, particularly during construction. Key environmental issues have been examined throughout the project development and construction planning processes. Consultation with affected stakeholders has been undertaken to ensure that key potential impacts were identified and discussed at an early stage, and, where possible, appropriate mitigation agreed in principle.

The key issues identified comprise:

- Operational and construction traffic and transport implications.
- Operational and construction noise and vibration impacts.
- Impacts on ecology.
- Urban design and landscaping issues.
- Aboriginal cultural heritage.
- Surface water impacts during construction.
- Non-Aboriginal heritage.

Many impacts would be temporary and need to be considered within the context of the overall objectives of the project and the benefits it would produce.

The project is of significance to the State as it provides essential improvements to a key link in the Sydney Orbital motorway network and integrated efficient public transport (bus) facilities, which would support the significant growth planned in Sydney's north west and the 'global arc'. The project is consistent with the goals and objectives described in key NSW Government strategy documents, including the State Plan and Metropolitan Strategy. The project would provide:

- An integrated M2 Motorway transport solution significantly improving accessibility for cars, freight vehicles, public transport and bicycles.
- Improved capacity and efficiency of existing commuter, commercial, freight and road-based public transport infrastructure.
- Reducing peak hour travel times.
- More attractive and reliable public transport options.

In meeting the primary objectives of the project, the design development process has sought to minimise the potential environmental, social and economic impacts.

As with any motorway development, the project would result in some adverse impacts. The development of mitigation and management measures to reduce the scale of these impacts has been a key feature of project development and has been reflected through this environmental assessment. The RTA has made firm commitments to implement appropriate mitigation and management measures.

There is the potential for a degree of cumulative impacts associated with this and other projects that may occur within the same time and area. The precautionary approach taken in the development of mitigation and management measures proposed for this project would provide sufficient mitigation to minimise both immediately-identified impacts and potential additional or cumulative impacts that may arise.

The project achieves acceptable environmental, social and economic outcomes, and delivers substantial road safety and wider economic and road-user benefits. The project is considered justified.

13. References

ABS (2006) *2006 Census of Population and Housing*, Australian Bureau of Statistics

ANZECC and ARMCANZ (2000) *Australian and New Zealand guidelines for fresh and marine water quality. National Water Quality Management Strategy Paper No 4*, Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand, Canberra, Australia

Biosphere Environmental Consultants (2007) *Monitoring Survey for Red-crowned Toadlet*, M2 Site, North Ryde

BOM (2008) www.bom.gov.au, Bureau of Meteorology, Commonwealth of Australia

City of Ryde (2009) *Development Control Plan – Water Sensitive Urban Design*

City of Ryde (2002) *Macquarie Park Structure Plan*

City of Ryde (2007a) *Ryde Local Environment Plan No. 137*

City of Ryde (2007b) *Ryde Integrated Transport*

City of Ryde (2007c) *Land Use Strategy*

City of Ryde (2008) *Macquarie Park Traffic Study*

Corkill, T. (2001) *Monitor of Aboriginal Archaeological Sites along M2 Motorway*

CRC for *Catchment Hydrology* (2005 Version 3) MUSIC User Manual

CSIRO and BOM (2007) CSIRO, and the Australian Bureau of Meteorology. *Climate change in Australia: technical report 2007*. Commonwealth Scientific and Industrial Research Organisation

Conybeare Morrison and Partners (1992) *North West Transport Links East, Environmental Impact Statement*, Working Paper European Heritage Survey

DCC (2006) *National Greenhouse Gas Inventory*, Department of Climate Change

DCC (2008) *Green Paper on the Carbon Pollution Reduction Scheme*, Department of Climate Change

DEC (2004a) *Air Quality and meteorological monitoring data conducted at Lindfield*, NSW Department of Environment and Conservation

DEC (2004b) *National Environment Protection (Ambient Air Quality) Measure (NEPM) NSW Annual Compliance Report 2004*, Department of Environment and Conservation

DEC (2004c) *Interim Community Consultation Requirements for Applicants*

DEC (2005) *Guidelines for Aboriginal Cultural Heritage Impact Assessment and Community Consultation*

DEC (2005a) *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, Department of Environment and Conservation

DEC (2005b) *Draft Recovery Plan for the Green and Golden Bell Frog (Litoria aurea)*. Department of Environment and Conservation NSW, Hurstville

DEC (2006a) *Assessing Vibration: a technical guideline*, Department of Environment and Conservation (now Department of Environment, Climate Change and Water)

DEC (2006b) *Guidelines for the NSW Site Auditor Scheme 2nd edition, Health-based investigation levels for Commercial or Industrial land use*, Department of Environment and Conservation (now Department of Environment, Climate Change and Water)

DECCW (2007) *Waste Avoidance and Resource Recovery Strategy 2007*

DEC and DPI (2005) *Draft Guidelines for Threatened Species Assessment*. Department of Environment and Conservation (now Department of Environment, Climate Change and Water) and Department of Primary Industry, NSW

DEC(2004. *Interim Community Consultation Requirements for Applicants*

DECCW (2009a) *Interim Construction Noise Guideline*

DECCW (2009b) *Threatened species, populations and ecological communities of NSW*. Threatened species Website. NSW Department of Environment and Climate Change. Available from: <http://www.threatenedspecies.environment.nsw.gov.au/index.aspx> NSW Department of Environment and Climate Change

DECCW (2009c) *Waste Classification Guidelines: Parts 1 and 2*

DECCW (2009d) *Action for Air*

DECCW (2009e) *Draft Vegetation Community Mapping Scheme for the Sydney Metropolitan Catchment Area*

DEH (2005) *Turpentine–Ironbark Forest of the Sydney Basin Bioregion Nationally threatened species and ecological communities information sheet*, Department of the Environment and Heritage

DEH (2006) *Significant Guidelines and Matters of National Significance*, Department of Environment and Heritage, Australia

DEWHA (2001) *Fuel Standard (Automotive Diesel) Determination 2001*, Legislative Instrument Compilation (current) – F2009C00145

DEWHA (2009) *Species Profile and Threats Database*, Department of the Environment, Water, Heritage and the Arts, Canberra. Available from: <http://www.environment.gov.au/sprat>

DIPNR (2004) *Guideline for the Preparation of Environmental Management Plans*

DMR (1987) *Roads 2000*, Department of Main Roads (now Roads and Traffic Authority)

DoP (1992a) *Hazardous Industry Planning Advisory Paper No.4 – Risk Criteria for Land Use Safety Planning*

DoP (1992b) *Hazardous Industry Planning Advisory Paper No.6– Guidelines for Hazard Analysis*

DoP (1994) *Applying SEPP 33 Hazardous and Offensive Development Application Guidelines*

DoP (1997a) *Guidelines, Hazard Industry Planning Analysis Paper No.6 (HIPAP)*

DoP (1997b) *Multi-Level Risk Assessment*

DoP (2005) Sydney Metropolitan Strategy, titled *City of Cities: A Plan for Sydney's Future*

DoP (2007a) *Inner North Subregional Strategy*

DoP (2007b) *North Subregional Strategy*

DoP (2007c) *North West Subregional Strategy*

DoP (2007d) *West Central Subregional Strategy*

DoP (2008) *New South Wales State and Regional Population Projections, 2006-2036*

Eco Logical Australia (ELA) (2008) *Constraints and Opportunities Assessment M2 Site and Bundarra reserve North Ryde, NSW*. Report to Transport Infrastructure development Corporation (TIDC), Chatswood, NSW

EPA (1999a) *Environmental Criteria for Road Traffic Noise*

EPA (1999b) *Environmental Guidelines: Assessment, Classification and Management of Liquid and Non-liquid Wastes*

EPA (2000) *Industrial Noise Policy*

Fairfull, S. and Witheridge, G. (2003) *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings*. NSW Fisheries, Cronulla

Federal Office of Road Safety (2007) *The Australian Code for the Transport of Dangerous Goods by Road and Rail* (known as the Australian Dangerous Goods Code or ADG), 7th ed., Canberra, ACT

Future Fuels Forum (2008) *Fuel for Thought The Future of Transport Fuels: challenges and opportunities*

Gunninah, X (2000) *M2 Hills Motorway Fauna Monitoring Report*

Haglund, L., 1995. *The Proposed M2 Motorway: Investigation of Aboriginal Heritage Significance Test Excavation of Rock Shelter PAD1/DC1 on Devlins Creek, Pennant Hills – Beecroft*. Report to the Roads and Traffic Authority.

HLA Envirosciences Pty Ltd (2007) *M2 Motorway Water Quality Monitoring Report – 21 May to 1 June 2007*

HLA Envirosciences Pty Ltd (2008), *M2 Motorway Construction Water Quality Environmental Monitoring Report. 6 January 1998 – 14 April 2008*.

HLA Envirosciences Pty Ltd (6 January 1998 – 14 April 2008) *M2 Motorway Construction Water Quality Environmental Monitoring Report*

Holper, P., Lucy, S., Fox, P., Nolan, M., Senese C., Hennessy, K. (2007) *Infrastructure and Climate Change Risk Assessment for Victoria*. Consultancy Report to the Victorian Government prepared by CSIRO, Maunsell AECOM and Phillips Fox.

[http://www.greenhouse.vic.gov.au/CA256F310024B628/0/2021C307264A6473CA2572DD00055CBB/\\$File/Climate+change+and+Infrastructure+Final.pdf](http://www.greenhouse.vic.gov.au/CA256F310024B628/0/2021C307264A6473CA2572DD00055CBB/$File/Climate+change+and+Infrastructure+Final.pdf)

- Institution of Engineers Australia (2000) *Australian Rainfall and Runoff*
- Institution of Engineers Australia (2005) *Australian Runoff Quality*
- IPCC (2007) Intergovernmental Panel on Climate Change. *Fourth Assessment Report: Climate Change 2007 (AR4)*
- Landcom (2004 and 2006) *Managing Urban Stormwater – Soils and Construction Volumes 1 and 2*
- Lees, F.P. (1996) *Loss Prevention in the Process Industries*, Butterworth-Heinemann, London
- Mount King Ecological Surveys (1992a) *North West Transport Links Western Section Flora and Fauna Evaluation*. Report prepared by Mount King Ecological Surveys for Manidis Roberts Pty Ltd. And Snowy Mountains Engineering Corporation Pty Ltd on behalf of the Roads and Traffic Authority, NSW
- Mount King Ecological Surveys (1992b) *North West Transport Links East Environmental Impact Statement Working Paper Flora and Fauna Evaluation (Bushland Effect and Management) Report (Eastern Section)* prepared by Mount King Ecological Surveys for Maunsell Pty Ltd on behalf of the Roads and Traffic Authority, NSW
- NEPM (2004) *National Environmental Protection (Air Toxics) Measure*
- NPWS (2002a) *Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain*, Western Sydney, Final Edition, NSW National Parks and Wildlife Service, Sydney
- NPWS (2002b) *Native Vegetation of the Cumberland Plain – Final Edition*, NSW National Parks and Wildlife Service, Sydney
- NSW Government (2006a) *State Plan – A New Direction for Sydney*
- NSW Government (2006b) *Urban Transport Statement – Responding to the Challenges of Travel and Transport within and across Sydney*
- NSW Heritage Office and DUAP (1996) *NSW Heritage Manual* (now Heritage Branch, Department of Planning)
- NSW Heritage Office (2002) *Statements of Heritage Impact* (now Heritage Branch, Department of Planning)
- NSW Treasury (2006) *State Infrastructure Strategy New South Wales 2006-07 to 2015-16*
- Rooney, B. (1994) *Water sampling data conducted downstream of the M2 Motorway*
- RTA (1989) *F2 – Castlereagh Freeway – Section: Pennant Hills Road to Land Cove River Environmental Impact Statement*
- RTA (1992) *North West Transport Link – Pennant Hills Road to Old Windsor Road*
- RTA (1999) *Water Policy and Code of Practice for Water Management*
- RTA (2001) *Environmental Noise Management Manual*
- RTA (2002) *Guide to Traffic Generating Development*

RTA (2003) *Bridge Aesthetics*

RTA (2005) *Shotcrete Design Guidelines*

RTA (2006) *Noise Wall Design Guideline*

RTA (2008a) *Community Involvement Policy and Community Involvement and Communication Resource Manual*

RTA (2008b) *Landscape Guidelines*

RTA (2008c) *Procedure for Aboriginal Cultural Heritage Consultation and Investigation*

RTA (2009) *Preliminary environmental assessment for the M2 Upgrade project*

SESL (2008) *Detention Basin Water Sampling – M2 Motorway, Sydney Environmental and Soil Laboratory*

Sinclair Knight Merz (2008) *Transurban M2 Upgrade project – Environmental Scoping Study*

SMEC Australia (2006) *Review of Environmental Factors for M2 Motorway Westbound Third Lane Conversion*

SMEC Australia (2006) *the M2 Environmental Review*

Smith, J. and Smith, P. (2008) *Native Vegetation Communities of Hornsby Shire 2008 Update*. Report prepared for Hornsby Shire Council

Standards Association of Australia AS1940-2004 *The storage and handling of flammable and combustible liquids*

Tozer, M.G., Turner, K., Simpson, C., Keith, D.A., Beukers, P., MacKenzie, B., Tindall, D. and Pennay, C. (2006) *Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands*. Version 1.0 NSW Government Department of Environment and Conservation and Department of Natural Resources

Transurban (2009) *Road User Cost Benefit Analysis*

Upper Parramatta River Catchment Trust (1999) *Green corridors Management Strategy for Upper Parramatta River Catchment*. Oculus Environmental Planning Consultants

US Federal Highway Administration (2009 Version 7.2) *HY-8 Culvert Hydraulic Analysis Program*

Unsworth, B. (2004) *Review of Bus Services in New South Wales*
http://www.transport.nsw.gov.au/sites/default/file/inquiries/unsworth-final-bus-report_full.pdf

World Business Council for Sustainable Development and World Resources Institute (WBCSD and WRI) (2004) *The Greenhouse Gas Protocol A Corporate Accounting and Reporting Standard, Revised Edition*

XP Software (2008 Version 7) *XP-Rafts User Manual*

14. Glossary of terms and abbreviations

Terminology	Description
AADT	Average Annual Daily Traffic
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ALARP	As Low As Reasonably Practicable
alternative cycle route	Describes the cycle route provided on local roads because cyclists would be diverted off the M2 Motorway during construction
ARQ	Australian Runoff Quality
BOM	Bureau of Meteorology
CAL3QHCR	The transportation dispersion model CAL3QHCR, developed by the USEPA for the modelling of air quality impacts
CBD	Central business district
CCTV	Closed Circuit Television
CEEC	critically endangered ecological community
CEMP	Construction Environmental Management Plan
Chainage	An imaginary line used to measure distance
CLM Act	Contaminated Land Management Act 1997
CO	Carbon Monoxide
Contractor	Leighton Contractors Pty Ltd
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DCC	Department of Climate Change
DEC	Department of Environment and Conservation (now Department of Environment, Climate Change and Water)
DECC	Department of Environment and Climate Change (now Department of Environment, Climate Change and Water)
DECCW	Department of Environment, Climate Change and Water (previously known as DECC)
Deep lift asphalt	Thick asphalt over heavily bound material
DEH	Department of Environment and Heritage
DEWHA	Department of the Environment, Water, Heritage and the Arts
DGR's	Director-General's environmental assessment requirements
Director-General's Requirements	Reference to the Director-General's environmental assessment requirements under Part 3A of the EP&AEP&A Act. Can be shortened to 'DGRs'
DoP	Department of Planning
DPI	Department of Primary Industries
DUAP	Department of Urban Affairs and Planning (now Department of Planning)
DWE	Department of Water and Energy
ECRTN	Environmental Criteria for Road Traffic Noise
EEC	Endangered Ecological Community

Terminology	Description
EIS	Environmental Impact Statement
ENMM	Environmental Noise Management Manual produced by the RTA
Environmental assessment (EA)	The document prepared under Part 3A to assess environmental impacts for seeking Project Approval. Can be shortened to 'EA'.
Environmental assessment	Generic term for describing the undertaking of an assessment of impacts
EPA	Environmental Protection Authority (part of the Department of Environment, Climate Change and Water)
EP&A Act	Environmental Planning and Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPI	environmental planning instruments
ESD	Ecologically Sustainable Development
ETC	Electronic Toll Collection
Full depth asphalt	Asphalt layer over selected material
GHG	Greenhouse Gas
'Global Arc'	A strategic employment related development corridor stretching from Sydney Airport to Macquarie Park
Hills M2	The Hills Motorway Limited, the company responsible for the operation and maintenance of the M2 Motorway. Hills M2 is a wholly owned subsidiary of Transurban Limited.
IAP2	International Association of Public Participation
ICNG	Interim Construction Noise Guideline prepared by the Department of Environment, Climate Change and Water
ICOMOS	Australian International Council on Monuments and Sites
IPCC	Intergovernmental Panel on Climate Change
ISEPP	State Environmental Planning Policy (Infrastructure) 2007
ITS	Intelligent Transport System
Level of Service (LoS)	Level of Service (LoS) is defined as a qualitative measure describing operational conditions within a traffic stream
LCPL	Leighton Contractors Pty Ltd
LCT	Lane Cove Tunnel
LEP	Local Environmental Plan
LGA	Local Government Area
LUS	Lane Usage Signs
the M2 corridor	The site, generally bounded by the Hills M2 Motorway lease boundary
M2 environs	The area inclusive of the M2 corridor and the area of influence
M2 Motorway	M2 Motorway, which extends from the M7 Motorway/Abbott Road to the Lane Cove Tunnel including carriageways, ramps and associated structures and infrastructure
M2 Motorway catchments	The area or population from which the M2 Motorway attracts users
M2 Motorway operator	Hills M2
M2 Upgrade project	The proposed works
M2 Upgrade project Project Team	The name of the project team delivering the M2 Upgrade project. This includes Leighton Contractors Pty Ltd, Hills M2, AECOM, and KMH Environmental

Terminology	Description
M7 Motorway	M7 Motorway, which extends from end of M2 at Abbott Road interchange
MCR	Motorway Control Room
METS	Motorist Emergency Telephone System
mm	Millimetres
MNCS	Motorway Network Communications System
the M2 Motorway	M2 Motorway, which extends from the M7 Motorway/Abbott Road to the Lane Cove Tunnel including carriageways, ramps and associated structures and infrastructure, abbreviated to 'the M2 Motorway'.
Mt CO ₂ -e	Million tonnes of CO ₂ -equivalent
MUSIC	Model for Urban Stormwater Improvement Conceptualisation, used to simulate urban stormwater systems operating at a range of temporal and spatial scales
NEPM	National Environmental Protection (Air Toxics) Measure
NES	National environmental significance
NETS	National Emissions Trading Scheme
NGERS	National Greenhouse and Energy Reporting Act 2007
NMLs	Noise Management Levels
NO ₂	Nitrogen dioxide is the chemical compound with the formula NO ₂ , and is a prominent air pollutant
NO _x	NO _x is a generic term for mono-nitrogen oxides (NO and NO ₂), both prominent air pollutants
NPW Act	National Parks and Wildlife Act 1974
OGA	open graded asphaltic concrete
PAD	Potential Archaeological Deposit
park and ride facility	Describes the previously proposed park and ride facility at Herring Road
PCBs	polychlorinated biphenyls
PM ₁₀	Particulate matter less than 10 microns in aerodynamic diameter, a parameter used to measure air quality
PM _{2.5}	Particulate matter less than 2.5 microns in aerodynamic diameter, a parameter used to measure air quality
ppm	Parts per million
the project	M2 Upgrade project works
the proponent	Roads and Traffic Authority (RTA)
t CO ₂ -e	tonnes of CO ₂ -equivalent
RIDBC	Royal Institute for Deaf and Blind Children
RTA	NSW Roads and Traffic Authority
RUCBA	Road Users Cost Benefit Analysis
SO ₂	Sulphur dioxide is the chemical compound with the formula SO ₂ . It is produced by industrial processes and is a prominent air pollutant.
'SO' gutter	A gutter type used by the RTA
SCATS	Sydney Coordinated Adaptive Traffic System is a management system for traffic signals that gathers data on traffic flows in real-time at intersections.

Terminology	Description
SCATES	Scates Computer Aided Traffic Engineering System is a traffic signal optimisation programs
SEPP	State Environmental Planning Policy
Super-T Bridge	A bridge formed from pre-cast concrete girders with a cast in-situ concrete deck.
SWMP	Soil and Water Management Plan
Sydney's north west	The area within Sydney that the M2 Motorway serves
Sydney's North West Growth Centre	As defined under Metropolitan Strategy
TAPM	'The Air Pollution Model'
TMC	RTA Transport Management Centre (TMC)
Sydney Orbital Motorway network or 'Sydney Orbital'	the M2 Motorway network orbiting Sydney metropolitan area
TMPs	Traffic Management Plans
TMS	Tunnel Message Signs
TN	Total Nitrogen
TP	Total Phosphorus
TSC Act	Threatened Species Conservation Act 1995
TSP	Total Suspended Particles
TSS	Total Suspended Solids
UPS	Uninterruptible Power Supply
USEPA	United States Environment Protection Authority
VENM	Virgin excavated natural material
VKT	Vehicle Kilometres Travelled
VMS	Variable Message Signs
VSLs	Variable Speed Limit Signs
WEBS	Wider economic benefits
Note: project description terminology is contained in the project description.	