14 Noise

14.1 Introduction

Noise is a key issue for the Northern Expressway Project. The study area is generally characterised by very quiet background noise levels due to its predominantly rural setting. This section summarises the existing environmental noise levels, the future predicted noise levels, and the mitigation measures used to reduce noise. The key concerns raised in the community consultation about noise related to the effects of the Expressway on the quiet rural environment, the nature of treatments to address noise and the effects of noise on property values. Noise effects are addressed in this section and in other parts of the report.

For humans, sound has two main characteristics – volume (or intensity) and frequency (pitch). The most common unit for measuring the intensity of sound is the decibel (dB). Since the human ear is not equally sensitive to all parts of the audible frequency range, the decibel scale is modified to take this into account leading to the use of what are described as A-weighted decibels or dB(A).

However, the decibel scale does not bear a simple relationship to apparent loudness. If traffic volumes double along a road, then the amount of noise energy doubles. However, this doubling of the energy only increases the noise level by 3 dB(A), an increase which can just be detected by the ear. For apparent loudness to double there would have to be an increase of 10 dB(A), that is, a ten-fold increase in energy. This would occur, if for example, the number of cars on a road were to increase from 1,000 to 10,000 per day.

Figure 14.1 illustrates the range of generally experienced (unweighted) instantaneous noise levels and some typical sources of these levels.

14.2 Assessment methodology

The noise assessment methodology included:

- monitoring of existing (background) environmental noise levels in the study area
- use of a computer noise model to predict the future traffic noise effect
- identification of the percentage of sensitive receptors predicted to exceed the daytime noise criteria in 2026
- investigation of measures to minimise the effect of construction noise and road traffic noise.

14.3 Legislative and policy requirements

14.3.1 State

Environment Protection Act 1993

The *Environment Protection Act 1993* requires DTEI to have a 'duty of care' in managing road traffic noise. It states that: 'A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practical measures to prevent or minimise any resulting environmental harm.'

The DTEI *Road Traffic Noise Guidelines* (2007) provides the Department's policy on assessing and treating road traffic noise from infrastructure projects involving new roads or major upgrading of existing roads.

14.4 Existing environmental noise

As shown on Figure 14.2, existing environmental noise levels were measured at 30 locations around the project area.

The existing environmental noise can be summarised as follows:

- the majority of residents affected by the proposed Northern Expressway Project currently experience very quiet background noise levels typical of a rural area
- higher background noise levels are experienced by those residents closer to the existing road network where there is significant traffic volume.

Noise catchment areas

Figure 14.2 shows the eight noise catchment areas identified for the project. The catchment areas were established to analyse areas with similar existing noise exposure.

Table 14.1 provides the median ambient noise levels for each noise catchment area.

Table 14.1
Median ambient noise levels for each noise catchment area in dB(A)

Catchment area	Description	Total receptors in catchment	Daytime $L_{Aeq, 15h}$	Night time $L_{Aeq, 9h}$
A	< 500 m Main North Road	139	58	57
B	< 500 m Two Wells Road	41	55	53
C	Hillier/Gawler River	16	51	43
D	< 500 m Angle Vale Road	12	50	50
E	Macdonald Park/Andrews Farm/Munno Para	56	49	46
F	< 500 m Heaslip Road	11	67	64
G	Virginia/Penfield	31	58	54
H	< 500 m Port Wakefield Road	185	61	60

Notes:

- *Daytime is the 15 hour period between 7 a.m. and 10 p.m.*
- *Night time is the 9 hour period between 10 p.m. and 7 a.m.*
- *The Port Wakefield catchment is discussed further in Part E, Section 29.*
-

Aircraft noise

The study area includes two aerodromes, the RAAF Base Edinburgh and the Gawler gliding field. Aircraft operations in the air and on the ground contribute to the ambient noise levels for the areas immediately surrounding the aerodromes.

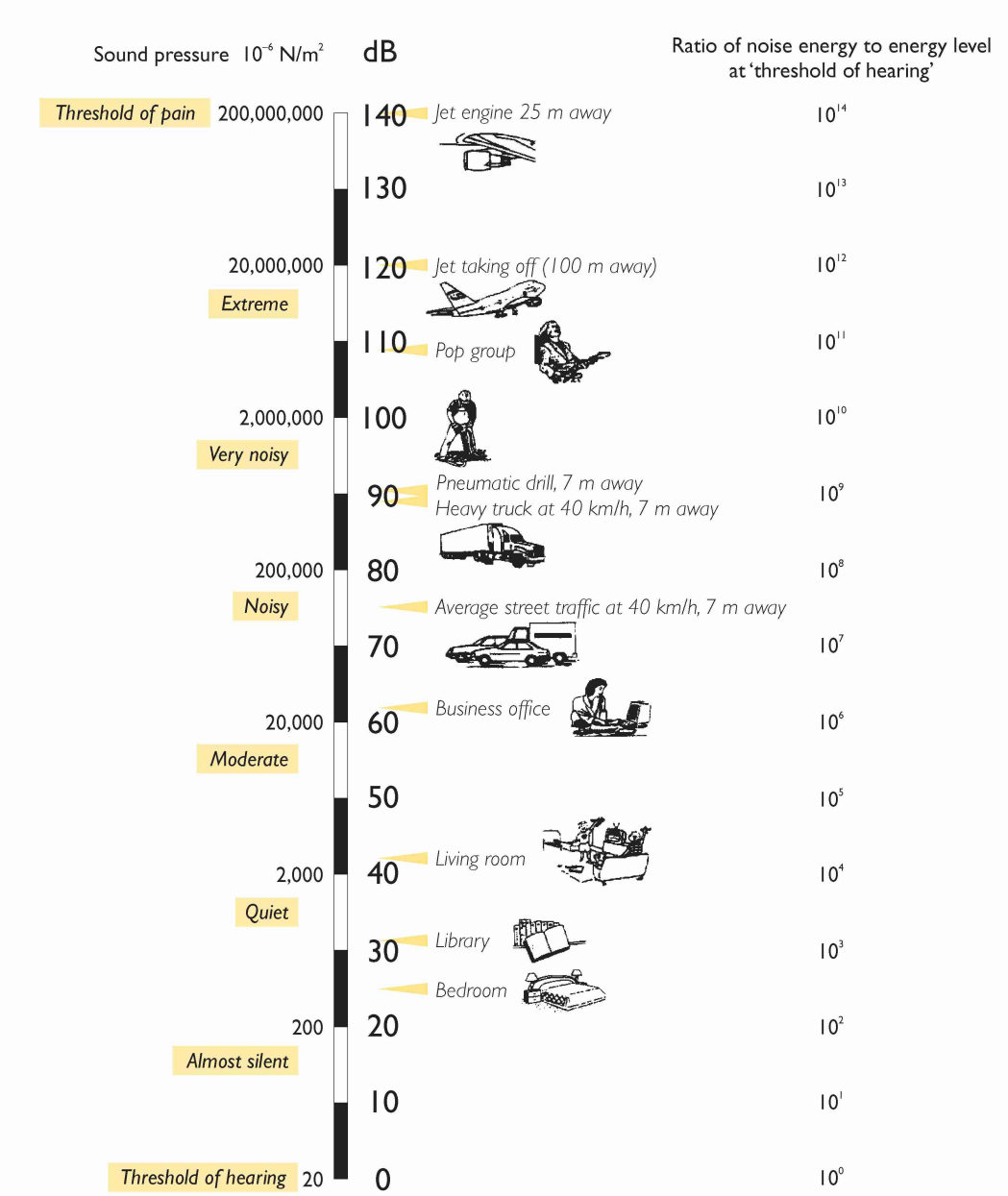
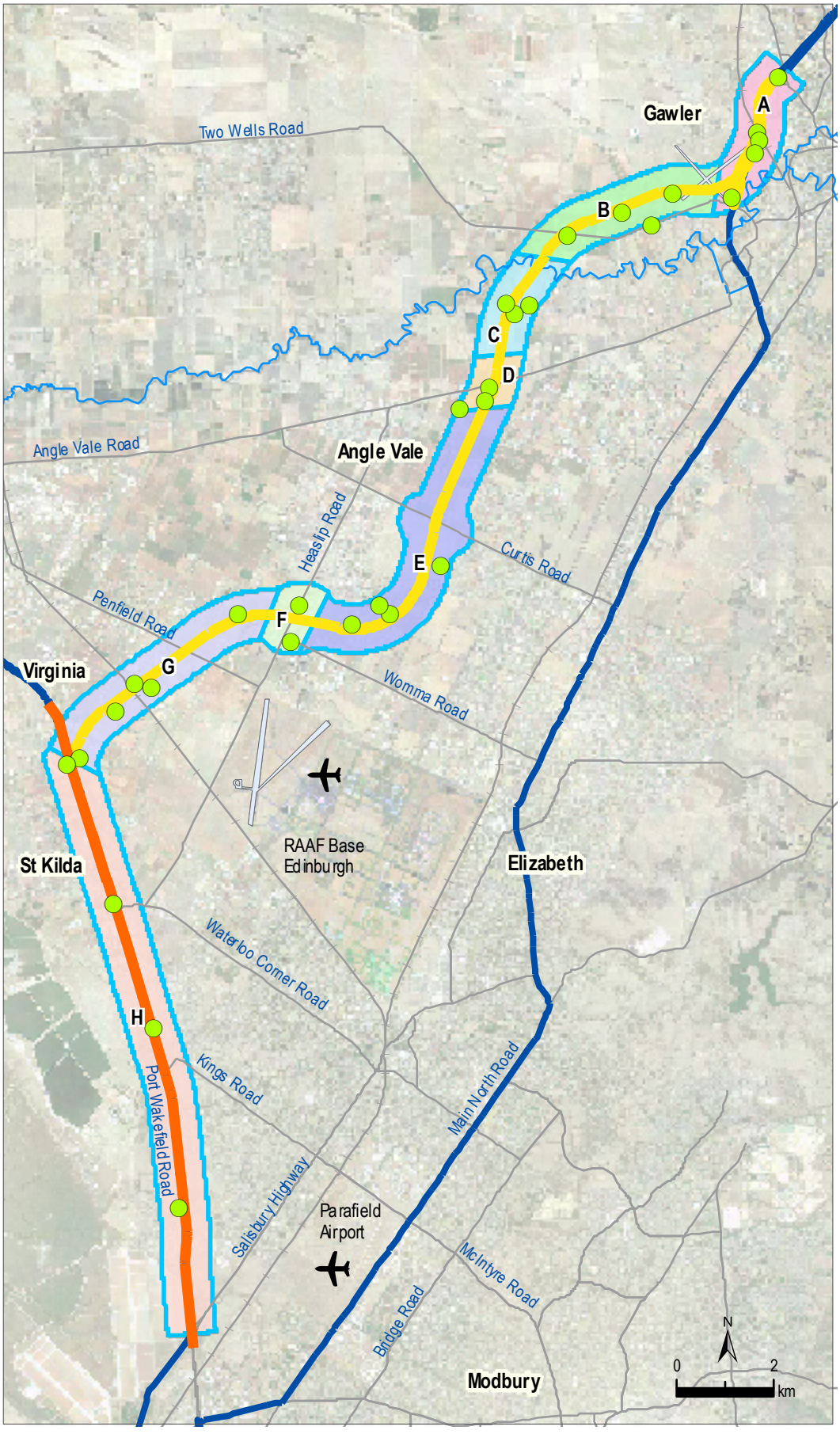


Figure 14.1 **Unweighted sound levels and typical sources**
(NSW Roads and Traffic Authority Environmental Noise Management Manual (2001))



Noise logging site

Noise catchments boundary

Refer Section 14 for catchment areas identification

Figure 14.2 **Noise catchment areas and monitoring sites**

Aircraft operations constitute significant noise events resulting in high maximum noise levels. Road and aircraft noise are measured using different, and incompatible, parameters, and their respective effects are mitigated by different organisations. As a result, aircraft noise has not been considered as part of this study.

14.5 Noise effects of the project

14.5.1 Road traffic noise

Noise level criteria

Residents who currently experience little or no traffic noise are likely to be more affected by an increase in traffic noise than those residents who already experience some road traffic noise. Additional traffic on an upgraded road may make little or no change to the existing noise level.

The noise level criteria for the Northern Expressway are based on DTEI's Road Traffic Noise Guidelines and are equivalent to the criteria used by other road authorities in Australia.

The noise level criteria are as follows:

- for areas presently exposed to noise levels less than daytime 53 dB(A) $L_{eq,15h}$ and night time 48 dB(A) $L_{eq,9h}$, the external target criteria (to be achieved at the sensitive receptor) for 2026 will be:
  - daytime 55 dB(A) $L_{eq,15h}$ and night time 50 dB(A) $L_{eq,9h}$
- for areas presently exposed to noise levels greater than daytime 53 dB(A) $L_{eq,15h}$ and night time 48 dB(A) $L_{eq,9h}$, the external target criteria (to be achieved at the sensitive receptor) for 2026 will be the lower of:
  - the existing noise level plus 2 dB(A); or
  - a daytime 65 dB(A) $L_{eq,15h}$ and night time 60 dB(A) $L_{eq,9h}$.

Where the predicted future road traffic noise levels exceed the external target criteria at noise-sensitive receivers, noise mitigation will be provided in accordance with DTEI's *Road Traffic Noise Guidelines* (2007).

Noise-sensitive land uses

Noise-sensitive land uses include:

- existing dwellings
- existing nursing homes
- caravan parks that accommodate existing long-term residential use.

14.5.2 Modelling methodology

Noise modelling was carried out in accordance with DTEI's Road Traffic Noise Guidelines, using the CORTN predication algorithm as implemented in SoundPLAN version 6 software. Predictions are for neutral meteorological conditions. Under conditions of worst case wind and/or meteorological effects, noise would be expected to be higher than predicted.

The noise model incorporated the following features:

- traffic volume and/or percentage of cars on the roadway
- traffic volume and/or percentage of heavy vehicles on the roadway
- posted vehicle speed
- corrections for pavement surface types
- all identified sensitive receptors within 500 m of the proposed roadworks
- contributed noise from all relevant traffic sources to determine the cumulative noise effect at receiver locations
- + 2.5 dB(A) correction for the façade reflection factor.

All identified sensitive receptors at distances less than 500 m from the proposed Northern Expressway, Port Wakefield Road or the Gawler Bypass were included in the noise model.

Note that all the predicted future noise levels on the Northern Expressway are based on the use of stone mastic asphalt (SMA) as a low noise road surface. However, they do not include any other specific mitigation measures such as noise walls and therefore present the baseline effect.

14.5.3 Predicted noise levels

Tables 14.2 and 14.3 provide an overview of the noise impact by indicating the percentage of sensitive receptors, which fall within a specific noise level range.

The Northern Expressway will significantly increase road traffic noise in the vicinity of the new road corridor, but will reduce noise levels on Angle Vale Road, Heaslip Road and Main North Road. There will be an initial large increase in noise, with a smaller increase over time as traffic increases. This can be seen in Tables 14.2 and 14.3 when comparing the percentage of receptors affected by the Northern Expressway between 2011 and 2026.

The main exception to this increase is within catchment area A (i.e. along the Gawler Bypass) where there will be a decrease in noise, south of the Northern Expressway after opening due to a decrease in traffic.

Table 14.2
Predicted daytime noise levels ($L_{eq,15h}$)

Catchment area (No. of receptors)		> 70 dB(A) (%)	65–70 dB(A) (%)	60–65 dB(A) (%)	55–60 dB(A) (%)	< 55 dB(A) (%)
A	Without NExy 2011	0	12	39	22	27
(139)	NExy 2011	0	4	32	34	29
	NExy 2026	0	23	24	37	15
B	Without NExy 2011	0	0	0	7	93
(41)	NExy 2011	0	0	5	10	85
	NExy 2026	0	0	5	20	76
C	Without NExy 2011	0	0	0	0	100
(16)	NExy 2011	0	6	0	19	75
	NExy 2026	0	6	6	38	50
D	Without NExy 2011	0	0	33	25	42
(12)	NExy 2011	17	0	25	42	17
	NExy 2026	17	0	33	33	17
E	Without NExy 2011	0	0	0	0	100
(56)	NExy 2011	2	0	2	9	88
	NExy 2026	2	0	7	13	79
F	Without NExy 2011	0	0	0	0	100
(11)	NExy 2011	0	0	0	9	91
	NExy 2026	0	0	9	45	45
G	Without NExy 2011	0	0	0	0	100
(31)	NExy 2011	0	0	10	10	81
	NExy 2026	0	3	10	23	65
All	Without NExy 2011	0	6	19	12	64
(306)	NExy 2011	1	2	18	22	57
	NExy 2026	1	11	16	29	43

Notes:

- *Without Northern Expressway (NExy) 2011 represents the predicted 2011 traffic noise effect with the existing road network, i.e. without NExy.*
- *NExy 2011 represents the predicted traffic noise effect of the NExy alignment at road opening in 2011.*
- *NExy 2026 represents the predicted traffic noise effect of the NExy alignment 15 years after opening (2026).*
- *Figures may not sum precisely due to rounding.*

Table 14.3

Predicted night time noise levels ($L_{eq,9h}$)

Catchment area (No. of receptors)		> 65 dB(A) (%)	60–65 dB(A) (%)	55–60 dB(A) (%)	50–55 dB(A) (%)	< 50 dB(A) (%)
A	Without NExy 2011	0	0	0	41	59
(139)	NExy 2011	0	0	1	37	63
	NExy 2026	0	4	36	32	29
B	Without NExy 2011	0	0	0	0	100
(41)	NExy 2011	0	0	0	0	100
	NExy 2026	0	0	5	15	80
C	Without NExy 2011	0	0	0	0	100
(16)	NExy 2011	0	0	6	0	94
	NExy 2026	0	6	0	25	69
D	Without NExy 2011	0	0	0	33	67
(12)	NExy 2011	17	0	0	25	58
	NExy 2026	17	0	33	33	17
E	Without NExy 2011	0	0	0	0	100
(56)	NExy 2011	0	2	0	2	98
	NExy 2026	2	0	2	13	84
F	Without NExy 2011	0	0	0	0	100
(11)	NExy 2011	0	0	0	0	100
	NExy 2026	0	0	9	36	55
G	Without NExy 2011	0	0	0	0	100
(31)	NExy 2011	0	0	0	6	94
	NExy 2026	0	3	10	16	71
All	Without NExy 2011	0	0	0	20	80
(306)	NExy 2011	1	0	1	18	80
	NExy 2026	1	2	20	24	53

Notes:

- *Without Northern Expressway (NExy) 2011 represents the predicted 2011 traffic noise effect with the existing road network, i.e. without NExy.*
- *NExy 2011 represents the predicted traffic noise effect of the NExy alignment at road opening in 2011.*
- *NExy 2026 represents the predicted traffic noise effect of the NExy alignment 15 years after opening (2026).*
- *Figures may not sum precisely due to rounding.*

14.5.4 Receptor noise effects above criteria

Tables 14.4 and 14.5 summarise the difference between the predicted 2026 noise levels and the noise criteria adopted for individual sensitive receptors in each catchment area.

A number of noise sensitive receptors are above the adopted noise criteria for the project by varying amounts.

Compliance with the daytime noise criteria will control overall compliance for day and night, that is, compliance with the daytime criteria automatically achieves compliance with the night time criteria.

Table 14.4
Percentage of sensitive receptors predicted to be above the daytime noise criteria ($L_{eq,15h}$) in 2026

Catchment area (No. of receptors)	> 8 dB(A) above (%)	5–8 dB(A) above (%)	3–5 dB(A) above (%)	1–2 dB(A) above (%)	Below criteria (%)
A (139)	0	0	4	37	60
B (41)	0	5	5	10	80
C (16)	6	0	13	19	63
D (12)	17	0	8	17	58
E (56)	2	5	5	5	82
F (11)	0	0	18	27	55
G (31)	6	6	6	10	71
All (306)	2	2	6	23	68

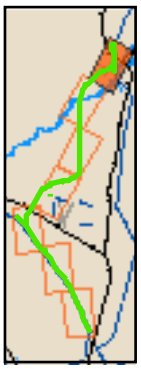
Table 14.5
Percentage of sensitive receptors predicted to be above the night time noise criteria ($L_{eq,9h}$) in 2026

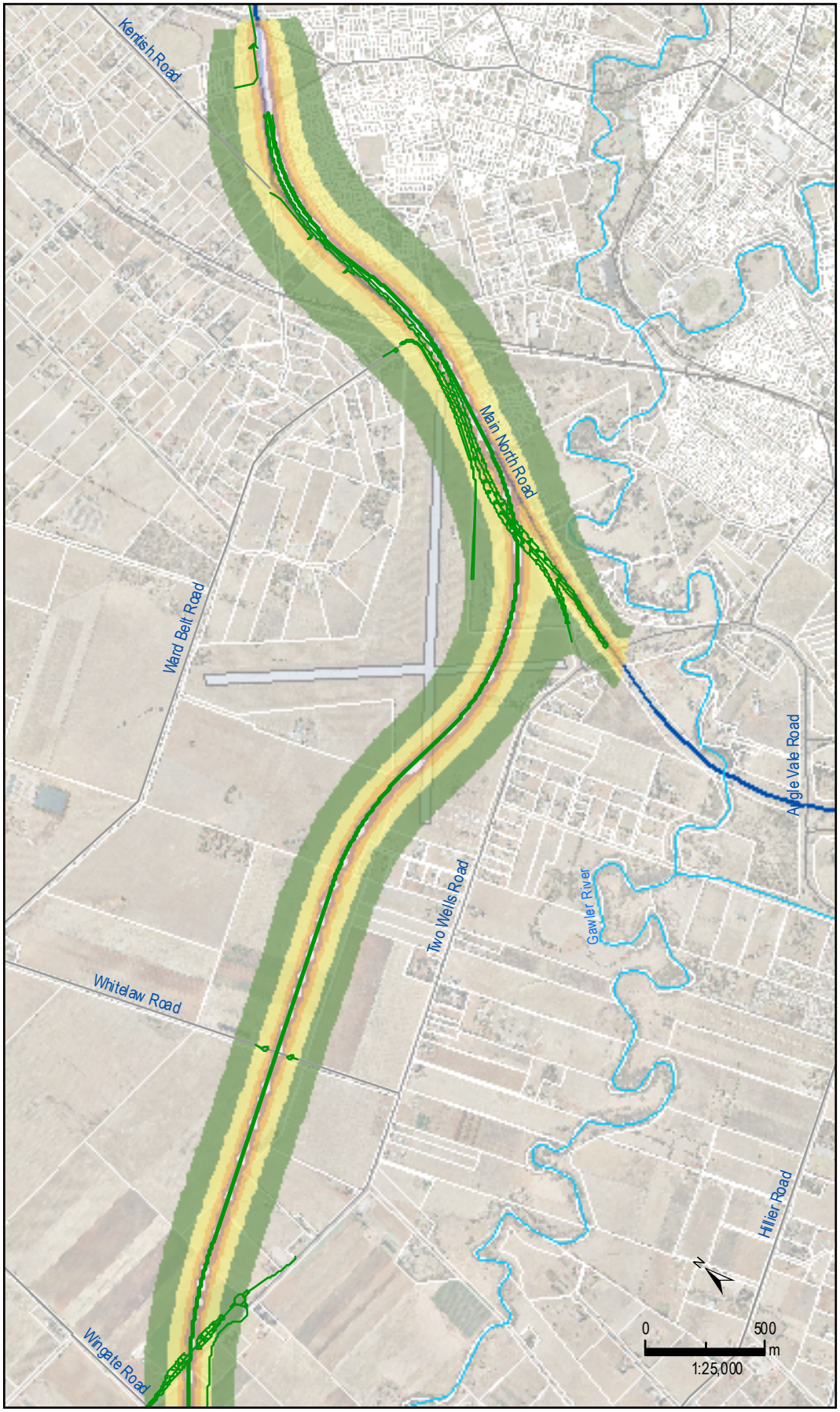
Catchment area (No. of receptors)	> 8 dB(A) above (%)	5–8 dB(A) above (%)	3–5 dB(A) above (%)	1–2 dB(A) above (%)	Below criteria (%)
A (139)	0	0	0	4	96
B (41)	0	2	2	5	90
C (16)	6	0	6	6	81
D (12)	17	0	8	0	75
E (56)	2	0	9	2	88
F (11)	0	0	9	9	82
G (31)	3	10	3	3	81
All (306)	2	1	3	4	90

14.5.5 Noise contours in 2026 without mitigation measures

Figures 14.3 to 14.6 indicate the predicted daytime 2026 noise contours in 5 dB(A) intervals.

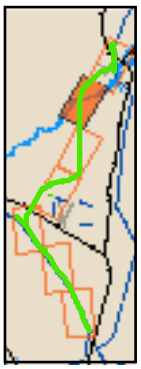
Noise level contours provide a visual noise 'footprint' indicating predicted noise levels at different distances from the Expressway. They should be used as an indicative guide only.

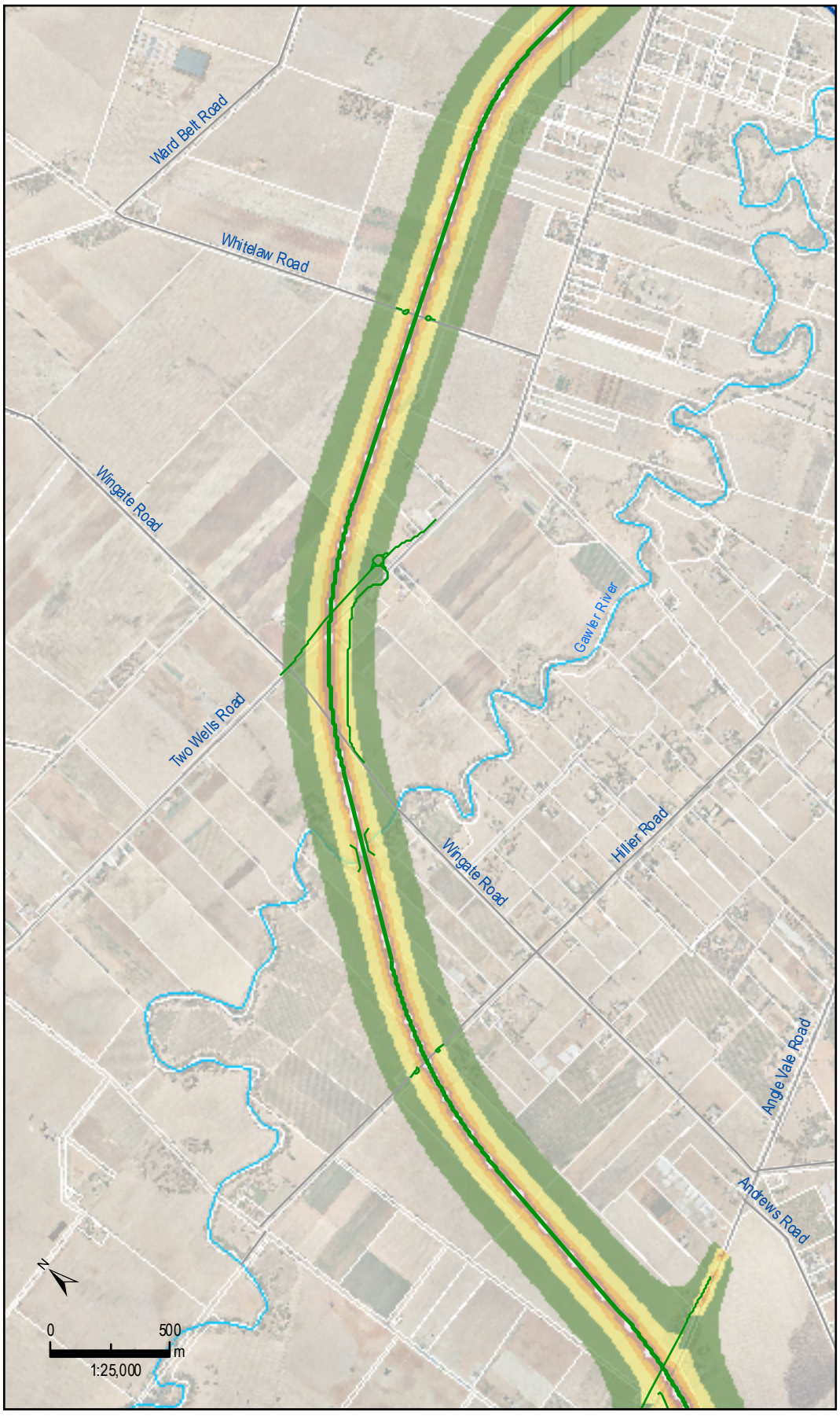




55 - 60 dB(A) band
60 - 65 dB(A) band
65 - 70 dB(A) band
70 - 75 dB(A) band
>75 dB(A)

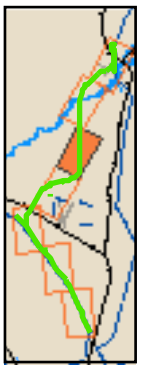
Figure 14.3 **2026 daytime noise projections sheet 1 of 4**

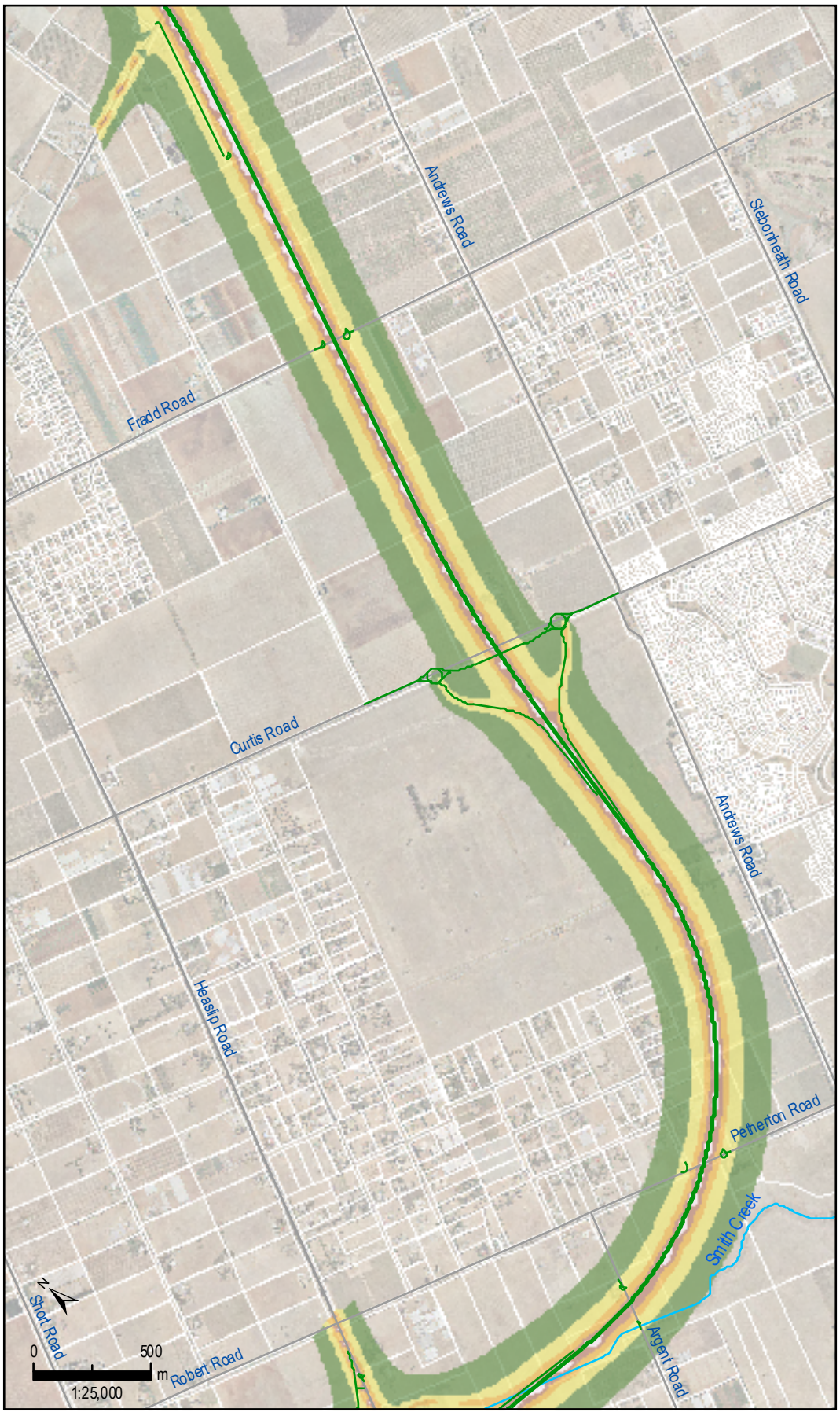




55 - 60 dB(A) band
60 - 65 dB(A) band
65 - 70 dB(A) band
70 - 75 dB(A) band
>75 dB(A)

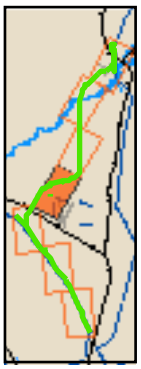
Figure 14.4 **2026 daytime noise projections sheet 2 of 4**





55 - 60 dB(A) band
60 - 65 dB(A) band
65 - 70 dB(A) band
70 - 75 dB(A) band
> 75 dB(A)

Figure 14.5 **2026 daytime noise projections sheet 3 of 4**



55 - 60 dB(A) band
60 - 65 dB(A) band
65 - 70 dB(A) band
70 - 75 dB(A) band
> 75 dB(A)

Figure 14.6 **2026 daytime noise projections sheet 4 of 4**

It is recognised that additional noise impacts may be generated by individual noisy vehicles including those using noisy engine brakes. These peak noise events have a very small influence on L_{eq} noise levels due to their short duration; however, potentially they have a propensity to annoy. The impact of this noise is likely to be greater around undulating terrain including overpasses.

14.6 Management of road traffic noise

DTEI is committed to providing all 'reasonable and practicable' noise mitigation measures to meet the appropriate target noise levels.

Below are a number of measures that may be used to reduce road traffic noise for the Northern Expressway Project.

14.6.1 Controlling vehicle noise at the source

Ideally the most effective way of minimising noise from vehicles and traffic is to control vehicle noise at the source and/or make the vehicles quieter as described below:

Quieter vehicles

The reduction of noise from vehicles is a major factor in reducing traffic noise. For maximum effectiveness, vehicle noise management needs to include design, education and enforcement components.

DTEI actively supports and/or contributes to the development of national vehicle design standards (i.e. reducing noise emitted from engine brakes) and monitoring and enforcement of in-service vehicle noise standards.

'Low noise' road surfaces

The type of road surface can have a significant impact on traffic noise generated by pavement surface/tyre interactions.

The Northern Expressway is currently proposing to use stone mastic asphalt (SMA) to reduce the pavement noise emissions. SMA provides a reduction in the order of 2 dB(A) relative to dense grade asphalt.

Reducing design speeds

On high-speed roads such as motorways, halving the average speed will lead to a reduction of up to 5 to 6 dB(A) in the traffic L_{eq} noise level. The Northern Expressway will be part of the National Network and will be designed to a freeway standard with a maximum speed limit of 110 km/h. A reduction in design speed would negate part of the original purpose of the proposed Expressway. It is not proposed to reduce the posted speed below 110 km/h.

14.6.2 Controlling noise at the receiver

Non-vehicle-based noise management strategies include:

- Careful environmental assessment to identify existing and potential traffic noise problems and the most effective solutions.

- New road route selection and design so as to minimise the propagation of noise from vehicles to sensitive receptors, through physical separation, landscaped noise moundings, noise barrier buildings and landscaped roadside noise walls.
- Noise mitigation treatments near and within existing noise-sensitive buildings.

Modifying road alignments

The Northern Expressway study area is a rural environment, characterised by a variety of agricultural land uses and interspersed with isolated dwellings and townships.

A number of route options were considered during the route selection phase. The proposed route affected the least number of people within the study area when compared against the other viable options.

Roadside noise walls and mounds

Acoustic barriers provide immediate reductions in road traffic noise at the shielded properties once barrier construction is complete. Road traffic noise barriers, in the form of 'noise walls' or mounded earthworks, must break the lines-of-sight between road traffic noise sources and the noise-sensitive receiver, to gain maximum effectiveness.

The acoustic effectiveness of a barrier depends on its density, height, length and location. The higher the barrier (compared to the direct line-of-sight from the source to the receiver) and the closer its location to either the source or the receiver, the greater the noise attenuation provided. The barrier also needs to be of sufficient length.

Roadside barriers, as distinct from barriers close to dwellings, usually have to provide shielding along an appreciable length of road to be effective. Roadside barriers can therefore be efficient in providing attenuation to groups of residences, but will not be cost effective for single structures and may be ineffective where openings are required for driveway access. Barriers in this case are more cost effective adjacent to moderately dense residential living areas such as Macdonald Park.

The physical heights of barriers can usually be reduced if the pavement is lowered. This is not possible along the Northern Expressway route due to drainage reasons outlined in Section 20. Combinations of earth mounding with a noise wall on top of the mound can reduce the scale and potential visual impacts of fabricated barriers, especially in conjunction with landscape treatments.

The use of earth mounds is currently being investigated. However, it is likely that the earthworks balance will be equalised between the swale cuts and the pavement embankment fill requirements. As such, any material for earth mounds would have to be imported onto the site, making it cost prohibitive for large mounds. Smaller mounds may still be accommodated for landscaping purposes.

Noise walls can be constructed from a range of materials with appropriate acoustic density. While dense vegetation screen planting will have visual and privacy benefits, it provides only minor acoustic attenuation, about 1 dB(A) for a 10 m depth. For significant noise attenuation, a solid barrier (earth mounding, noise wall, cutting, etc.) is required.

Roadside noise barriers are currently being investigated at a number of locations along the Northern Expressway alignment. The exact locations will depend on their acoustic benefits and a cost–benefit analysis with other treatment options.

Noise mitigation treatment of dwellings and other noise-sensitive receptors

Acoustic building treatments will be provided to dwellings and other noise-sensitive uses adjacent to the Expressway where noise levels exceed the project noise level criteria and barriers are not provided.

Individual dwelling treatments can be provided in lieu of, or in conjunction noise control measures such as low noise road surfaces, roadside noise barriers and barriers near the dwellings.

Any acoustic architectural treatments will be undertaken in consultation and with the agreement of the property owner.

Building treatments will be provided where external road traffic noise criteria cannot be achieved at the premises and other measures are impractical or not cost effective.

Acoustic treatment of buildings will be undertaken on the façades exceeding the criteria where required, treatment packages will include all or some of the following:

- closing air vents or gaps under floors
- improved glazing and door construction in the façades exposed to the road
- fresh air ventilation in accordance with the Building Code of Australia
- the installation of courtyard walls to provide a reduction in external noise to an outdoor entertaining/living area
- acoustic treatment to roof or ceilings.

Individual noise treatment packages will be designed for each dwelling. The level of treatment will depend on the amount of noise reduction that is required to achieve the relevant noise criteria. The exact noise treatments will be developed by an acoustic engineer during the detailed design phase of the project.

Future development adjacent to the Expressway

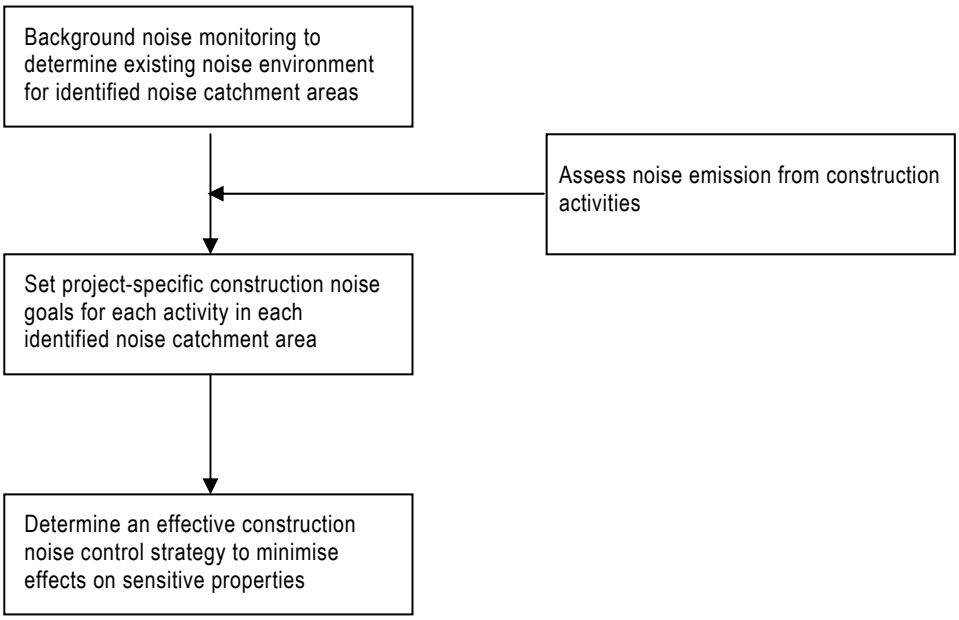
It is the property owner/developer's responsibility to provide noise mitigation measures for noise-sensitive land uses which are submitted for planning approval after the release of this Environmental Report.

DTEI will encourage councils to ensure appropriate acoustic design (and policy mechanisms) are incorporated into future noise-sensitive land uses adjacent to the corridor and Council Development Plans.

14.6.3 Managing construction noise

DTEI will develop a project-specific framework for the management of construction noise to ensure the minimisation of adverse construction noise effects where possible.

The following flow chart describes in summary the role of a construction noise assessment used to arrive at an appropriate noise control strategy for the project.



Construction noise sources

Noise generated by construction activities will vary as construction progresses along the route. Table 14.6 outlines some typical operating scenarios.

The effect depends on the type of construction, the distance to the affected residences or other noise-sensitive uses, any natural or introduced shielding, and the duration of the construction.

Table 14.6
Construction noise activities

Construction activity	Description
Corridor clearing	Typical operations may be either one plant operating on its own or a bulldozer, chainsaw and tub grinder/mulcher operating simultaneously
Bridge works	Typical operations at interchange bridges may be either one plant operating on its own or a piling rig, power generator, pneumatic jackhammer and crane operating simultaneously
Earthworks and drainage	The earthworks and drainage phase of the project is likely to be the longest in duration and generate the highest levels of construction noise. Major sources of noise include the operation of heavy plant and equipment including bulldozers, excavators and graders, excavation involving loading, haulage and ground compaction Typical operations may be either one plant operating or a simultaneous combination of bulldozer, scraper and excavator or scrapers, compactors and graders on road embankments
Pavement	Typically pavers, rollers, generators and backhoes are used simultaneously. Concrete cutting may also occur
Retaining walls	Typical operations may be either one plant operating on its own or a crane, welding equipment and tracked excavator operating simultaneously
Construction compound	Typical operations during site establishment may be either one plant operating or a backhoe, excavator and delivery truck operating simultaneously. Cranes, semitrailer deliveries of offices, some minor concrete works, some minor earthworks in establishing hard stands for parking areas, includes use of graders and body trucks, backhoe for general drainage works

Generally, most of the residences identified as affected by construction noise are also affected by operational traffic noise. For those receptors where noise mitigation treatment is allocated for the reduction of operational noise, the proposed treatment should be implemented at the project start to provide benefit during construction as well as during operation.

A detailed Noise and Vibration Management Plan will be developed prior to construction outlining the noise mitigation measures to be implemented.

Proactive noise control strategies to minimise noise during construction may include temporary acoustic barriers, enclosures, silencers or the substitution of alternative construction processes. Identification of all reasonable and practicable noise mitigation methods should be conducted by the site supervisor on a daily if not hourly basis during noisy night works. Noisier activities will be undertaken during the day, where feasible.

While noise management measures will not necessarily result in meeting the construction noise goals at all times, they will assist in reducing impacts.

In some cases, a balance between a higher acceptable noise emission to enable faster construction progress may be preferred by the community to ultimately reduce the perceived noise effect, that is, shorter duration of a higher noise level is better than longer term lower increased noise level.

The following are suggested mitigation measures in three key areas, namely, site management, equipment management and sensitive receiver noise control.

Site management

The following mitigation measures can be incorporated into site management to reduce construction noise effects:

- locate noisy plant as far from noise-sensitive receptors as possible
- care should be taken to avoid dropping materials, including materials from a height into a truck, to minimise peak noise events
- machines that are used intermittently should be shut down in the intervening periods between works or throttled down to a minimum
- select and locate site access roads as far from noise-sensitive receptors as possible
- truck movements should avoid residential streets where possible
- the reversing of vehicles should be minimised to reduce the noise from reversing signals
- vehicle warning devices such as horns should not be used as signalling devices
- implement worksite induction training, educating staff on noise-sensitive issues and the need to make as little noise as possible, for example, workers should avoid shouting and whistling
- install temporary noise barriers.

Equipment management

The following mitigation measures can be incorporated into equipment management to reduce construction noise effects:

- ensure equipment has quality mufflers installed
- ensure equipment is well maintained and fitted with adequately maintained silencers which meet the design specifications
- ensure silencers and enclosures are intact, rotating plants are balanced, loose bolts are tightened, frictional noise is reduced through lubrication and cutting noise reduced by keeping equipment sharp
- use only necessary power to complete the task
- loaders and bobcats fitted with articulated buckets should be rubber lined at the contact points to ensure that noise levels are minimised during release of materials
- modify equipment, such as improved exhaust systems, stiffening of panels to stop vibrations, applying noise dampening materials to panels to reduce noise transmission and fixing resilient materials between contact surfaces
- use traffic practice controllers to prevent vehicles and equipment queuing, idling or reversing near noise-sensitive receivers.

Sensitive receiver noise control

The following measures can be incorporated into managing noise at sensitive receivers:

- install any permanent noise barriers or at-house treatment required to minimise operational road traffic noise as early as possible in the construction process
- consult with affected residents to aid in the development of acceptable noise management strategies
- provide an easily accessible and well-publicised complaints hotline, and develop and implement a suitable complaint handling procedure to effectively deal with any issues raised during the work.

14.7 Conclusions

The Northern Expressway study area is generally characterised by very quiet background noise levels due to its predominantly rural setting. There are some areas with higher noise levels, particularly adjacent to the existing road network.

The proposed Northern Expressway will alter the noise environment within the study area. There will be increased traffic noise exposure adjacent to the Northern Expressway, and a reduction in noise along parts of the existing network, such as Angle Vale Road, Heaslip Road and Main North Road.

Noise monitoring has been carried out within the study area to identify the existing noise levels and to calibrate the noise model. Detailed noise modelling has been carried out to determine the future noise levels and develop noise treatment measures.

Specific target noise criteria have been set and a range of noise treatment measures are proposed to reduce the traffic noise levels. These measures include:

- targeted use of SMA which is one of the quietest road surfaces
- provision of noise barriers at specific locations along the Expressway, such as adjacent to Macdonald Park
- provision of individual treatment measures for isolated houses exceeding the target noise levels.

Individual noise treatment packages will be designed for each dwelling that does not meet the specific target noise criteria. The level of treatment will depend on the amount of noise reduction that is required to achieve the noise criteria. An acoustic engineer will be engaged to develop the specific noise treatment measures during the detailed design phase of the project.

Construction noise will be managed through the development of a Noise and Vibration Management Plan.