

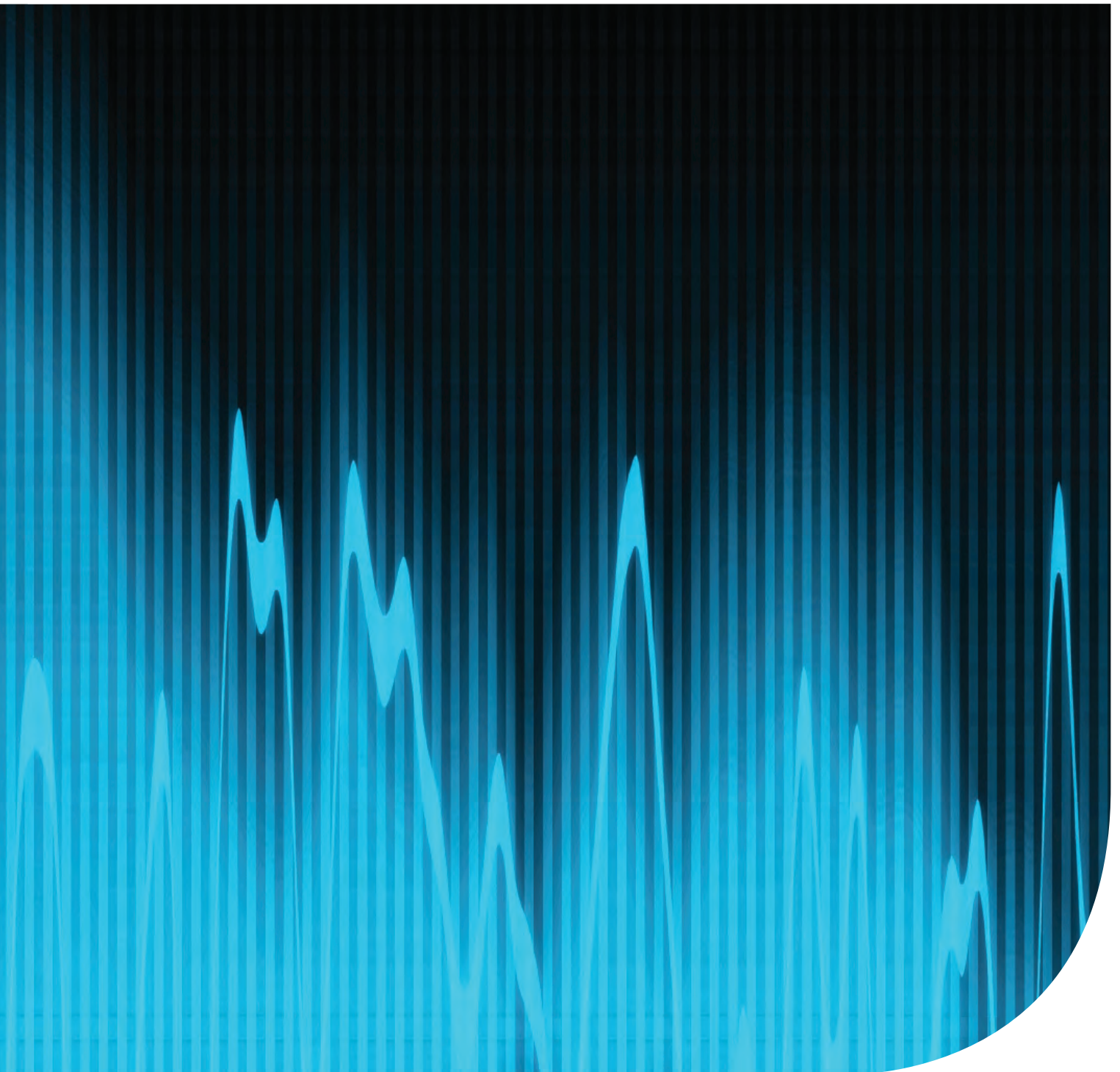
Appendix J

Noise Impact Assessment

Noise Impact Assessment

Proposed Rezoning for the Goulburn Health Hub at 35 Ross Street, Bradfordville

Prepared for Cullingral Pty Ltd | 10 December 2014



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Noise Impact Assessment

Final

Report J14085RP1 | Prepared for Cullingral Pty Ltd | 10 December 2014

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Date 10 December 2014

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1 Introduction

1.1 Background

EMGA Mitchell McLennan Pty Limited (EMM) has been commissioned by Cullingral Pty Ltd to complete a noise impact assessment as part of a rezoning application for the construction and operation of the Goulburn Health Hub (the project). The project is to be located on a greenfield site at 35 Ross Street, Goulburn NSW. Figure 1.1 shows the location of the site.

This report addresses several noise related aspects pertaining to the project including:

- quantifying the existing ambient noise environment in and around the proposed development;
- assessing the potential impacts of operational noise from the project on surrounding sensitive receptors;
- assessing the potential impacts of construction noise from the project on surrounding sensitive receptors;
- assessing potential road noise impacts on public roads; and
- reporting on results and providing recommendations to ensure that the project satisfies relevant noise goals.

The assessment has been carried out with reference to the following standards, guidelines and policies:

- Environment Protection Authority (EPA), NSW Industrial Noise Policy (INP) (EPA 2000);
- NSW EPA, Road Noise Policy (RNP)(EPA 2011); and
- NSW Department of Environment and Climate Change (DECC), Interim Construction Noise Guideline (ICNG)(DECC 2009).

This assessment also references the Noise Assessment completed by Acoustic Consulting Engineers (ACE) on 17 June 2014. The ACE report includes an assessment of background noise at the site.

A review of potential vibration impacts during the construction phase has been completed and it was concluded that due to the distance between the project and structural receptors, impacts would be negligible. Therefore construction vibration impacts are not further considered in this report.

1.2 Project description

The site is currently zoned IN1 – General Industrial under the Goulburn Mulwaree Local Environmental Plan 2009 (the LEP). Health services facilities, which include hospitals, are currently prohibited within this zone. It is noted that medical centres and residential care facilities, which include seniors housing, are permissible with consent within this zone.

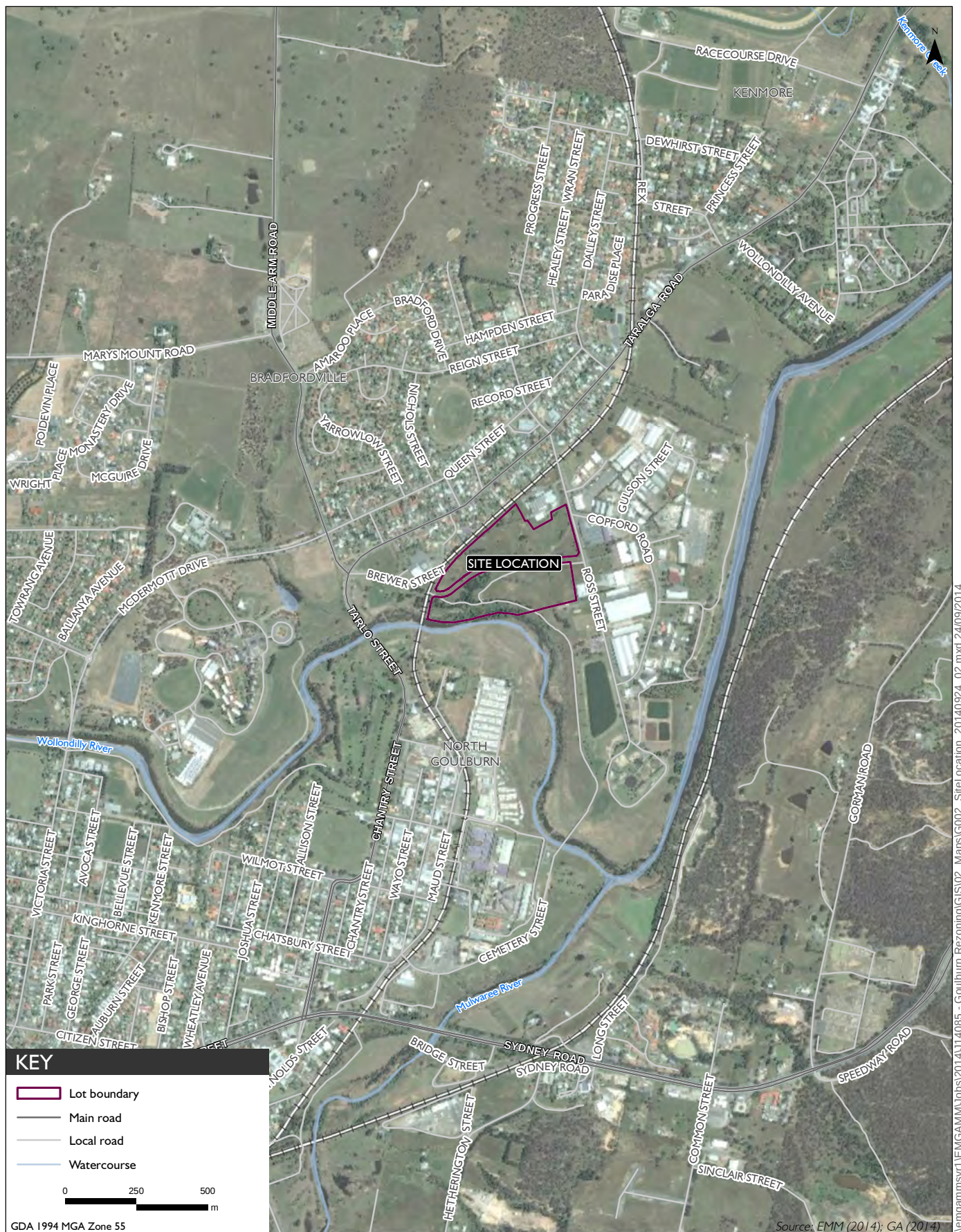
In order to construct a hospital on the site it will be necessary to rezone the land. Following discussions with both the Department of Planning and Goulburn Mulwaree Council it is recommended that the land be rezoned to SP2 Infrastructure to allow the establishment of the hospital and aged care facility. The new zoning will also incorporate the uses previously approved on the site (DA/0084/1213 and MOD/0064/1314), including a medical centre, day surgery, specialist and radiology rooms, cafe and pharmacy.

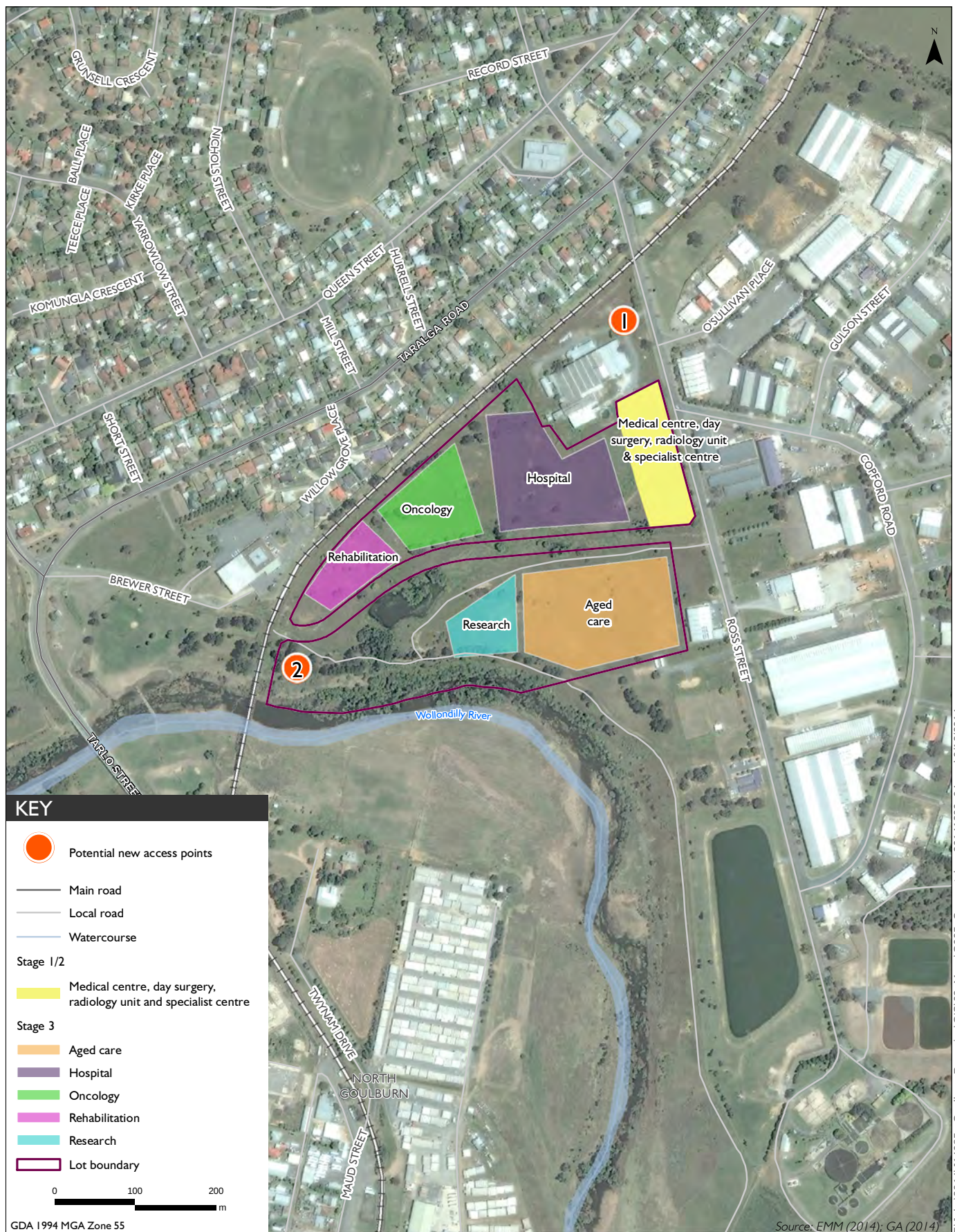
It is intended that the development will occur in three stages which will be described in detail in subsequent development applications (DAs). The stages will comprise the following elements:

- Stage 1 : medical centre and ancillary uses including a pharmacy and cafe;
- Stage 2 : day surgery, radiology unit and specialist centre; and
- Stage 3 : hospital, oncology and research units, a rehabilitation clinic and aged care facility.

Preliminary information is available for the purpose of this assessment, with conceptual layout drawings provided for Stage 1/2 (MOD/0064/1314). Information for Stage 3 is limited and a more detailed assessment will be required as part of the development application process for parts of Stage 2 and for Stage 3.

Figure 1.2 presents the indicative concept plan for the project. It is understood that each building will have an area for loading, delivery and waste disposal, including for delivery of emergency medical supplies during the day period only. The disused railway line bordering the western boundary of the project boundary is to be landscaped and will provide additional buffers to northern residences in the vicinity of the project.





1.3 Glossary

A number of technical terms are required for the discussion of noise and vibration. These are explained in Table 1.1.

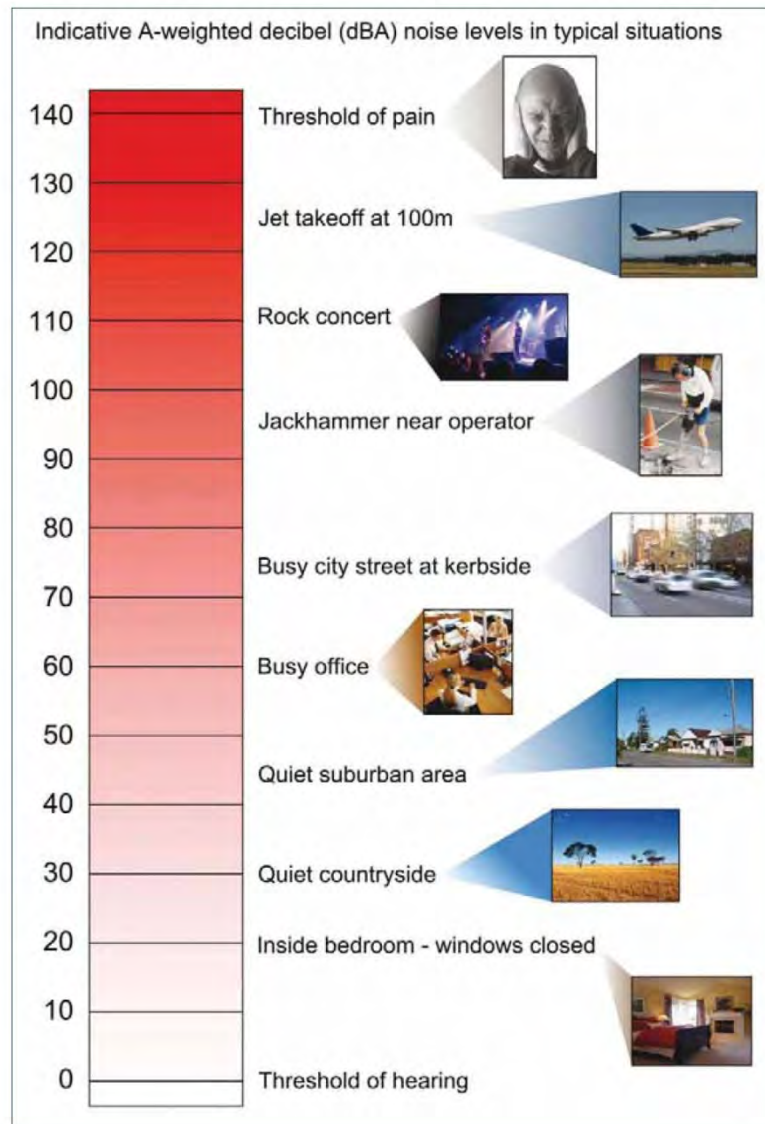
Table 1.1 Glossary of acoustic terms

Term	Description
dB(A)	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the 'A-weighted' scale. This attempts to closely approximate the frequency response of the human ear.
EPA	NSW Environment Protection Authority.
RNP	NSW Road Noise Policy (published by the OEH, 2011).
INP	NSW Industrial Noise Policy (Published by the Environment Protection Authority in 2000).
ICNG	Interim Construction Noise Guideline (published by the Department of Environment and Climate Change in 2009).
L ₁	The noise level exceeded for 1% of a measurement period.
L ₁₀	A noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise levels.
L ₉₀	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
L _{eq}	It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period. The L _{eq,15min} descriptor refers to an L _{eq} noise level measured over a 15 minute period.
L _{max}	The maximum root mean squared sound pressure level received at the microphone during a measuring interval.
ABL	The assessment background level (ABL) is defined in the INP as a single figure background level for each assessment period (day, evening and night). It is the tenth percentile of the measured L ₉₀ statistical noise levels.
RBL	The Rating Background Level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period. The RBL is used to determine the intrusiveness criteria for noise assessment purposes and is the median of the ABLs.

It is useful also to have some appreciation of the scale of decibels, the unit of noise measurement. The following gives some practical indication as to what an average person perceives about changes in noise levels:

- differences of less than approximately 2 dB are imperceptible in general, ie, most people would find it difficult to discern which is the louder of two noise sources having levels within 2 dB of each other; and
- a difference in noise levels of around 10 dB appears as either doubling or halving of loudness.

Examples of common noise levels are provided in Figure 1.3.



Source : RTA Environmental Noise Management Manual (RTA, 2001)

Figure 1.3 Common noise levels

2 Existing environment

2.1 Assessment locations

Several assessment locations surrounding the project have the potential to be impacted by future site noise. Table 2.1 provides a list of assessment locations and approximate distances from the project boundary. Figure 2.1 provides a locality plan identifying assessment locations surrounding the project.

Table 2.1 **Assessment locations**

Assessment location	Description	Easting	Northing	Approximate distance to project boundary (m)
R1	8 Willow Grove Place	750813	6153458	35
R2	75 Taralga Road	750923	6153556	40
R3	25 Ross Road	751093	6153710	160
R4	Corner O'Sullivan Place and Ross Street	751185	6153622	70
R5	Corner Copford Road and Ross Street	751179	6153537	20
R6	Lot 91 Ross Street	751070	6153510	15
R7	28 Ross Street	751194	6153463	20
R8	39 Ross Street	751189	6153274	10
R9	41 Ross Street	751242	6153063	175
R10	31 Taralga Road	750678	6153329	45
R11	Public recreation	750886	6153312	n/a ¹

Notes: 1. This assessment location is classified as a public recreation reserve under the LEP and is located within the project boundary.

Where compliance is demonstrated at assessment locations listed in Table 2.1, compliance is expected at all other surrounding assessment locations.

2.2 Unattended noise monitoring

Noise monitoring for this project was conducted by ACE in May 2014 and has been adopted for the purpose of characterising the noise environment in the vicinity of the project. Monitoring data is available for a period of five days, however this is considered sufficient to characterise the noise environment. Relevant extracts of the ACE report are presented in Appendix A, including noise logging charts for the monitoring period. It is considered that these levels provide a conservative estimate of the noise environment at surrounding receptors due to the proximity of the monitoring location to the road compared to sensitive residential receptors.

Unattended noise logging was conducted from 22 May to 27 May 2014 to measure noise levels at the project site. The monitoring location was approximately 10 m from the nearside kerb, opposite the intersection of Ross Street and Copford Road (refer to Figure 1.1) and is considered representative of the subject site.

The results of long-term unattended noise monitoring conducted by ACE are produced in Table 2.2.

Background monitoring indicates that the ambient noise environment in the vicinity of the project is 41 dB(A) during the day, decreasing to 35 dB(A) in the evening and below 30 dB(A) at night. The noise environment is typical of a suburban area exposed to through traffic from the adjacent industrial estate, with recorded background levels reducing during evening and night periods due to a reduction in through traffic. Data from this location has been adopted to determine criteria at all relevant assessment locations.

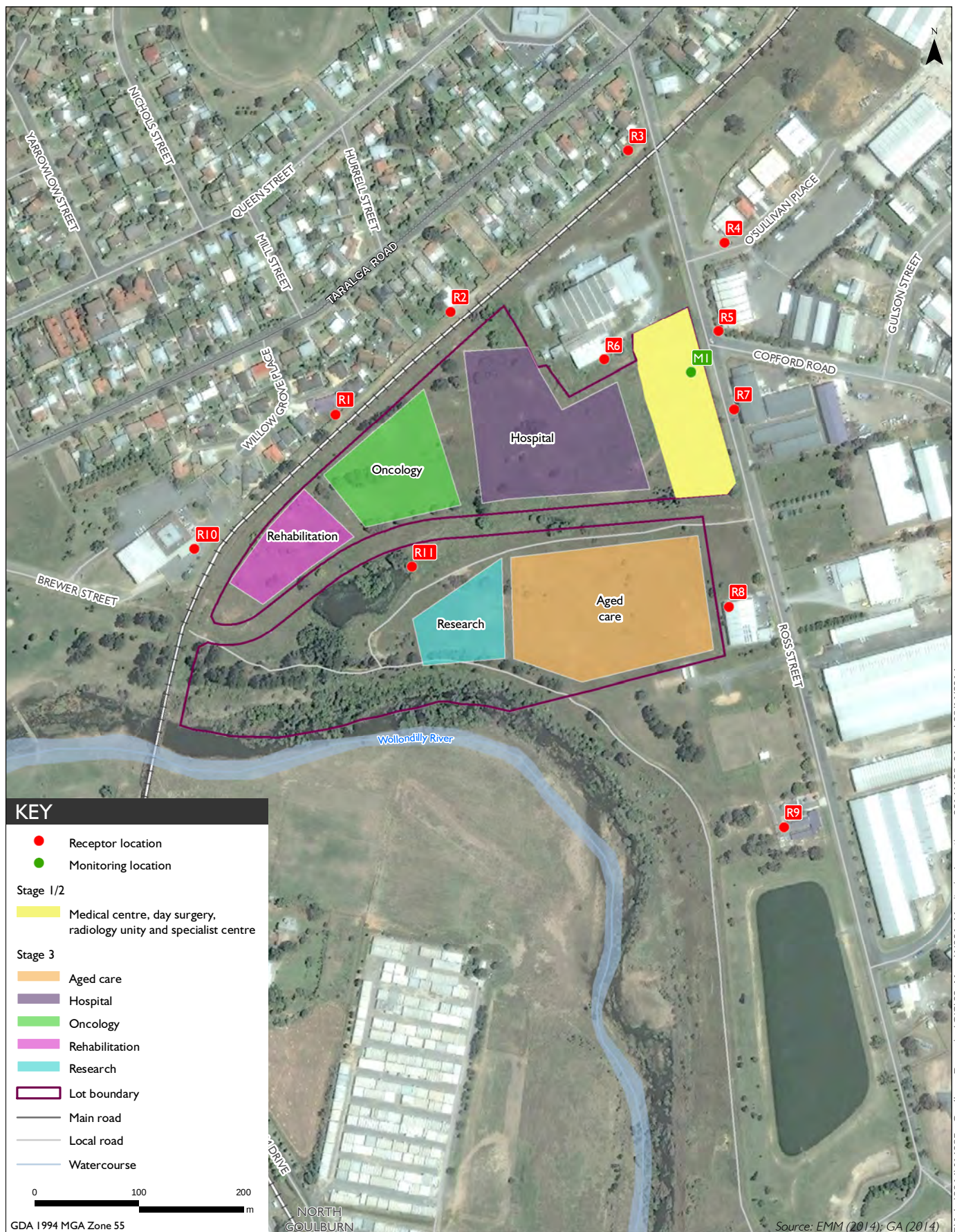
Observations during monitoring identified that the noise environment was dominated by road noise as vehicles accessed the industrial estate via the intersection of Ross Street and Copford Road during peak hours, with intermittent noise from the Oxley Timber Company audible. It was also noted that the buildings to the north and east of the project are currently unoccupied.

Table 2.2 **Summary of unattended noise monitoring results**

Date	Measured background noise level, ABL, dB(A)			Measured L _{eq} , dB(A)			Measured L _{eq} peak-hour noise level, dB(A)
	Day	Evening	Night	Day	Evening	Night	
Thursday 22 May 2014	n/a	36	<30	n/a	49	48	56
Friday 23 May 2014	44	35	<30	57	46	43	58
Saturday 24 May 2014	40	33	<30	54	47	45	57
Sunday 25 May 2014	41	34	<30	52	45	50	53
Monday 26 May 2014	41	29	<30	56	46	48	59
Tuesday 27 May 2014	44	42	n/a	58	57	n/a	60
Rating background level (RBL)	41	35	30 ²	n/a	n/a	n/a	n/a

Source: Acoustic Consulting Engineers 2014.

Notes: 1. Day period is 7 am to 6 pm, evening period is 6 pm to 10 pm, night is the remaining period.
 2. The INP minimum background noise default of 30 dB(A) has been adopted 30 dB(A) for the night period.
 3. 'n/a' indicates insufficient data collected to determine ABL for this period.



Site plan and noise monitoring locations

Goulburn Health Hub

Noise assessment

Figure 2.1

3 Noise criteria

3.1 General noise criteria

3.1.1 Goulburn Mulwaree Council

i Development Control Plan

Goulburn Mulwaree Development Control Plan (DCP) states that a noise assessment should be completed in accordance with the INP, the Environmental Criteria for Road Traffic Noise (ECRTN) (EPA 1999) and the Noise Guide for Local Government. It is noted that the ECRTN has been superseded by the Road Noise Policy (RNP).

ii Development application conditions

A modified development consent (MOD/0064/1314) was granted by Goulburn Mulwaree Council in June 2014. Modifications included the removal of the child care centre and approval for additional specialist services. Relevant sections pertaining to noise are presented in Appendix B.

The requirements of Schedule A condition 3 of the modified consent for Stage 1, relating to internal design requirements, have been addressed by Acoustic Consulting Engineers in May 2014.

The requirements of Schedule A section 4 will be addressed in the detailed noise assessments for subsequent DAS.

3.2 Operational noise

3.2.1 Industrial noise criteria

The NSW Government's INP stipulates guidelines for assessment of noise from the operation of industrial facilities. The main objectives of the policy are to protect the community from excessive intrusive noise, and to preserve the amenity for specific land uses. In order to do so the INP provides two criteria to assess industrial noise sources, namely the intrusiveness and amenity criteria.

i Intrusiveness

The intrusiveness criterion requires that the $L_{eq,15min}$ noise levels from the newly-introduced source during each of the day, evening and night time periods do not exceed the existing rating background noise levels (RBL) by more than 5 dB at the most affected noise sensitive location. Table 3.1 shows the derived intrusive noise criteria for the project based on measured background noise levels, assuming the background noise measurements are applicable to all residential assessment locations.

Table 3.1 Intrusiveness noise criteria

Assessment location	Noise level criteria, $L_{eq,15min}$ dB(A)		
	Day	Evening	Night
R1-R3 ¹ (residential)	46	40	35 ¹
R4-R9 (industrial)	n/a	n/a	n/a
R10 (commercial)	n/a	n/a	n/a
R11 (public recreation)	n/a	n/a	n/a

Notes: 1. Criterion is based on the minimum RBL of 30 dB(A) as defined in the INP.

2. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night is the remaining periods.

3. Non-residential assessment locations are assessed against the amenity criteria, therefore intrusive criteria are not applicable.

ii Assessing amenity

The INP stipulates acceptable and maximum noise levels from all industry consistent with maintaining amenity for specific land uses. The acceptable target noise levels are presented in Table 3.2 for each assessment period and for appropriate surrounding land uses. In this case the 'suburban' category has been applied to determine the target noise levels at the existing residences. Also presented are criteria for industrial land uses within the industrial estate to the east of the site.

Table 3.2 Amenity criteria - recommended L_{eq} noise levels from industrial noise sources

Type of receptor	Indicative noise amenity area	Time of day	Recommended $L_{eq,period}$ noise level, dB(A)	
			Acceptable	Recommended maximum
Residence	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Industrial premises	All	When in use	70	75
Commercial premises	All	When in use	65	70
Area specifically reserved for passive recreation (e.g. National Park)	All	When in use	50	55

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night is the remaining periods.

3.3

3.4 Project specific noise levels

Table 3.3 summarises the applicable criteria that are derived from the more stringent of the intrusive and amenity criteria.

Table 3.3 Project specific noise criteria

Assessment location	Period	RBL, dB(A) ¹	Intrusiveness criteria ² , dB(A) $L_{eq,15min}$	Amenity criteria ³ , dB(A) $L_{eq,period}$	Project specific noise level, dB(A)
R1-R3 (residential)	Day	41	46	55	46 $L_{eq,15-min}$
	Evening	35	40	45	40 $L_{eq,15-min}$
	Night	30 ²	35	40	35 $L_{eq,15-min}$
R4-R9 (industrial)	When in use	n/a	n/a	70	70 $L_{eq,period}$
R10 (commercial)	When in use	n/a	n/a	65	65 $L_{eq,period}$
R11 (public recreation)	When in use	n/a	n/a	50	50 $L_{eq,period}$

Notes: 1. RBL value taken from Table 2.2.

2. Equal to the RBL plus 5 dB.

3. Representative of the acceptable amenity noise level for a suburban receptor from Table 3.2.

3.5 Sleep disturbance

The INP criteria are appropriate for assessing noise from continuous and intermittent sources, such as general mechanical plant and equipment. However, transient noise sources such as truck unloading activities (laundry and equipment) also require assessment.

Given the transient nature of these events, the L_{eq} noise level from such sources would not be representative since the noise in question may not be present for much of the time. Hence, the above criteria are not appropriate for this type of noise. The most important effect of these transient noises would be the possibility of disturbing the sleep of nearby residents. The EPA's INP Application Notes indicates that to prevent sleep disturbance, the $L_{1,1min}$ noise level from an intrusive source should not exceed the background noise level by more than 15 dB. More recent advice from the EPA has confirmed that the L_{max} and $L_{1,1min}$ descriptor can be considered interchangeable for such assessments. On this basis, the maximum noise level from any operational event should not exceed the levels shown in Table 3.4 for the night time assessment period at any residential assessment location.

Table 3.4 Sleep disturbance noise criteria (10 pm to 7 am)

Assessment location	Sleep disturbance criteria, L_{max} dB(A)
All residences	45

Notes: 1. Sleep disturbance criteria apply at residential assessment locations during the night assessment period only.

2. Criteria are assessable at the façade of the most affected sleeping area.

However, this criterion does not take account of more recent research of the effects of road traffic noise on sleep. The EPA's Road Noise Policy (RNP) indicates that maximum noise levels below 50 to 55 dB(A) inside residences from road traffic sources are unlikely to cause awakening reactions. If bedroom windows are partly open, this corresponds to an external maximum noise level of approximately 60 to 65 dB(A) outside a residence.

In our experience, adopting the former more stringent criterion would be desirable in the first instance, and if exceedances are predicted, consideration should be given to the potential number of such events and the more recent research above.

3.6 Construction noise

The ICNG provides guidelines for the assessment and management of noise from construction works. The ICNG recommends a quantitative approach for projects where construction is anticipated to occur for greater than three weeks in duration.

i Noise management level

The ICNG suggests the following time restriction for construction activities where the noise is audible at residential premises:

- Monday to Friday 7 am – 6 pm;
- Saturday 8 am – 1 pm; and
- no construction work is to take place on Sundays or public holidays.

For qualitative assessments, these time restrictions are the primary management tool of the ICNG. Table 3.5 is an extract from the ICNG and provides noise management levels for residential assessment locations for standard and out of hours (OOH) periods.

Table 3.5 ICNG residential criteria

Time of day	Management level $L_{eq,15min}$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm. No work on Sundays or public holidays.	Noise affected RBL + 10 dB.	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured $L_{eq,15min}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A).	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: • times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences; and

Table 3.5 ICNG residential criteria

Time of day	Management level $L_{eq,15min}$	How to apply
Outside recommended standard hours.	Noise affected RBL + 5 dB.	if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times. A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB(A) above the noise affected level, the proponent should negotiate with the community. For guidance on negotiating agreements see section 7.2.2.

Source: ICNG (DECC 2009).

Table 3.6 is an extract from the ICNG and provides noise management levels for commercial and industrial land uses for standard and OOH periods.

Table 3.6 Noise at commercial and industrial land uses using quantitative assessment

Land use	Management level, $L_{eq,15min}$
Industrial premises	External noise level 75 dB(A) (when in use)
Offices, retail outlets	External noise level 70 dB(A) (when in use)

Source: ICNG (DECC 2009).

In summary, the ICNG noise management levels for activities during the standard hours are 10 dB above the existing background levels. For activities outside of the above hours the noise levels should be no more than 5 dB above the existing background levels.

Table 3.7 presents the construction noise criteria for the project based on the background monitoring data (refer to section 2.2).

Table 3.7 Construction noise criteria

Assessment location	Receptor type	RBL, dB(A)	Criteria, $L_{eq,15min}$ ¹	
			Standard hours (RBL+10 dB)	OOH (RBL+5 dB)
R1-R3	Residential	41	51	46
R4-R9	Industrial	n/a	75	75
R10	Commercial	n/a	70	70
R11	Public recreation	n/a	65	65

Notes: 1. Standard hours: Monday to Friday 7 am to 6 pm, Saturday 8 am – 1 pm; no construction on Sundays or public holidays.

3.7 Cumulative noise

To limit continuing increases in industrial noise within a particular area, ambient industrial noise should not exceed the levels specified in Table 2.1 of the INP. The predominant existing industrial noise source in the vicinity of the project was identified during monitoring as transient noise from the Oxley Timber Company. Cumulative operational noise should be considered in detail as part of future assessments and compared against the INP's acceptable and recommended maximum amenity criteria levels, reproduced in Table 3.8. This assessment has adopted the suburban amenity criteria for surrounding residential assessment locations.

Table 3.8 Recommended acceptable and maximum amenity criteria noise levels

Receptor	Indicative area	Time period ¹	Recommended noise level dB(A), $L_{eq,period}$	
			Acceptable	Maximum
Residential	Suburban	Day	55	60
		Evening	45	50
		Night	40	45
Active recreation	All	When in use	55	60
Industrial	All	When in use	70	75

Source: INP (EPA 2000).

Note: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night is the remaining periods.

Stage 1/2 (as identified on the indicative concept plan) of the development has been approved subject to modifications by Goulburn Mulwaree Council. The combined impacts of the various stages of health hub will be quantified as part of subsequent development applications. As part of these detailed assessment, an assessment of combined project noise will be required, as well as quantification of site noise with existing industrial noise to determine compliance with the relevant maximum amenity criteria outlined in the INP.

Based on the available concept layout and site plans it is anticipated that combined site noise can be managed using design controls and standard mitigation measures. Therefore, cumulative noise has not been considered further in this assessment.

3.8 Road traffic noise

The potential impacts of traffic noise resulting from both the construction and operational related traffic on public roads are assessed against criteria defined in the NSW Government's RNP. The application of appropriate criteria for this project has followed Section 3.4.1 of the RNP. This policy supersedes the Environmental Criteria for Road Traffic Noise (EPA 1999) referenced by Goulburn Mulwaree Council.

Site related traffic will access the broader road network via Ross Street and Taralga Road. Ross Street is a local road used primarily to access the adjacent industrial estate and Taralga Road is a sub-arterial road connecting Goulburn and Taralga.

Table 3.9 presents the road noise assessment criteria reproduced from Table 3 of the RNP.

Table 3.9 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB(A)	
		Day (7 am to 10 pm)	Night (100 pm to 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{eq(15-hr)}$ 60 (external)	$L_{eq(9-hr)}$ 55 (external)
Local roads	Existing residences affected by additional traffic on existing local roads generated by land use developments.	$L_{eq(1-hr)}$ 55 (external)	$L_{eq(1-hr)}$ 50 (external)

Source: RNP (EPA 2011).

Additionally, the RNP states where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB, which is generally accepted as the threshold of perceptibility to a change in noise level.

3.8.1 Relative increase criteria

In addition to meeting the assessment criteria, any significant increase in total traffic noise at receptors must be considered. Receptors experiencing increases in total traffic noise levels above those presented in Table 3.10 should be considered for mitigation.

Table 3.10 Relative increase criteria for residential land uses

Road category	Type of project/development	Total traffic noise level increase, dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads and transitways	New road corridor/redevelopment of existing road/land use development with the potential to generate additional traffic on existing road.	Existing traffic $L_{eq(15-hr)} + 12$ dB (external)	Existing traffic $L_{eq(9-hr)} + 12$ dB (external)

4 Assessment methodology

A preliminary noise model was developed to quantify noise impacts of operational and construction noise.

Noise predictions were carried out using Brüel and Kjær Predictor Version 8.14 noise prediction software. 'Predictor' calculates total noise levels at receivers from the concurrent operation of multiple noise sources. The model considers factors such as the lateral and vertical location of plant, source-to-receiver distances, ground effects, and atmospheric absorption, topography of the site and surrounding area and meteorological conditions.

4.1 Prevailing winds

The INP recommends consideration of wind effects if they are a "feature" of the area. The INP defines "feature" as the presence of source-to-receiver wind (measured at 10 m above ground level) of 3 m/s or less, occurring for 30% of the time in any assessment period and season. This is further clarified by defining source-to-receiver wind direction as being the directional component of wind. The INP states that where wind is identified to be a feature of the area then assessment of noise impacts should consider the highest wind speed below 3 m/s, which is considered to prevail for at least 30% of the time.

A noise assessment was completed by EMM (2013) in the vicinity of the project, including an analysis of prevailing meteorological conditions in accordance with the INP. Table 4.1 summarises the prevailing winds adopted for this assessment.

Table 4.1 Modelled prevailing winds (all periods)¹

Meteorological condition	Wind speed (m/s)	Stability class
Calm	nil	nil
Inversion	nil	F

Note: 1. Inversions are only applicable during the night assessment period.

4.2 Operational noise

Preliminary concept plans were available for the combined Stages 1 and 2 of the development, providing indicative locations of mechanical plant and internal parking and roadway configurations. As a result, a preliminary noise model was developed for these stages. The dominant noise sources for the project are mechanical plant and vehicular access, which are assumed to be relatively constant. It has been assumed that Stage 1 and 2 will be operational prior to elements of Stage 3, and that the site will be operational 24 hours a day.

The noise model was configured to predict the total L_{eq} noise levels from the project. The model has assumed simultaneous operation of all plant and equipment which is considered conservative. Predictions were made for the prevailing meteorological conditions in Table 4.1.

Noise emission data used was obtained from an EMM database of for similar projects and is summarised in Table 4.2.

Table 4.2 Indicative operational plant and equipment sound power levels

Item	Sound power level $L_{eq,15min}$, dB(A)
Air conditioning unit	85
Car movements	75

Notes: 1. Traffic movements on site are classified as operational sources.

Traffic information for Stage 1 and 2 was sourced from the Traffic Assessment for Rezoning (EMM 2014), which identified that the medical centre development would generate an additional 288 vehicle movements per hour during morning peak hour and 245 during the afternoon peak hour. Predictions have been made adopting the peak hour movements, therefore results are considered to be conservative.

As only preliminary information is available for the Stage 3 development, calculations have been made to approximate the maximum permissible noise levels from each building envelope. More detailed assessment would be required as part of the future development application process.

4.3 Sleep disturbance

Commercial truck (laundry, supplies) deliveries during the night may occur and are likely to generate worst case maximum noise levels from the site.

Typical maximum noise level event activities are likely to include door impact events during truck loading/unloading operations. A typical L_{max} sound power level for commercial delivery vehicles is 102 dB(A) (ie 97 dB(A) L_w for the reverse alarms plus a 5 dB tonality correction as per the INP).

4.4 Construction noise

Construction works associated with the project are expected to be divided into several activities. Details are not available at this stage, however it has been assumed that each stage will occur over a period of several months.

The construction noise impact assessment has adopted the items of equipment presented in Table 4.3 and associated noise emission data, as obtained from the EMM noise database.

Table 4.3 Construction plant and equipment

Plant and equipment	Sound power level $L_{eq,15min}$, dB(A)
Compressor	91
Truck (deliveries, tippers, general movements)	103
Excavator	111
Crane	105
Hand tools (including grinding, hammering etc.)	105

4.5 Road traffic

Table 4.4 summarises the projected traffic movements for morning and peak hour traffic as a result of the elements of the project, sourced from the traffic impact assessment (EMM 2014).

Table 4.4 Additional traffic volumes generated by potential rezoning developments

Traffic generation source	Morning peak hour traffic (vehicle trips)	Afternoon peak hour traffic (vehicle trips)
Approved medical centre development	288	245
Potential private hospital	49	84
Aged care facility	30	30
Potential oncology unit	20	34
Potential rehabilitation unit	39	64
Potential medical research facility	60	60
Total additional generated traffic	486	517
Additional rezoning generated traffic (excluding medical centre)	198	272

5 Noise impact assessment

5.1 Operational noise

5.1.1 Stage 1 and 2 (medical centre only)

Table 5.1 presents the predicted noise levels for operational noise, comprising mechanical plant and internal road noise, under the prevailing meteorological conditions described in section 4.2. Predictions have been made assuming the site is operational 24 hours a day, and incorporate the shielding effects of intervening topography and buildings.

The results indicate that Stage 1 and 2 operations will comply with relevant criteria at the nearest assessment locations for calm and inversion conditions.

Table 5.1 Predicted operational noise levels – Stage 1 and 2

ID	Period	Predicted operational noise level $L_{eq,15min}$, dB(A)		Criteria, dB(A)
		Calm	Inversion ¹	
R1	Day	<30	n/a	46 $L_{eq,15-min}$
	Evening	<30	n/a	40 $L_{eq,15-min}$
	Night	<30	<30	35 $L_{eq,15-min}$
R2	Day	<30	n/a	46 $L_{eq,15-min}$
	Evening	<30	n/a	40 $L_{eq,15-min}$
	Night	<30	<30	35 $L_{eq,15-min}$
R3	Day	<30	n/a	46 $L_{eq,15-min}$
	Evening	<30	n/a	40 $L_{eq,15-min}$
	Night	<30	30	35 $L_{eq,15-min}$
R4	When in use	32	33	70 $L_{eq,period}$
R5	When in use	40	40	70 $L_{eq,period}$
R6	When in use	39	39	70 $L_{eq,period}$
R7	When in use	42	42	70 $L_{eq,period}$
R8	When in use	35	36	70 $L_{eq,period}$
R9	When in use	<30	<30	70 $L_{eq,period}$
R10	When in use	<30	<30	65 $L_{eq,period}$
R11	When in use	<30	<30	50 $L_{eq,period}$

Notes: 1. Inversion conditions are applicable to night periods only.

5.1.2 Stage 3

Preliminary calculations have been made for Stage 3 development based on the indicative concept plan presented in Figure 1.2. It is considered that the main noise generating sources as part of Stage 3 would be air conditioning and vehicle movements on internal access roads.

Estimations of the allowable noise generation for each building within Stage 3 have been made based on the closest distance to the nearest residential assessment location, which would provide the most stringent criteria and limitation to potential operating conditions. Table 5.2 summarises the results of these calculations.

Table 5.2 Maximum allowable noise generation – Stage 3

Stage 3 element	Distance to closest resident (m)	Distance attenuation (dB)	Maximum allowable sound power emission from building envelope, dB(A)		
			Day	Evening	Night
Hospital	45	41	87	81	76
Oncology	45	41	87	81	76
Rehabilitation	40	40	86	80	75
Aged Care	290	57	103	97	92
Research	210	54	101	94	89

Based on preliminary discussions, it is anticipated that an access road will be constructed between the various elements of Stage 3. It is not anticipated that noise generation associated with internal vehicle access will contribute significantly to the noise emissions for Stage 3, however vehicle deliveries should be limited to the daytime period only to ensure maximum noise levels are not exceeded.

Selection of plant items such as air conditioning units and construction elements such as glazing and ventilation should ensure compliance with the above maximum noise levels. Detailed assessment is required as part of the development application process for Stage 3.

5.2 Sleep disturbance

The predicted L_{max} noise levels associated with the project at the nearest residential assessment locations are presented in Table 5.3 for calm and inversion conditions. Predictions have been made for the night time (10 pm to 6 am) period in accordance with the INP and have incorporated the shielding effects of proposed buildings based on available concept plans. Exceedances of the L_{max} screening criteria are indicated in bold font.

The results indicate that maximum noise emissions during night time periods are predicted to remain below the sleep disturbance noise criteria at the majority of residential assessment locations, with minor exceedances of criteria predicted during night time inversion conditions at assessment location R2.

Table 5.3 Sleep disturbance noise levels (night time only) L_{max} , dB(A)

ID	Stage 1 and 2		Stage 3 - Hospital		Stage 3 - Oncology		Stage 3 - Rehabilitation		Stage 3 - Aged care		Stage 3 - Research		Criteria, dB(A)
	Calm	Inv	Calm	Inv	Calm	Inv	Calm	Inv	Calm	Inv	Calm	Inv	
R1	43	45	32	34	33	35	37	38	37	39	40	42	45
R2	42	44	30	32	32	33	37	39	39	41	45	47	45
R3	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30	45

5.3 Construction noise

Noise predictions have been made at indicative locations within the project boundary within the various areas of potential construction for Stages 1, 2 and 3.

presents the predicted noise levels associated with general construction activities. The criteria provided in should be used as a guide for screening potential noise impacts and also used as reference in providing adequate and suitable noise management and mitigation.

It is noted that inversion conditions only occur during the night time period during OOH construction activities. For standard construction hours, only calm meteorological conditions would apply.

The results in indicate that generated noise levels will exceed criteria during the majority of Stage 3 construction at assessment locations R1 and R2 for calm and inversion conditions.

Construction activities for Stages 1 and 2 would comply with standard hour construction criteria at all assessment locations, with exceedances of OOH criteria expected at locations R1 and R2 predicted under inversion conditions.

In the event that construction activities occurred outside standard hours, construction noise levels will exceed criteria during all phases of construction at assessment locations R1 and R2.

Noise levels are predicted to remain below relevant criteria for all non residential receptors.

The management of construction noise is recommended for the construction phase of the project, in particular with reference to assessment locations R1 and R2.

Table 5.4 Predicted construction noise levels, $L_{eq,15min}$, dB(A)

ID	Stage 1/2		Stage 3 - Hospital		Stage 3 - Oncology		Stage 3 - Rehabilitation		Stage 3 - Aged care		Stage 3 - Research		Criteria	
	Calm	Inversion	Calm	Inversion	Calm	Inversion	Calm	Inversion	Calm	Inversion	Calm	Inversion	Standard	OOH
R1	51	53	56	57	65	65	60	61	50	53	51	53	51	46
R2	51	53	60	60	58	59	54	55	51	53	50	52	51	46
R3	32	34	32	34	<30	31	<30	<30	<30	30	<30	<30	51	46
R4	36	37	<30	30	<30	31	<30	<30	<30	<30	<30	30	75	75
R5	64	64	59	61	53	55	51	53	55	57	52	55	75	75
R6	64	64	64	64	54	56	50	53	55	57	52	54	75	75
R7	68	68	58	60	51	53	48	51	56	57	52	54	75	75
R8	60	61	56	58	53	55	48	51	65	65	54	55	75	75
R9	34	37	26	29	25	27	24	26	50	52	30	32	75	75
R10	47	50	50	52	55	57	61	61	48	50	49	51	70	70
R11	52	54	56	57	62	62	60	60	54	56	56	58	65	65

Notes: 1.Calm conditions applicable to standard construction hours as defined in section 3.3.

2. Inversion conditions occur at night time only; predictions under these conditions would apply during OOH construction activities.

5.4 Road noise

5.4.1 Operational road noise

A detailed assessment of road noise will be required as part of subsequent Das due to the preliminary nature of information available. All project traffic will travel along Ross Street prior to being diluted into the local traffic network. Therefore, this assessment has been limited to the road traffic impacts of the project on local roads (Ross Street). Compliance with local road criteria will ensure compliance with less stringent criteria for sub-arterial roads (Taralga Road).

Preliminary traffic information has been sourced from the traffic assessment for the project (EMM 2014). This report calculated anticipated traffic volumes for the morning and afternoon peak hour periods. The highest of either the morning or afternoon peak hour have been used to determine noise levels for the day period, and calculations for the night time period made based on 20 percent of the daytime peak hour volume. Heavy vehicle percentages (HVP) were not available and were therefore assumed at five percent for day and 20 percent for night. Vehicle speeds are anticipated to be around 40 km/h as vehicles leave the site and approach the Taralga Road intersection.

Table 5.5 summarises the hourly traffic volumes for Ross Street south of Taralga Road (EMM 2014). Based on this summary, the maximum traffic volume for the approved Stage 1 development is the morning peak, and for the rezoning (Stage 3) it is the afternoon peak. The volumes for the future adjusted base hourly traffic include volumes from Stage 1 and have been subsequently used to determine future traffic noise for Stage 3.

Table 5.5 Summary of hourly traffic volumes and traffic increases

Traffic generation route	Existing traffic volume (October 2012)	Additional traffic from the approved development	Future adjusted base hourly traffic	Additional rezoning hourly traffic increase	Percentage traffic increase from rezoning
Ross Street south of Taralga Road (am peak)	160	288	448	198	44%
Ross Street south of Taralga Road (pm peak)	180	245	425	272	64%

The Calculation of Road Traffic Noise (CORTN) (UK Department of Transport) method was used to predict the L_{eq} noise levels at adjacent receptors for additional traffic travelling along Ross Street. CORTN, which was developed by the UK Department of Transport, considers traffic flow volume, average speed, percentage of heavy vehicles and road gradient to establish noise source strength, and includes attenuation due to distance, ground, atmospheric absorption and screening from buildings or barriers. Table 5.6 presents the results of the road noise assessment for Stage 1 of the project. Results indicate that traffic flows from the approved Stage 1 will exceed relevant assessment criteria at the nearest residential assessment location on Ross Street and will therefore need to be managed.

Table 5.6 Road traffic noise levels at receptors on Ross Street – Stage 1/2

Distance to nearest residence (m)	Calculated existing traffic noise	Calculated additional site traffic noise	Combined (existing + site) traffic noise	Assessment criteria	Increase from existing
Day¹ L_{eq}(1-hour), dB(A)					
10	53.5	55.6	57.6	55	4.2
Night L_{eq}(1-hour), dB(A)					
10	50.6	52.6	54.7	50	4.2

Notes: 1. Day period is from 7 am to 10 pm, night is 10 pm to 7 am.

Table 5.6 presents the results of the road noise assessment for Stage 3 of the project, incorporating traffic volumes from the approved Stage 1 medical centre (EMM 2014).

Table 5.7 Road traffic noise levels at receptors on Ross Street – Stage 3

Distance to nearest residence (m)	Calculated existing traffic noise ²	Calculated additional site traffic noise	Combined (existing + site) traffic noise	Assessment criteria	Increase from existing
Day¹ L_{eq}(1-hour), dB(A)					
10	57.6	55.3	59.5	55	2.0
Night L_{eq}(1-hour), dB(A)					
10	54.7	51.0	56.2	50	1.6

Notes: 1. Day period is from 7 am to 10 pm, night is 10 pm to 7 am.

2. Includes future adjusted traffic volumes from approved medical centre.

The results of this preliminary operational road traffic noise assessment indicate that noise levels associated with road traffic from the approved Stage 1 development (MOD/0064/1314) and the future Stage 3 development will result in exceedance of relevant criteria. The predicted noise levels are based on peak hour flows and are therefore conservative estimates of future road traffic noise as a result of the project.

Detailed road traffic noise predictions will be completed as part of subsequent DAs.

5.4.2 Construction road noise

Details of construction vehicle movements are unavailable at this stage, however it is considered that due to the progressive development of Stages 1, 2 and 3, construction activities will have marginal impacts on the local road network, and impacts can be effectively managed via the implementation of standard management techniques and driver awareness training.

6 Findings and recommendations

EMM has completed a noise impact assessment as part of a rezoning application for the construction and operation of the Goulburn health hub.

6.1 Operational noise recommendations

Results indicate that Stage 1 and 2 operations will comply with relevant criteria at the nearest assessment locations for calm and inversion conditions.

Maximum recommended sound power levels for plant and equipment to meet the relevant criteria for the Stage 3 development have been provided in Table 5.2. Where future plant and equipment exceed these levels, noise controls and management strategies would be required to satisfy relevant criteria.

It is envisaged that no significant operational noise impacts would arise from the proposed rezoning of the project site.

6.2 Sleep disturbance recommendations

Sleep disturbance from night-time operation of the site has been assessed. Maximum noise level events which have potential to disturb sleep are predicted to be below the EPA screening criteria at all surrounding residential receivers with the exception of a minor exceedance of criteria predicted during night time inversion conditions at assessment location R2 for the Stage 3 development.

It is envisaged that no sleep disturbance impacts would arise from rezoning of the project for Stage 1 and Stage 2 development. Notwithstanding, minor sleep disturbance impacts may arise from the proposed rezoning of the project site for the Stage 3 development. It is noted, that the assessment for Stage 3 is preliminary in nature. Therefore, during the DA stage of the Stage 3 development, it is recommended that a noise reduction strategy be implemented to minimise potential sleep disturbance impacts to the community.

6.3 Construction noise recommendations

The construction noise assessment demonstrates that construction activities for Stages 1 and 2 would comply with standard hour construction criteria at all assessment locations, with exceedances of OOH criteria expected at locations R1 and R2 predicted under inversion conditions.

Noise levels will exceed criteria during the majority of Stage 3 construction at assessment locations R1 and R2 for calm and inversion conditions.

It is envisaged that no significant construction noise impacts would arise from the proposed rezoning of the project site for construction works performed during standard hours. Therefore, it is recommended that approval for the rezoning of the site be granted pending a condition that permits standard construction hours only, in accordance with the ICNG (DECC 2009).

6.4 Road traffic recommendations

Road traffic noise levels are predicted to exceed relevant RNP local road noise criteria during peak traffic movements. The assessment approach should be considered conservative as peak movements were adopted in preceding calculations. Notwithstanding, a significant reduction of movements would be required to satisfy the local road noise criteria. Therefore, it is recommended as part of the rezoning approval, a road traffic noise management plan is prepared once further details regarding the Stage 3 development is available. A key management requirement would be to limit the number of heavy vehicles accessing the project via Ross Street.

Construction noise is expected to be insignificant compared to existing and manageable using standard controls.

Notwithstanding, it is anticipated that road traffic noise for the project can be managed were approval for the rezoning granted.



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