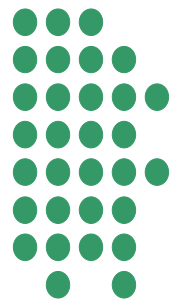


Section 5

Evaluation and Justification

Preamble

This section concludes the EIS with an evaluation of the alternatives considered during the design stage of the proposed road and preparation of this document. This section also includes an evaluation of the construction and operation of the proposed road in terms of biophysical, economic and social aspects and consistency with sustainable development principles. The construction and operation of the proposed road and its likely impacts are then justified in terms of the objectives of the proposed road.



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5.1 INTRODUCTION

The Director-General's requirements require that an analysis of the feasible alternatives to the Proposal be carried out. In addition, Schedule 2(6) of the *Environmental Planning and Assessment Regulation 2000* requires this EIS to justify the proposed road, having regard to biophysical, economic and social considerations and to evaluate the extent to which the principles of Ecologically Sustainable Development would be met.

The following sub-sections provide an analysis of each of the feasible alternatives, provide an overview of the anticipated residual biophysical and socio-economic impacts associated with the Proposal, evaluate the Proposal in terms of Ecological Sustainable Development and provide a justification of the Proposal against the objectives identified in Section 2.1.2.

5.2 CONSIDERATION OF ALTERNATIVES

5.2.1 Overview of Alternatives Considered

During the design phase for the proposed road, a number of alternatives were considered. Broadly, these may be classified as:

- alternative routes and road alignments;
- alternative intersection designs; and
- do nothing.

The following sub-sections provide a brief analysis of these alternatives.

5.2.2 Alternative Routes and Alignments

As identified in Section 1.4.2, there has been a long history of consideration of routes to provide traffic, particularly heavy vehicles, with an alternative route to around the City including a northern and a southern route(s). In February 2001, Council resolved to pursue the option of a northern route and selected an alignment that broadly corresponded with the route identified in the Orange LEP 2000. Following that decision, and the subsequent construction of the Northern Distributor Road from the Escort Way to Astill Drive (North), the southern route alternative became increasingly unviable.

The proposed alignment for the final section of the North Orange By-pass is constrained by a number of factors, including the following.

- The need to continue road construction from the eastern end of the existing Northern Distributor Road.
- The location of industrial and residential development along Discovery Drive, Colliers Avenue, Amaroo Circuit, Emily Place, Sophie Drive, Ophir Road and Daydawn Place.
- The location of infrastructure to the south of the proposed Ophir Road intersection, including a rising main, high voltage overhead transmission lines and fibre optic communications cables.



- The location of the residence at 261 Icely Road.
- The topography from approximately 1km south of Icely Road to Diary Creek where relatively steep slopes require the proposed road to be located immediately to the east of a south-flowing, unnamed drainage line.
- The location of the items of European heritage significance in the vicinity of Chinaman's Bend, including a cemetery and the ruins of the Traveller's Rest Inn and possibly the Government Stock Station.
- The need to maintain the required sight distance between the proposed intersection with the Mitchell Highway and Chinaman's Bend.

As a result, the alignment of the proposed road is tightly constrained and alternative alignments would be likely to adversely impact on one or more of the items identified above.

5.2.3 Alternative Intersection Designs

5.2.3.1 Introduction

A number of alternative intersection design options have been considered for the Ophir Road, Icely Road and Mitchell Highway intersections. These are discussed in detail below.

5.2.3.2 Ophir Road Intersection - Off-set T-Intersection

As identified in Section 2.3.5, during the community consultation stage for the proposed road, concerns were raised in relation to the Ophir Road intersection. Council originally proposed a left-right offset T-intersection for Ophir Road. The offset T-intersection would have required through traffic travelling in either direction on Ophir Road to stop at the proposed road, give way to traffic on the right, turn left onto the proposed road and merge to the right into a protected right-hand turn lane. Motorists intending to continue on Ophir Road would then be required to give way to oncoming traffic before turning right and continuing their journey.

This intersection design had the following advantages.

- All relevant design standards would have been achieved,
- An analysis of the intersection performance indicated that the intersections would have had a 'good' level of service, with average peak-hour delays for users of Ophir Road of approximately 27 seconds. Users of the proposed road would have experienced no delays.
- The speed limit of the proposed road could be maintained at 100km per hour from the intersection with the Mitchell Highway to immediately south of Astill Drive (North) reducing travel times for through traffic.
- The intersection would have cost considerably less than other options.



However, during the community consultation stage, it became apparent that the community had numerous concerns in relation to this design option, principally in relation to the perceived safety and operation of the intersection. As a result, Council proposes to construct a roundabout at the Ophir Road intersection, as described in Section 2.3.4.4.

5.2.3.3 Ophir Road Intersection - Grade-separated

As identified in Section 3.2.2.2, three intersection designs were prepared for the Ophir Road intersection. The third design option, namely a grade-separated intersection that would allow through traffic on Ophir Road to pass under the proposed road, is described in more detail in Section 2.3.5.2.

As indicated in Section 2.3.5.1, the intersection performance and noise impacts associated with this intersection design was assessed and the results are presented in NTPE (2009) and Heggies (2009) respectively. The following sub-sections provide a summary of the results of that assessment.

Intersection Performance

Table 5.1 presents the results of the intersection performance analysis for the proposed grade-separated intersection.

Table 5.1
Ophir Road Intersection Performance Analysis - Grade-separated

Peak Hour	Road	Direction of Travel	Turning Movement	Average Delay (seconds)	Level of Service
Intersection between link road and proposed road					
AM	Link road	West	L	12.7	B
			R	14.1	B
	Proposed road	North	T	0.0	A
			R	13.5	B
		South	T	0.0	A
			L	13.4	B
PM	Link road	West	L	12.8	B
			R	14.0	B
	Proposed road	North	T	0.0	A
			R	13.4	B
		South	T	0.0	A
			L	13.8	B
Intersection between link road and Ophir Road					
AM	Link road	East	L	13.1	B
			R	10.9	B
	Ophir Road	North	T	0.0	A
			L	8.7	A
		South	T	0.0	A
			R	11.9	B
PM	Link road	West	L	12.9	B
			R	11.2	B
	Ophir Road	North	T	0.0	A
			L	8.5	A
		South	T	0.0	A
			R	11.7	B

Source: NTPE (2009) - After Appendix E



In summary, motorists turning onto the link road from the proposed road and then onto Ophir Road would experience delays during peak hour of up to 28.5 seconds. It should be noted, however, NTPE (2009) note that approximately 95% and 75% of vehicles using Ophir Road and the proposed road respectively would be through traffic. These vehicles would experience no delays.

By comparison, the proposed Ophir Road roundabout would result in delays for all traffic of between 10.4 seconds and 16.3 seconds. In addition, the construction of a roundabout at the Ophir Road intersection has required the speed limit from a point 150m south of the intersection to the intersection with Astill Drive (North) to be reduced from 100km per hour to 80km per hour. This would result in an additional travel time for motorists using the proposed road of approximately 17 seconds. As a result, the alternate grade-separated intersection would reduce travel times for motorists using the proposed road and Ophir Road by up to approximately 33 seconds and 16 seconds respectively.

Noise Performance

The noise assessment criteria and methodology are described in Section 4.3.4 and 4.3.5. **Table 5.2** presents the results of the noise assessment for the Ophir Road intersection, including the grade-separated intersection. Section 4.3.7.3 summarises those residences that would be likely to experience exceedances of the relevant noise criteria. However, in summary the only residence that would be likely to require noise mitigation as a result of the construction of the proposed roundabout would be Residence R7.

Table 5.2
Anticipated Noise Levels - Ophir Road Intersection¹

Receiver ²	Facade	Existing Alignment (do nothing)		Roundabout Intersection		Grade-separated Intersection	
		LAeq(15hour)	LAeq(9hour)	LAeq(15hour)	LAeq(9hour)	LAeq(15hour)	LAeq(9hour)
R1	SW	39	33	51	47	51	47
	NW	41	35	50	46	50	46
R2	W	49	43	52	48	52	48
	N	48	42	50	45	49	45
	S	44	38	50	46	50	46
R3	W	55	50	55	50	54	49
R4	W	56	51	55	50	54	49
R5	S	59	53	57	52	55	50
R6	W	48	43	54	50	54	50
	E	62	56	59	54	59	53
	S	58	53	58	52	58	52
R7	W	52	46	58	54	58	54
	S	57	52	58	54	58	53
	E	59	53	58	52	58	52
R8	NE	46	40	61	57	61	57
R9	E	48	42	52	48	51	47
R10	E	52	46	53	49	52	48
R11	E	60	54	60	54	60	54
	S	63	57	64	58	64	58
R12	NE	48	42	51	47	51	47
R13	N	46	41	49	45	49	45
	E	32	26	47	44	47	44
R14	E	44	38	50	46	50	46
	E	43	37	50	46	50	46

Note 1: Units = dB(A)

Note 2: For residence locations see **Figure 4.11**.

Source: Heggies (2009b) - Table 18.



In summary, **Table 5.2** indicates that if the grade-separated intersection were constructed, all modelled residences would experience noise emissions that would be the same or less than the noise emissions that would be experienced should the proposed roundabout be constructed

Summary

In summary, the grade-separated intersection would result in time savings of up to 16 seconds and 33 seconds for users of Ophir Road and the proposed road respectively and noise emissions associated with the grade-separated intersection would be less than or equal to the roundabout. However, Council notes that the grade-separated intersection would cost considerably more to construct than the proposed roundabout. As Council does not have the funds available to construct the proposed grade-separated intersection, it was resolved to incorporate the intersection design in this *Environmental Impact Assessment* and assess its impacts. Should funding become available prior to the construction of the proposed roundabout, Council would seek a modification to the consent, assuming that it is granted, to construct the grade-separated intersection rather than the proposed roundabout.

5.2.3.4 Icely Road Intersection

During the community consultation stage for the proposed road, Icely Road motorists expressed concern in relation to the design of the proposed right-left offset T-intersection described in Section 2.3.4.5. As a result, Council agreed to review the option of a left-right offset T-intersection as described in Section 2.3.5.3.

The alternative intersection design would require through traffic on Icely Road to turn left onto the proposed road, giving way to traffic on the right only. Through traffic would then be required to turn right from the proposed road onto Icely Road, giving way to oncoming traffic. This would have the advantage of requiring through traffic to give way to traffic in only one direction at a time.

The alternative intersection design would, however, require a significant realignment of Icely Road as indicated in Section 2.3.5.3. This would require additional land to be acquired and construction of approximately 200m of road. One option for the realignment would require the relocation of the eastern section of Icely Road to the north of the residence at 261 Icely Road, with adverse impacts on the visual and noise amenity and privacy of that residence. The alternative realignment would require the western section of Icely Road to be relocated to the south. The slope of that section of the realigned road would be potentially as much as 1:10 (V:H). This would make construction of the realigned road difficult and costly and would result in a steep climb or decent for motorists using Icely Road.

As a result, Council resolved to that in light of the volume of traffic using Icely Road, the potential for adverse impacts on the residence at 261 Icely Road and the costs associated with construction of the alternative intersection, that construction of such an intersection would be deferred until such time as the traffic volume on Icely Road increased substantially or funding becomes available.



5.2.3.5 Mitchell Highway Intersection

Council has instigated a number of discussions with the RTA in relation to the proposed road and its intersection with the Mitchell Highway. The RTA has indicated that the existing Mitchell Highway route via Summer Street would remain the designated highway for the foreseeable future. In addition, it is noted that while the proposed road would divert a significant proportion of through traffic away from the existing highway, approximately 85% of west-bound traffic and approximately 99% of east-bound traffic on the highway would continue past the intersection with the proposed road (see **Figures 2.16 to 2.19**). As a result, traffic on the Mitchell Highway will be required to have priority over traffic using the proposed road.

Council considered a grade-separated intersection for the intersection of the proposed road and the Mitchell Highway as described in Section 2.3.5.4. Such an intersection would have the advantage of allowing west-bound traffic wishing to access the proposed road to do so without slowing or giving way to oncoming traffic. This would reduce the travel time for through traffic using the proposed road and would reduce the potential for traffic incidents at the intersection.

Such an intersection, however, would cost considerably more than the proposed T-intersection. As a result, Council resolved to construct the proposed intersection, including the alignment of the proposed road between Dairy Creek and the highway, in such a manner that the intersection can be realigned or reconstructed in the future to incorporate a grade-separated intersection in the event that funding becomes available.

5.2.4 The "Do Nothing" Approach

The alternative of Council not proceeding with the construction of the proposed road and completion of the North Orange By-pass would result in the following.

- By 2019 daily traffic levels in Summer Street would approach 27 100 vehicle movements per day (NTPE, 2004). If the proposed road were not constructed, the opportunity to significantly reduce this figure would be foregone.
- The time taken for motorists to travel through Orange would progressively increase and the opportunity would be foregone to reduce that travel time.
- The benefit of the existing Northern Distributor Road would not be fully realised and that road would remain a road principally used by local traffic.

5.3 EVALUATION OF THE PROPOSAL

5.3.1 Introduction

This sub-section evaluates the proposal to construct and operate the proposed road by drawing together and reviewing the full range of positive and negative predicted residual impacts, including cumulative impacts previously discussed in Section 4 of this document.



5.3.2 Impacts on the Biophysical Environment

5.3.2.1 Noise and Vibration

Council would implement the following noise and vibration management and mitigation measures.

- Prepare an *Environmental Management Plan* (EMP) which would include measures that would be implemented to address construction noise-related issues.
- Undertake construction activities between 7:00am and 6:00pm Monday to Friday and 8:00am to 1:00pm Saturday, with no construction activities being undertaken on Sunday or public holidays.
- Undertake the higher noise level activities during the least sensitive times in consultation with the community.
- Construct the proposed noise barriers adjacent to sections of the proposed road as early in the construction stage as possible.
- Undertake noise mitigation works in consultation with the owners of isolated residences not protected by the noise barriers as early in the construction stage as possible.

During construction operations, residents in the vicinity of the proposed road are expected to experience noise levels that would exceed the relevant construction-noise criteria. However, the assessment assumes that all construction equipment would be operating concurrently in a single location at the point closest to the residences in question. In reality, construction equipment is likely to be operating in a range of locations within the construction area and would move around during the day. In addition, the management and mitigation measures identified above would reduce, to the greatest extent possible, construction noise-related impacts.

During construction operations, Council would comply with the recommendations of the RTA in relation to the use of vibratory rollers. As a result, the impact of construction-related vibration would not be significant.

Council would implement the following noise management measures to reduce the impact of noise during the operation of the proposed road.

- Construction noise barriers adjacent to the proposed road.
- Undertake, in consultation with landowners, noise mitigation works at the following residences that would not be protected by the proposed noise barriers.
 - 95 Ophir Road.
 - 261 Icely Road.
 - 23 Cossack Close.

As a result, noise impacts during operation of the proposed road are not anticipated to be significant.



5.3.2.2 Ecology

Three vegetation communities were identified within the road corridor, as follows.

- Invaded Grassland Community.
- Invaded Yellow Box, Apple Box Woodland Community.
- Invaded Creek Community.

The invaded Yellow Box, Apple Box Woodland Community may be considered to be a variant of the Yellow Box, White Box and Blakely's Red Gum Endangered Ecological Community (Box-Gum Woodland EEC) listed under the *Threatened Species Conservation Act 1995* (TSC Act). The Eastern Bentwing Bat was the only threatened flora or fauna species identified within the road corridor.

A total of 43 native trees were identified as occurring within 15m of the centre line of the proposed road, predominantly between Icely Road and the Mitchell Highway.

The ecology assessment concluded that a maximum of 43 native trees would be removed, of which two have high habitat value and two have moderate habitat value, with the remainder having low or nil habitat value. As a result, the limited clearing of native vegetation, together with the revegetation of sections of the road corridor, would be unlikely to have a significant impact on the ecological value of the road corridor. In addition, a detailed test of significance under Section 5A of the TSC Act concluded that the proposed road would not have a significant impact on the Box-Gum Woodland EEC or the Eastern Bentwing Bat. Finally, the ecology assessment concluded that the proposed road would not have a significant impact on fish species, habitat or passage.

5.3.2.3 Air Quality

Potential sources of airborne pollutants include dust generated during construction-related operations and pollutants associated with vehicle emissions during operation of the proposed road.

Council would implement the following air quality management and mitigation measures during construction of the proposed road.

- Develop and implement an EMP, including an Air Quality Management Plan identifying mitigation measures that would be implemented and how each would be applied.
- Minimise the area to be disturbed and undertake progressive revegetation of completed areas.
- Apply water to all disturbed areas and stockpiles to reduce dust emissions.
- Remove any dust, soil or mud deposited on public roads by construction-related vehicles as soon as practicable.



In addition, Council would strictly implement existing management measures to minimise risks associated with naturally-occurring chrysotile asbestos, including the following.

- Assume that all materials to be disturbed during construction operations may contain chrysotile asbestos.
- Ensure all personnel entering the road corridor are appropriately trained and use appropriate protective equipment at all times.
- Erect appropriate signage warning of asbestos risks.
- Provide mechanisms such as wash down areas, tyre washes and gravel beds to ensure potentially asbestos-laden material is not tracked out of the road corridor onto public roads.

The air quality assessment concluded that the proposed management and mitigation measures would minimise, to the greatest extent possible, dust emissions during construction operations. In addition, monitoring of previous construction operations within areas of naturally-occurring asbestos using the proposed management measures have not detected a single fibre of chrysotile asbestos. Finally, air quality-related impacts associated with the operation of the proposed road are anticipated to be significantly less than the relevant air quality goals.

5.3.2.4 Non-Indigenous Heritage

The non-Indigenous heritage assessment identified the following sites of significance in the vicinity of Chinaman's Bend to the north of the Mitchell Highway.

- The Chinaman's Bend Cemetery which is currently fenced but is likely to extend beyond the fenced area, possibly to the north and west.
- The Traveller's Rest Inn which was established in 1847 and is located to the east of the cemetery. The site comprises the ruins of an inn and associated infrastructure.
- The possible site of a Government Stock Station which was established in the 1820s.

The non-Indigenous heritage assessment concluded that the proposed road would not result in any significant adverse impacts to sites of non-Indigenous heritage significance.

5.3.2.5 Indigenous Heritage

The Indigenous heritage assessment did not identify any objects of Indigenous heritage significance with the vicinity of the road corridor and determined that the proposed road would be unlikely to have an adverse impact on such items.



5.3.2.6 Soil Resources

The soils assessment identified the following five soil landscape units within the road corridor.

- Unit A: Byng Soil Landscape – Footslopes.
- Unit B: Byng Soil Landscape – Drainage Flats.
- Unit C: Byng Soil Landscape – Rises.
- Unit D: North Orange Soil Landscape – Hillslopes.
- Unit E: North Orange Soil Landscape – Drainage Depressions and Saddles.

The assessment concluded that each soil landscape unit, with the exception of Unit B, is suitable for stripping and use during rehabilitation and revegetation operations. In addition, Council would implement the following soil management and mitigation measures to maximise the viability of soils during rehabilitation and revegetation operations and to minimise the risks associated with erosion and sedimentation.

- Strip soil material only.
- Soil stockpiles would have slopes of no more than 1:2 (V:H), would be no more than 2m high and would be stabilised if they are to be retained for more than three months.
- Treat all areas with a gradient steeper than 16% or within 20m either side of the top bank of Dairy and Blackman's Swamp Creeks as having a high erosion potential.
- Construct sediment basins, if required, to the appropriate standards.

The soils assessment concluded that there would be no significant soil-related impacts associated with construction and operations of the proposed road.

5.3.2.7 Water Resources

The road corridor lies within the Dairy Creek, Suma Park Reservoir and Blackman's Swamp Creek Reservoir surface waters within the Dairy Creek and Suma Park Reservoir. Catchments flow to the Suma Park Reservoir which forms Orange's water supply. Surface waters within the Blackman's Swamp Creek Catchment flow to Blackman's Swamp Creek and may enter Orange's water supply network via Council's storm water harvesting scheme.

Council would develop and implement an EMP for the proposed road, including an *Erosion and Sediment Control Plan* and a *Hydrocarbon Management Plan*. As a result, the water resources assessment concluded that there would be no significant adverse surface water or groundwater-related impacts associated with the construction and operation of the proposed road.



5.3.2.8 Visual Amenity

Council would implement the following visual amenity management and mitigation measures.

- Establishment of grass on all fill batters, most cut batters and road verges.
- Planting of a range of shrubs on the slopes of any noise barriers and in other areas of the road corridor.
- Planting of native trees at selected locations within the road corridor.
- The erection of non-reflective/attractive fencing (eg. wood palings) on the top of the earth mounds as part of the noise barriers.

The visual assessment concluded that residences close to the road corridor would have low level views of the road and that construction of the proposed noise barriers would, to a large extent obscure the proposed road and vehicles using it. In addition, residences located further from the road corridor in elevated locations would have more distant views of the proposed road and road-side plantings would progressively shield residences from the views of the proposed road.

5.3.3 Impacts on the Social and Economic Environment

The proposed road and North Orange By-pass, once complete, is anticipated to have the following benefits for motorists, both those passing through Orange and those travelling within the City.

Traffic travelling from the eastern end of the By-pass, once complete, to the Molong Road or Escort Way would save approximately 3 minutes and 40 seconds and 2 minutes and 7 seconds respectively. These time savings would be reduced further should the alternative grade-separated Ophir Road intersection be constructed.

An analysis of the performance of each of the proposed intersections indicates that the level of service for each of the proposed intersection may be classified as excellent or very good.

Finally, the number of heavy vehicle movements on Summer Street would be expected to decrease by approximately 400 movements per day following opening of the proposed road. In addition, the number of light vehicle movements would be anticipated to be significantly reduced.

In addition to the identified traffic-related benefits, the proposed road and the North Orange By-pass, once complete would have additional benefits of increasing the amenity of the CBD through a reduction in the number of vehicles using Summer Street and providing additional opportunities for development of the principal retail area within the City



5.4 ECOLOGICALLY SUSTAINABLE DEVELOPMENT

5.4.1.1 Introduction

Sustainable practices by industry, all levels of Government and the community are recognised to be important for the future prosperity and well-being of the world. Schedule 2(6) of the *Environmental Planning and Assessment Regulation 2000*, requires an environmental impact assessment process to evaluate projects in terms of the principles of Ecologically Sustainable Development (ESD). The principles of ESD have been recognised for over a decade were based upon meeting the needs of the current generation while conserving our ecosystems for the benefit of future generations. In order to achieve sustainable development, recognition needs to be placed upon the integration of both short-term and long-term environmental, economic, social and equitable objectives.

Throughout the design of the Project, Council has endeavoured to address each of the sustainable development principles. The following sub-sections draw together the features of the Project that reflect the four principles of sustainable development, namely:

- the precautionary principle;
- the principle of social equity;
- the principle of the conservation of biodiversity and ecological integrity; and
- the principle for the improved valuation and pricing of environmental resources.

5.4.1.2 The Precautionary Principle

The two main issues relevant to the application of the precautionary principle relate to the need to avoid serious or irreversible damage and the need to reduce risks of environmental harm.

The evaluation of the operation and construction of the proposed road has been conservative in its assumptions in seeking to avoid serious and irreparable damage to the surrounding environment. For the purposes of preparing the EIS, a detailed understanding of the surrounding environment has been gained from available literature and a range of site-specific studies which has assisted Council to ensure the design of proposed road does not cause any severe or irreparable damage.

Examples of matters relating to the precautionary principle that were considered during the design of the proposed development are described below.

- A targeted and detailed assessment of those aspects of the environment that were considered to be a risk of potential adverse impacts was undertaken and the results of the assessments used to inform the design of the road.
- A comprehensive consultation program was undertaken to ensure that all issues relevant to stakeholders were identified and addressed in the design of the proposed road. This consultation resulted in the design of the intersection at Ophir Road being amended and alternative designs for the Ophir Road, Icely Road and Mitchell Highway intersections being prepared.



- Council has committed to prepare an Environmental Management Plan (EMP) prior to commencement of construction operations. The plan would include detailed measures to manage and mitigate against potential noise, air quality, surface water, erosion and sedimentation and hydrocarbon-related impacts associated with construction of the proposed road.

5.4.1.3 Social Equity

Social equity embraces value concepts of justice and fairness so that the basic needs of all sectors of society are met and there is a fair distribution of costs and benefits to improve the well-being and welfare of the community. Social equity includes concerns for both inter- and intra-generational equity.

Advancement of intra- and inter-generational equity would be achieved with the construction of the proposed road as it would have long term benefits for both present and future generations by providing improved access and safer travelling conditions. The proposed road, if constructed, would not affect the health, diversity and productivity of the environment to the detriment of either present or future generations.

5.4.1.4 Conservation of Biological Diversity and Ecological Integrity

The protection of biodiversity and maintenance of ecological processes and systems are central goals of sustainability. It is important that developments do not threaten the integrity of these processes and systems as a whole or the conservation of threatened species in the short or long term. Indeed, it is noted that road reserves provide one of the few areas where native vegetation, including species comprising the Box-Gum Woodland EEC, are able to become established in the absence of grazing by domestic stock.

Conservation of biological diversity and ecological integrity of the road corridor and surrounding areas would not be affected by the construction and operation of the proposed road. Considerable research has been undertaken relating to the existing environment and Council contends that the proposed road has been designed to meet sustainability goals.

5.4.1.5 Improved Valuation and Pricing of Environmental Resources

The main issues that form the basis of this principle relate to an acceptance that the polluter pays, all resources are appropriately valued, cost-effective environmental stewardship is adopted and the adoption of user pays prices based upon the full life cycle of the costs.

The reflections of these issues upon components of the proposed road would be addressed in the EMP prior to the commencement of any construction activities.

5.4.1.6 Conclusion

The design of the proposed road and proposed measures to mitigate impacts of the construction and operation of the road have addressed each of the sustainable development principles, and on balance, it is concluded that the proposed road achieves a positive sustainable outcome for the local and wider environment.



5.5 JUSTIFICATION OF THE PROPOSAL

This sub-section justifies the proposal against the objectives identified in Section 2.1.1

Council contends that the proposed road would achieve the following.

- Provide the community of Orange and other road users with a safe and efficient alternative route to allow travel between the eastern, northern to the western sections of the City and visa versa.
- Provide traffic passing through Orange with an alternative, more efficient travel route than the existing Mitchell Highway route via Summer Street.
- Provide a more efficient access from the Clergate and Narrambla Industrial Areas to the Mitchell Highway and important markets and suppliers to the east and west of Orange, without the need to use Phillip Street, Leeds Parade, William Street or those sections of the Mitchell Highway in urban areas.
- Reduce the daily number of heavy and other vehicles that pass through the centre of the City, particularly along Summer Street.
- Provide an additional vehicular crossing of Blackman's Swamp Creek to service the residential and industrial growth areas in the northern sections of Orange.
- Remove oversize and offensive vehicles and those carrying dangerous or hazardous goods from urban areas.

5.6 CONCLUSION

The construction and operation of the proposed road has been designed with an emphasis upon demonstrating that changes to the existing noise levels, air quality, water quality and visual amenity and satisfy relevant goals or realistic community expectations. The substantial investigations and community consultation undertaken during the preparation of the EIS have enabled Council to progressively implement a range of design and operational safeguards and management procedures consistent with recognised environmental practice to achieve a high standard of environmental performance.

This document and the range of specialist consultant studies undertaken have identified that the construction and operation of the proposed road should proceed as it would:

- have long term benefits for current and future generations by providing improved access and safer travelling conditions;
- have an acceptable impact on the biophysical, social and economic environment surrounding the road corridor; and
- satisfy sustainable development principles.



Section 6

References

Preamble

This section records the documents referred to in this EIS including relevant websites and the various reports prepared by the Specialist Consultants that are incorporated in the Specialist Consultant Studies Compendium that accompanies this EIS.



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Section 7

Glossary of Technical Terms, Acronyms & Symbols

Preamble

This section provides readers with a brief explanation of a number of the technical terms used throughout this document. Acronyms and symbols used throughout the document are also explained.



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TECHNICAL TERMS

A horizon – top of a soil profile

A-weighted – an electronic filter having the frequency response corresponding approximately to that of human hearing.

acceleration lane – a lane used for increasing speed before merging with the through lanes.

acid – substance with a pH less than 7.0; the lower the pH, the higher the corrosive ability of the substance.

acoustical shielding – a natural or artificial structure (e.g. a hill or a bund) that inhibits the transmission of sound.

acoustics – the science of sound and vibration.

adverse weather conditions (in respect of noise and dust) – conditions, such as high wind, that assist the movement of dust or low winds that propagation of noise away from a noise source towards receptors.

aerial photographs – photographs of landscape taken from a plane (typically areas several kilometres across) used for the surveying and interpretation of vegetation type, geology, land use, etc.

aesthetic significance – an item/area having visual or sensory appeal, landmark qualities and/or creative or technical excellence.

air pollutant - a substance in ambient atmosphere, resulting from the activity of man or from natural processes, causing adverse effects to man and the environment (also called "air contaminant").

air pollution - presence of air pollutants both man-made and natural causes.

alkaline – having a pH greater than 7.0.

ambient air quality – the quality of the ambient air near ground level, expressed as concentrations or deposition rates of air pollutants – also expressed as existing air quality.

ambient level – existing level of a phenomenon without the influence of the proposal.

ambient monitoring – monitoring of conditions outside the active project area (e.g. noise levels, water quality parameters).

amenity – the desirability of an area.

amphibians – animals (such as frogs) adapted to live both on land and in water.

anthropogenic – affected by, or relating to, human beings.

aquatic – pertaining to water.

aquifer - rock or sediment capable of holding and transmitting groundwater.

arboreal – pertaining to tree habitats.

archaeology – the scientific study of human history, particularly the relics and cultural remains of the distant past.

artefact – anything made by human workmanship, particularly by previous cultures (such as chipped and modified stones used as tools).

arterial road – principle avenues of urban traffic movement characterised by heavy and continuous traffic flow during peak periods.

asphaltic concrete – road capping material which is a blend of crushed rock and sand, bound by bitumen to provide a road seal and wear surface.

atmospheric stability - a measure of turbulence which determines the rate at which the effluent is dispersed as it is transported by the wind.

attenuation – reduction in sound pressure levels between two locations.

average annual daily traffic (AADT) – unit of assessment of traffic flow along a road.

average annual rainfall – the average amount of rain to fall at a specific location over the period of 1 year (measured in millimetres).



B horizon – subsoil material located below the A horizon material and above the parent rock.

background – the conditions (e.g. noise levels, bird populations) already present in an area before the commencement of a specific activity.

background level – the concentration (deposition) level of a pollutant which must be added to the concentration (deposition) level of the modelled sources in order to obtain a total.

background dust level – dust level in the absence of an activity.

background noise levels - the level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation. **backhoe** – a machine designed for small-scale excavation work.

backhoe refusal – the depth at which a backhoe is unable to excavate deeper due to the hardness of the ground.

basalt – fine-grained, dark volcanic igneous rock.

Base course – road material placed on sub-base to receive bitumen seal.

baseline data – a body of information collected over time to define specific characteristics of an area (e.g. species occurrence or noise levels) prior to the commencement of an activity; baseline data allows any impacts arising from the activity to be identified by comparison with previously existing conditions.

baseline monitoring – monitoring performed prior to site development.

basement rock – unweathered rock lying below the soil and weathering profile.

batter – an earth slope formed from placed fill material or cut into the natural hillside, during road construction.

bcm – bank cubic metre – a volume of 1 m³ in the ground prior to disturbance.

bedrock – unweathered rock lying below the soil and weathering profile.

benchmark site – a site that serves as a scientific reference point from which the extent of changes to natural systems as a result of human activity can be measured.

best management practice – the most effective actions which minimise human impact on the environment.

biodiversity – the full range of living things and the ecosystem in which they live.

biological diversity/biodiversity – a concept encompassing the diversity of indigenous species and communities occurring in a given region; biological diversity includes genetic diversity, which is the diversity of genes and genotypes within each species; species diversity, which is the variety of living species; and ecosystem diversity which is the diversity of the different types of communities formed by living organisms and the relations between them.

biomass – the quantity of living material present at a given time within a given area. Synonymous with standing crop, stock and standing stock.

bore – a well, usually of less than 20 cm diameter, sunk into the ground and from which water is pumped.

bulk density – for aggregate is the mass in the air of surface-dry particles divided by the saturated by surface-dry volume.

bulldozer – an item of tracked mobile earth moving equipment fitted with a front blade and with rear rippers used for pushing and ripping soil and rock.

bund wall – a man-made earth mound used to visually and acoustically screen nearby receivers.

catch drains – drains used to intercept and redirect runoff.

catchment area - the area determined by topographic features within which rainfall will contribute to runoff at a particular point.

channel – river or irrigation channel, includes bed and bank.



clay – very fine-grained sediment or soil (often defined as having a particle size less than 0.002 mm (2 microns) in diameter).

colonise – to establish a species in an area in which it was not previously found.

collector roads – connect the local road system in built up areas to freeways, arterial and sub-arterial roads.

community – a combination of plants that are dependant on their environment and influence one another and modify their own environment. They form together, with their common habitat and other associated organisms, an ecosystem, which is also related to neighbouring ecosystems and to the macroclimate of the region.

compaction – the process of close packing of individual grains in a soil or sediment as a response to pressure.

compactor – an item of steel wheeled earthmoving equipment usually fitted with a front blade, used to spread and compact soil and rock.

competent rock – rock having substance strength characteristics requiring significant energy to dislodge or fracture.

concentration – the amount of a substance, expressed as mass or volume, in a unit volume of air.

concentration of runoff – the channelling of runoff over a wide area into a narrower flow with greater depth and/or velocity.

concrete – mixture of gravel, cement, etc. for use in building.

concrete aggregate – gravel and sand mix combined with cement and water to make concrete.

confluence - junction of streams.

conglomerate – sedimentary rock consisting of poorly sorted grains (typically pebbles surrounded by finer material, such as sand or silt).

contaminant – a chemical compound or element which has been introduced as a result of human activity. It is noted, however, that some chemical compounds

and elements also occur naturally in water and sediments.

contingency procedures – procedures put in place to handle an event considered unlikely to occur.

contour bank - an earth bank constructed across a slope parallel to contours.

contractor – specialist brought in to perform a specific task, such as the construction of a bridge, road or some form of infrastructure.

conversion factor – a factor used to convert one quantity (e.g. conductivity) into another quantity (e.g. salinity).

cross-section – a two-dimensional diagram of an object presented as if the object had been cut along its length.

culvert – large pipe or channel carrying water underneath a structure (e.g. a road or railway track) or underneath the ground.

cumulative – increasing by successive additions.

cut- material excavated typically from a road excavation to reach the preferred final level.

cut-off drains – drains constructed to divert upslope runoff around disturbed areas.

dB(A) – decibels, A-weighted scale; unit used for most measurements of environmental noise; the scale is based upon typical responses of the human ear to sounds of different frequencies.

deceleration lane – a lane used for decreasing speed before leaving a road.

detection limit – the smallest concentration of a substance that an analytical procedure can accurately and precisely detect.

dip - the angle that rock strata make with a horizontal surface measured at right angles to the strike.

dispersibility - a characteristic of soils relating to their structural breakdown in water into individual particles.



dispersion model – a set of mathematical equations relating to the release of air pollutant to the corresponding concentrations in the ambient atmosphere or deposition on the surface.

dispersion parameters – the parameters which describe the growth of the dimensions of a Gaussian plume as a function of travel distance of travel time.

disseminated – spread widely, diffused.

distribution of species – the entire area in which a population of a species, subspecies or other taxon is found.

diversion bank – an earth bank constructed to divert water away from disturbed areas.

drainage grading works – earthmoving and levelling activities to carefully regulate drainage (e.g. from topsoil stockpiles).

drainage line – a passage along which water concentrates and flows towards a stream, drainage plain or swamp intermittently during or following rain.

drainage structures – artificial structures to control and direct drainage and prevent erosion or flooding.

drilling – the action of boring holes (usually less than 30 centimetres in diameter and up to several kilometres deep) into the ground, typically to establish a water bore or to investigate the geology found at depth.

dust - particles of mostly mineral origin generated by erosion of surfaces and the mining and handling of materials.

dust concentration – the amount of a substance, expressed as mass or volume, in a unit volume of air.

dust gauge – instrument set up to record the rate of deposition of dust.

dust suppressant – any substance used to prevent dust disturbance.

EC - electrical conductivity.

ecology – the relationship between living things and their environment.

ecologically sustainable development (ESD) – using, conserving and enhancing the community's resources so that ecological processes on which life depends are maintained and the total quality of life, now and in the future can be increased.

ecosystem - the totality of biological processes and interactions within a specified physical environment.

electrical conductivity (EC) – the ability of a substance (either solid, liquid or gas) to transmit electricity.

element – a substance consisting entirely of atoms of the same atomic number (e.g. oxygen, carbon, gold).

Elliot trap – a baited cage used in fauna surveys to capture small animals.

emission – a discharge of a substance (e.g. dust) into the environment.

endangered ecological community –

environment – a general term for all the conditions (physical, chemical, biological and social) in which an organism or group of organisms (including human beings) exists.

environmental constraints - limitations on a project by components of the environment.

Environmental Impact Statement (EIS) – a formal description of a project and an assessment of its likely impact on the physical, social and economic environment. It includes an evaluation of alternatives and an overall justification of the project. The EIS is used as a vehicle to facilitate public comment and as the basis for analysing the project with respect to granting approval under relevant legislation.

environmental planning – planning that places emphasis on the possible environmental impacts of a development.

ephemeral – not permanent, e.g. a stream that flows only seasonally or after rainfall or a lake that periodically dries out.

erodibility – the tendency of soil, earth or rock to erode.



erosion – the wearing away of the land surface (whether natural or artificial) by the action of water, wind and ice.

erosion hazard – the susceptibility of a parcel of land to the prevailing agents of erosion. It is dependent on a combination of climate, landform, soil, land use and land management factors.

erosion risk – the intrinsic susceptibility of a parcel of land to the prevailing agents of erosion. Note that determination of erosion risk differs from that of erosion hazard in that land management factors are ignored.

evaporation – the loss of water as vapour from the surface of a liquid that has a temperature lower than its boiling point.

excavate – to dig into natural material or fill using an excavator or other machinery.

excavator - item of earthmoving equipment fitted with a bucket on an articulated boom and used for digging material from a face in front of, or below the machine. An excavator would be used around the perimeter of the lakes.

existing air quality – the quality of the ambient air near ground level, expressed as concentrations or deposition rates or air pollutants – also expressed as ambient air quality.

exotic - introduced or foreign, not native.

extinction – the extinction of a species occurs when the entire population of the species (across the world) has died out.

fallout – the sedimentation of dust or fine particles in the atmosphere.

fauna – a general term for animals (birds, reptiles, marsupials, fish etc.) particularly in a defined area or over a defined time period.

fill – material imported and emplaced to raise the general surface level of a site.

finer – material such as clay or silt sized particles.

flake – a piece of stone detached from a core, displaying a striking platform, bulb of percussion and flake scars on the ventral surface.

flaked piece – stone that has flake scars on its ventral surface but has been broken so it does not display other characteristics of a flake, i.e. the striking platform and bulb of percussion.

flora – plants including trees, shrubs, grasses and herbs.

fresh rock – rock unaffected by natural weathering processes.

friable – easily crumbled as in poorly cemented rocks.

front-end loader – machine used to lift and place soil, earth, rocks, etc. on a construction site.

fugitive emissions – emissions not entering the atmosphere from a stationary vent (stack). Examples of fugitive dust sources include vehicular traffic on unpaved roads, handling of raw materials, wind erosion of dusty surfaces, etc.

gabion - a wire basket filled with coarse rock - usually used to prevent erosion.

gabion wall – a wall constructed of large wire baskets usually filled with rocks.

grader – an item of earthmoving equipment, rubber tyred and fitted with a centrally mounted blade and rippers used to shape and trim the ground surface.

gradient – rate of change of a given variable (such as temperature or elevation) with distance.

grassland – an extensive area of largely treeless land covered mainly by natural grasses.

gravel – particles with a maximum diameter exceeding 2mm.

grazing capability – the maximum amount of stock able to be maintained on a given area of land.



groundcover – vegetation that grows close to the ground (such as grasses and herbs) providing protection from erosion.

groundwater – all waters occurring below the land surface; the upper surface of the soils saturated by groundwater in any particular area is called the water table.

habitat – the place where an organism normally lives; habitats can be described by their floristic and physical characteristics.

heavy vehicle – term used in traffic assessments to describe vehicle classes 3-12 (all trucks, buses, B Doubles etc).

heritage – the things of value which are inherited.

heritage significance – of aesthetic, historic, scientific, cultural, social, archaeological, natural or aesthetic value for past, present or future generations.

heritage study – a conservation study of an area. The study usually includes historical context report, an inventory of heritage items within the area and recommendations for conserving their significance.

highly weathered rock – rock affected by considerable weathering to the extent that it is friable.

homogeneous – composed of parts all of the same kind or nature.

in-situ – a term used to distinguish material (e.g. rocks, minerals, fossils, etc.) found in its original position of formation, deposition, or growth, as opposed to transported material.

indicator – any physical, chemical, or biological characteristic of the environment used to assess (i.e. indicate) environmental condition.

indigenous – belonging to, or found naturally in, a particular environment (see also exotic).

infiltration – the process of surface water soaking into the soil.

inter-generational equity – the principle that the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

inversion - generally used in meteorology with respect to an increase of temperature with height in contrast with the usual decrease of temperature with height in the troposphere. An inversion layer is distinguished by its large stability, which limits the turbulence and therefore the dispersion of pollutants.

landform – a specific feature of a landscape (such as a hill) or the general shape of the land.

light vehicle – term used in traffic assessments to describe vehicle classes 1 and 2 (cars and small utilities etc.).

lithology – refers to the general characteristics of sediments.

loam - loose soil composed of clay and sand, especially a kind containing organic matter and of great fertility.

Local Environmental Plan (LEP) - a plan developed by a council to control development in part or all of their local government area.

mammal – animal of the class mammalia, distinguished by the presence of hair and mammary glands.

metamorphosed rocks – rocks changed from their composition and/or texture by heat and pressure.

migratory – passing, usually predictably (based on aquatic species), from one region or climate to another, for purposes of feeding, breeding, or other biological purposes.

mitigation measures – measures employed to reduce (mitigate) an impact (such as the construction of a perimeter bund to reduce sound emissions).

mobile equipment - wheeled or tracked self propelled equipment such as trucks and front-end loaders.



monitoring - the regular measurement of components of the environment to establish environmental standards are being met.

mulch - straw, leaves, loose earth, etc. spread on the ground to protect the roots of newly planted trees, crops, etc.

natural – existing in, or formed by, nature (generally excludes anything obviously modified by human beings).

natural heritage – is the dynamic ecological processes, ongoing natural evolution and the ability of ecosystems to be self-perpetuating.

noise barrier– an earthen mound and/or wall constructed to reduce noise impact of activities.

noise contours – theoretical lines connecting points of equal noise value.

nuisance dust – relatively large dust particles which settle out – not detrimental to health.

operational constraints - limitations upon a project by equipment or machinery.

particle size distribution – the relative proportions of particles (e.g. in a sediment) that fall within specific size categories.

particulate matter - small solid or liquid particles suspended in or falling through the atmosphere - sometimes expressed by the term particulates.

perennial - refers to stream which has flow throughout the year.

permeability - a material property relating to the ability of the material to transmit water.

pH – a measure of the degree of acidity or alkalinity of a solution; expressed numerically (logarithmically) on a scale of 1 to 14, on which 1 is most acid, 7 is neutral acid, and 14 is most basic (alkaline).

plant communities – groupings of plants that inhabit the same area.

pollution – the alteration of air, soil, or water as a result of human activities such that it is less suitable for any purpose for which it could be used in its natural state.

population – a group of organisms all of the same species occupying a particular area.

precautionary principle – a principle of ESD which states that decisions about any proposed development should be guided by careful management to avoid serious and irreversible damage to the environment.

precipitation – natural water phenomena producing quantities of water measurable by standard methods (e.g. rainfall, snow).

progressive rehabilitation – rehabilitation of mine or disturbed areas as soon as practicable after they are released during the life of the mine.

quadrat – a square survey area.

quantify – to determine the quantity or amount of a component in a substance.

receptor – a designated place at which an impact may occur (e.g. a dwelling).

Regional Environmental Plan (REP) - a plan prepared by the State Government Department responsible for planning where controls on development are considered on a regional and/or statewide basis.

rehabilitation - the preparation of a final landform after disturbance and its stabilisation with grasses, trees and shrubs.

reptiles – cold-blooded vertebrates, including lizards, snakes, turtles, and crocodiles.

revegetated – an area that has been planted with trees, bushes and grasses after being disturbed.

riparian – pertaining to or situated on the bank of a river or creek.

ripping - breaking up of ground with a bulldozer using an action similar to a rake.

road base – road pavement usually made up of densely graded crushed rock in varying sizes.

road grades – the longitudinal slope of the road surface commonly expressed in per cent gradient (i.e. 10 per cent is a gradient of 1 vertical in 10 horizontal).



runoff – that portion of the rainfall falling on a catchment area that flows from the catchment past a specified point.

saline – water with high salt concentration.

scraper – irregularly shaped artefact that has been modified in a manner that suggests use in scraping activities, notably woodworking.

scour – erosional feature.

sealing aggregate – crushed rock usually of uniform size bonded by bitumen on the surface of the road to form a wear surface.

sedimentation – process or rate of depositing of sediment.

sedimentation dam – an earth embankment constructed so as to catch surface runoff and thus allow sediment carried to be deposited by reduction in runoff velocity.

setting pond – an artificially constructed pond designed to allow particulate matter to settle out of water.

sheet erosion – the removal of a fairly uniform layer of soil from the land surface by raindrop splash and/or runoff. No perceptible channels are formed.

silt – a classic sediment, most of the particles of which are between 0.063mm and 0.004mm in diameter.

silt-traps – structure designed to trap silt and sediment.

soil erosion hazard – the susceptibility of an area of land to erosion and includes rainfall erosivity, slope, soil erodibility and cover.

species diversity – a measure of the number of different species in a given area.

stands of vegetation – trees and bushes that are grouped together.

stockpile – a pile used to store material (such as low-grade ore) for future use.

stripping – removal of vegetation and topsoil.

structure (soil) – the physical texture of the soil arising from the interrelationship between the grain size, composition, and organic nature of a soil.

sub base – road material between natural surface and base course gravel.

subcatchment – a smaller area within a catchment drained by one or more tributaries of the main waterbody.

subsoil – the layer of soil lying below the topsoil; usually contains less organic matter and is less fertile.

surface waters – all water flowing over, or contained on, a landscape (e.g. runoff, streams, lakes etc).

suspended solids – solids held in suspension by the turbulent flow of a fluid.

temperature inversion - an increase in air temperature with height.

temporal - related to time.

terrestrial – of or relating to the land, as distinct from air or water.

topography – the physical relief and contour of a region.

topsoil – the upper layer of soil, usually containing more organic material and nutrients than the subsoil beneath it.

tributary – a stream or river that flows into a larger river or lake.

turbidity – the optical property of water that prevents light from being transmitted; turbidity or muddiness is caused by the presence of very fine suspended matter such as clay or organic matter.

undulation – the gentle rise and fall or wave-like structure of a landscape.

vegetated – covered with plants.

vertebrate fauna – animals with a backbone or spinal cord, includes mammals, birds, reptiles, amphibians and fishes.

vibration – oscillating movement.

visual amenity – attractiveness to the eye.



volcanics – a general term applied to rock types of volcanic origin (e.g. basalt).

water quality criteria – generally refers to numeric levels specified for key water quality variables, such as dissolved metals or pH, which can be measured to determine the suitability of water for human consumption, supporting aquatic life, etc.

water table – the upper limit of the saturated zone within a rock mass, generally at atmospheric pressure. It is characteristic of unconfined aquifers.

watercourse – stream or river, running water.

weathered rock – rock affected to any degree by the processes of chemical or physical weathering.

weathering – the group of processes (e.g. action of air, rain, water etc.) change in character, decay and eventually crumble to soil.

weed – any plant (in particular an herbaceous one) that survives in an area where it is harmful or troublesome to the desired land use.

wetland – a low-lying area regularly inundated or permanently covered by shallow water.

wildlife – non-domesticated fauna.

wildlife corridor – a strip of vegetation that has a design purpose of allowing animals to pass from one area to another and acting as an undisturbed area for wildlife preservation.

wind direction – the direction from which the wind, averaged over a certain period of time, is blowing.

wind rose – diagrammatic representation of wind direction, strength, and frequency of occurrence over a specified period.

woodland – plant communities dominated by trees whose crowns shade less than 30% of the ground.



ACRONYMS

AADT	Average Annual Daily Traffic	EMP	Environmental Management Plan
ABS	Australian Bureau of Statistics	ENMM	Environmental Noise Management Manual
AHD	Australian Height Datum; in metres	EP&A Act	Environmental <i>Planning and Assessment Act 1979</i> (NSW)
AHIMS	Aboriginal Heritage Information Management System	EPA	Environment Protection Authority (NSW) (Incorporated into DECC)
ANZECC	Australian and New Zealand Environment and Conservation Council	EPBC Act	<i>Environment Protection & Biodiversity Conservation Act 1999 (Commonwealth)</i>
AQMP	Air Quality Management Plan	ESD	Ecologically Sustainable Development
AS	Australian Standard	FM Act	<i>Fisheries Management Act 1994</i>
A-Scale	A sound level measurement scale which approximates what is heard by the human ear.	INP	Industrial Noise Policy
BOM	Bureau of Meteorology	LALC	Local Aboriginal Land Council
BS	British Standard	LEP	Local Environmental Plan
CAMBA	China Australia Migratory Birds Agreement	LGA	Local Government Area
CBD	Central Business District	NATA	National Accredited Testing Association
CORTN	Calculation of Road Traffic Noise	NDR	Northern Distributor Road
DECC	Department of Environment and Climate Change	NEPC	National Environmental Protection Measures
DSRD	Department of State & Regional Development	NHMRC	National Health and Medical Research Council
DGAC	Dense Graded Asphaltic Concrete	NPWS	National Parks and Wildlife Service (Incorporated within DECC)
DoP	Department of Planning	OCC	Orange City Council
DWE	Department of Water and Energy	OGAC	Open Graded Asphaltic Concrete
EC	Electrical Conductivity	OH & S	Occupational Health & Safety
ECRTN	Environmental Criteria for Road Traffic Noise	PM	Particulate Matter
EIS	Environmental Impact Statement	POEO Act	<i>Protection of the Environment Operations Act 1997</i>
		PSA	Particulate Size Analysis



RBL	Rating Background Level
REP	Regional Environmental Plan
RIC	Rail Infrastructure Corporation
RTA	Roads and Traffic Authority
SOE	State of the Environment
SRA	State Rail Authority
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
TEOM	Tapered Element Oscillating Microbalance
TSC Act	<i>Threatened Species Conservation Act 1995</i>
TSP	Total Suspended Particulates
WHO	World Health Organisation
WQMP	Water Quality Management Plan



SYMBOLS

~ - approximately.

°C – degrees Celsius.

% - percentage.

100 year flood limit – predicted extent of a 1 in 100 year flood occurrence.

< - less than.

≤ - less than or equal to.

> - greater than.

≥ - greater than or equal to.

bcm – bank cubic metre – a volume of 1m³ in the ground prior to disturbance.

CO – carbon monoxide

dB - decibels

dB(A) – decibels, A-weighted scale; unit used for most measurements of environmental noise; the scale is based upon typical responses of the human ear to sounds of different frequencies.

g – gram (= 0.001 kilogram).

g/km/hour – grams per kilometre per hour – unit measure for emission rate & pollutants.

g/km/vehicle – gram per kilometre per vehicle – unit measure of vehicle emission rate.

g/m²/month – grams per square metre per month unit for deposited dust.

ha – hectare (100 m x 100 m).

H_z – Hertz unit of frequency

km – kilometre (= 1 000 metres).

km² – square kilometres.

km/h – kilometres per hour.

L_{A10} – sound level exceeded 10 per cent of the sampling time.

L_{A90} – sound level exceeded 90 per cent of the sampling time.

L_{Aeq} – the L_{Aeq} is the “equal energy” average noise levels, and is used in some instances for the assessment of traffic noise effects or the risk of hearing impairment due to noise exposures.

L_{Aeq 1 hour} – the “equal energy” average noise level over 60 minutes – used for assessing impacts of motor vehicles.

L_{Aeq T} – Sound level of continuous noise which emits the same energy as the fluctuation sound over a given time period (T).

L_{Amax} – the absolute maximum noise level measured in a given time interval.

L_{AN} – the A-weighted sound pressure level exceeded by N% of a given measured period.

m – metre.

m AHD – metres Australian Height Datum.

m² – square metre.

m³ – cubic metre.

mg/m³ – milligram per cubic metre – unit for pollutant concentration

mm – millimetre (= 0.001 metres).

NO_x – nitrogen oxide

pH – measurement indicating whether water or soil is acid or alkaline.

PM10 – particulate matter <10µm in diameter.

pphm – parts per hundred million

ppm – parts per million.

TDS – total dissolved solids expressed in mg/L

µg/m³ – microgram per cubic metre – unit measure for pollutant concentration

µm – micron (1 micron=0.001 millimetre).

µS/cm – micro seimens per centimetre.

