Transport for NSW

TAP 3 - Hazelbrook

Noise and Vibration Impact Assessment

November 2018

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1. Introduction

1.1 Overview

The NSW Government is committed to facilitating and encouraging the use of public transport, such as trains, by upgrading stations to make them more accessible, and improving interchanges around stations with other modes of transport such as bicycles, buses and cars.

The Transport Access Program is a NSW Government initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure where it is needed most.

Hazelbrook Station does not currently meet key requirements of the *Disability Standards for Accessible Public Transport* (DSAPT) or the Commonwealth *Disability Discrimination Act 1992* (DDA).

The non-compliant access points and stairs to the Hazelbrook Station concourse and platforms do not facilitate access for people with reduced mobility, parents/carers with prams or passengers with luggage. There are no lift facilities and inadequate amenities and tactile surfacing to stairs, platforms and interchange facilities.

The Proposal would involve upgrade works to Hazelbrook Station, interchange facilities and surrounding footpaths. The station is located 93 kilometres west of the Sydney Central Business District (CBD) in the suburb of Hazelbrook and is serviced by the Blue Mountains Line. Platform 1 provides train services east to the CBD and Platform 2 provides train services west to Katoomba, Mount Victoria and Lithgow. The Proposal is located within the Blue Mountains local government area between Railway Parade and the Great Western Highway, Hazelbrook. The key features of the Proposal are summarised as follows:

- installation of a new lift, glazed awnings and a new lift landing from the existing footbridge to the platform
- modification to the existing levels within the commuter car park, Railway Parade pedestrian crossing (including new road humps) and footbridge to provide DDA compliant pedestrian routes to the proposed new lift
- regrade existing platform surfaces to provide DDA compliant pedestrian routes between new lift, station building, toilets and the boarding zone on the platform
- upgrade of two DDA compliant parking spaces to the commuter car park
- relocation of existing bike storage and construction of a retaining wall within the existing commuter car park
- new canopies around the lift and over the new family accessible toilet (FAT)
- installation of new corridor fencing
- removal of some plants and gardens within and surrounding the station to allow for works
- modification of existing station building layout to allow for new amenities and station services equipment room (SSER)
- ancillary works including adjustments to lighting and additional opal card readers, new anti-throw screens, handrails, electrical upgrades, minor drainage works, landscaping, improvements to station communications systems including closed circuit TV (CCTV) cameras, hearing loops, public announcement (PA) system, wayfinding signage, emergency help points and installation of tactile ground surface indicators (TGSIs)

- a new padmount and upgrade of low voltage system to account for new lift.

Subject to planning approval, construction is expected to commence in early 2019 and take around 18 months to complete.

1.2 Scope of work

The scope of work for the NVIA include:

- conducting long term noise monitoring at two locations representative of the area surrounding the train station
- identification of surrounding sensitive receivers potentially impacted by construction noise
- determination of the rating background level (RBL) for the Proposal from the noise monitoring data
- a quantitative assessment of construction noise and vibration
- reviewing the potential noise impacts due to construction traffic generation
- providing construction noise and vibration mitigation measures to minimise impacts on the community.

This report has been prepared with consideration to the following documents:

- *Construction Noise and Vibration Strategy* (TfNSW, 2018) (CNVS)
- *Road Noise Policy* (DECCW, 2011) (RNP)
- *Assessing Vibration: a technical guideline* (EPA, 2006) (AVTG)
- *Interim Construction Noise Guideline* (EPA, 2009) (ICNG)
- *Noise Policy for Industry* (EPA, 2017) (NPI).

1.3 Report structure

The report is comprised of the following sections:

- **Section 1 – Introduction:** provides the background and an overview of the proposal and the assessment
- **Section 2 – Existing environment:** summarises the existing noise conditions and details the noise monitoring methodology
- **Section 3 – Compliance criteria:** provides an overview of the construction noise, construction vibration and operational noise criteria
- **Section 4 – Construction impacts assessment:** presents a summary of the noise modelling and identifies potential noise and vibration impacts during construction
- **Section 5 – Operational impacts assessment:** presents a summary of the noise modelling and identifies potential noise impacts during operation
- **Section 6 – Mitigation measures:** provides an overview of the proposed noise and vibration mitigation measures during the construction and operational phases of the proposal
- **Section 7 – Conclusion:** presents a summary of the NVIA findings and sets out the principal conclusions for the assessment.

1.4 Limitations

This report: has been prepared by GHD for Transport for NSW and *may only be used and relied on by Transport for NSW for the purpose agreed between GHD and the Transport for NSW as set out of this report.*

GHD otherwise disclaims responsibility to any person other than Transport for NSW arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Transport for NSW and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Existing environment

2.1 Proposal location

The proposal is located about 93 kilometres west of Sydney, and 15 kilometres east of Katoomba. The train station runs east (towards Sydney) to west (towards Katoomba) and is fronted by the Great Western Highway A32 parallel to the train line. The surrounding area is commercial to the immediate south-west and north with residential encompassing the remaining surrounding area. The general site and noise monitoring locations are shown in Figure 2-1.

2.2 Sensitive receivers and land uses

Noise and vibration sensitive receivers are defined based upon the type of occupancy and the activities performed within the land parcel. The receivers are classified within the following categories:

- residential premises
- educational institutes
- hospitals and medical facilities
- places of worship
- passive and active recreation areas
- commercial or industrial premises.

2.2.1 Residential receivers

Residential receivers in the streets listed in Table 2-1 were identified near the proposal site and may experience noise impacts from the proposed station upgrade.

Table 2-1 Residential receiver locations

Residential street	Approximate distance from train station
Railway Parade	10 m south
Addington Road	100 m west
Landseer Road	170 m south
Terrace Falls Road	140 m west
Falcon Street	90 m north
Winbourne Road	90 m north
Burford Street	270 m east
Baths Road	250 m west
Rosedale Avenue	180 m north
Stuart Place	260 m north
Cambell Avenue	220 m north-west
Orama Road	540 m south-east

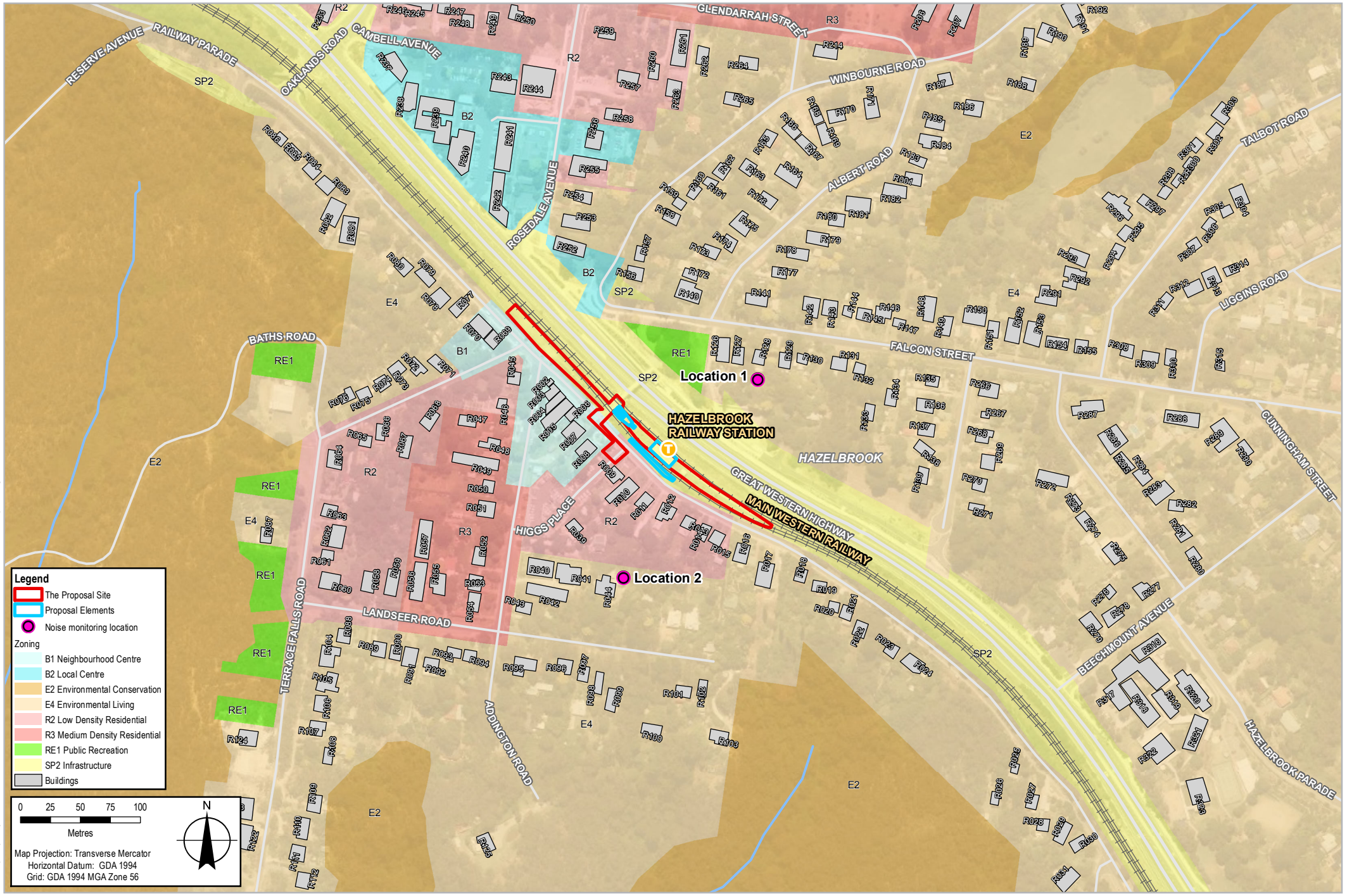
Residential street	Approximate distance from train station
Hazelbrook Parade	350 m east
Albert Road	110 m north
Liggins Road	470 m east
Talbot Road	390 east
Glendarrah Street	340 m north
Oaklands Road	400 m north-west

2.2.2 Other sensitive land uses

Non-residential sensitive land uses in the vicinity of the proposal area have been listed below in Table 2-2

Table 2-2 Non-residential sensitive receiver locations

Description	Address	Receiver type	Distance from station
Commercial precinct	Cambell Avenue	Commercial	250 m
Commercial precinct	Railway Parade	Commercial	30 m
Hazelbrook General Practice	Rosedale Avenue	Medical	225 m
Hazelbrook Public School	Beechmount Avenue	Educational	500 m
Hazelbrook Uniting Church	Rosedale Avenue	Place of worship	130 m



Noise monitoring locations, sensitive receivers and land use map **Figure 2-1**

2.3 Unattended noise monitoring

2.3.1 Noise monitoring methodology

Long term monitoring was undertaken at two locations for a period of seven days between 6 August and 14 August 2018 at following locations. Additional monitoring was undertaken from 17 August to 28 August at Location 2 due to corrupted noise logger data.

- Location 1: Background noise monitoring location located about 100 m north-east of the proposal site. This location is situated to the north of the Great Western Highway. The monitoring location had partial line of sight to the Great Western Highway and road traffic noise levels were observed to be the dominant noise source.
- Location 2: Background noise monitoring location located about 110 m south-west of the proposal site. This location is located to the south of the Great Western Highway. The monitoring location was set-back from the Great Western Highway is suitably shielded from road traffic noise from the highway.

The methodology of the unattended noise monitoring data was:

- The noise loggers were set to record L_{A90}, L_{A10}, L_{Aeq} and L_{Amax} noise descriptors. The instrument was programmed to accumulate environmental noise data continuously over a sampling period of 15 minutes over the entire monitoring period.
- A calibration check was performed on the noise monitoring equipment using a sound level calibrator with a sound pressure level of 94 dBA at 1 kHz. At completion of the measurements, the meter's calibration was re-checked to ensure the sensitivity of the noise monitoring equipment had not varied. The noise loggers were found to be within the acceptable tolerance of ± 0.5 dBA.
- Meteorological data for the monitoring period was sourced from the Bureau of Meteorology (BoM) Penrith Lakes Automatic Weather Station (AWS) (station number: 067113). The AWS is located about 21 km east of the proposal site.
- Noise levels were excluded during periods of extraneous noise, periods where average wind speeds were greater than 5 m/s or when rainfall occurred.

A summary of the noise monitoring locations and details of the noise loggers are provided in Table 2-3.

Table 2-3 Unattended noise logger details

Parameter	Value
Location 1	
Monitoring location	7 Falcon Street, Hazelbrook
Logger Type / Serial No.	Svan 977 / SN: 36873
Measurement started	11:45 am, 6th August
Measurement ceased	12:00 pm, 14th August
Pre/Post calibration	94.4 / 93.9 @ 1 kHz
Freq. weighting	A
Time response	Fast

Parameter	Value
Photograph	
Location 2	
Monitoring location	9 Landseer Road, Hazelbrook
Logger Type / Serial No.	Svan 977 / SNL 36871
Measurement started	9:30 am, 17th August
Measurement ceased	9:30 am, 28th August
Pre/Post calibration	94.8 / 94.7 @ 1 kHz
Freq. weighting	A
Time response	Fast
Photograph	

2.3.2 Noise monitoring results

The measured noise monitoring data were used to determine the Rating Background Levels (RBL) for the assessment during the day, evening and night-time periods in accordance with the NPI (EPA, 2017). A summary of the measured rating background levels and ambient noise levels is provided in Table 2-4. Daily noise level charts are provided in Appendix B.

The monitoring data from Location 2 is the more conservative of the two locations and has been used for this assessment.

Table 2-4 Summary of measured noise levels, dBA

Location	Rating background level, L_{A90}			Ambient level, L_{Aeq}		
	Day 7 am to 6 pm	Evening 6 pm to 10 pm	Night 10 pm to 7 am	Day 7 am to 6 pm	Evening 6 pm to 10 pm	Night 10 pm to 7 am
Location 1	42	39	28	52	50	48
Location 2	33	33	26	51	46	46

3. Compliance criteria

3.1 Construction noise

3.1.1 Proposed construction hours

Construction noise management levels for the proposal are based on the *Interim Construction Noise Guideline* (ICNG) (DECCW, 2009) and the *Construction Noise and Vibration Strategy* (CNVS) (TfNSW, 2018). Construction is expected to commence in early 2019 and would take around 18 months to complete.

Construction works would be conducted during standard construction hours and out-of-hours works are anticipated for track possessions. Works outside standard construction hours should only be conducted when it is not feasible or reasonable to work within standard hours. Any decisions to work outside of the standard construction hours shall be documented and assessed in the OOHW Application to justify the requirement.

The construction hours for the proposal are provided in Table 3-1.

Table 3-1 Construction hours

Construction hours	Monday to Friday	Saturday	Sunday/Public holiday
Standard hours	7 am to 6 pm	8 am to 1 pm	No work
OOHW Period 1	6 pm to 10 pm	7 am to 8 am 1 pm to 10 pm	8 am to 6 pm
OOHW Period 2	10 pm to 7 am	10 pm to 7 am	6 pm to 8 am

The ICNG acknowledges that the following activities have justification to be undertaken outside the standard construction hours assuming all feasible and reasonable mitigation measures are implemented to minimise the impacts to the surrounding sensitive land uses:

- the delivery of oversized plant, equipment and materials that police or other authorities determine require special arrangements to transport along public roads
- emergency work to avoid the loss of life or damage to property, or to prevent environmental harm
- maintenance and repair of public infrastructure where disruption to essential services or considerations of worker safety do not allow work within standard hours
- public infrastructure works that shorten the length of the proposal and are supported by the affected community
- works where a proponent demonstrates and justifies a need to operate outside the recommended standard construction hours
- works which maintain noise levels below the noise management levels outside of the recommended standard construction hours.

Works required outside standard construction hours would be identified during construction planning and nearby residents would be notified before possession work is expected.

3.1.2 Construction noise management levels

Construction noise management levels for residential premises and other sensitive land uses are provided in the CNVS and based on the ICNG.

The method to determine the noise management levels for residential receivers in accordance with the CNVS is outlined in Table 3-2.

Table 3-2 Noise management levels for residential receivers

Time of day	Noise management level, $L_{Aeq(15\ min)}$	Application notes
Recommended standard hours	Noise affected: RBL + 10 dBA	The noise affected level represents the point above which there may be some community reaction to noise. • where the predicted or measured $L_{Aeq(15\ min)}$ 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 dBA	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 proponent should consider very carefully if there is any other feasible and reasonable way to reduce noise to below this level. • If no quieter work method is feasible and reasonable, and the works proceed, the proponent should communicate with the impacted residents by clearly explaining the duration and noise level of the works, and by describing any respite periods that will be provided.
Outside recommended standard hours	Noise affected: RBL + 5 dBA	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 measures have been applied and noise is more than 5 dBA above the noise affected level, the proponent should consult with the community. For guidance on negotiating agreements see Section 7.2.2 of the *Interim Construction Noise Guideline*.

Noise management levels for other sensitive land uses are provided in Table 3-3 and only apply when the properties are in use.

Table 3-3 Noise management levels for other sensitive land uses

Land use	Noise management level, $L_{Aeq(15\ min)}$
Commercial premises	70 dBA (external)
Educational institutes	45 dBA (internal)
Hospital wards and operating theatres	45 dBA (internal)
Places of worship	45 dBA (internal)
Active recreation areas	65 dBA (external)

3.1.3 Sleep disturbance

The ICNG recommends that maximum noise level events and the frequency of maximum noise level events exceeding the RBL should be assessed where construction works are planned to extend over two or more consecutive nights.

The *Noise Policy for Industry* (NPI) (EPA, 2017) provides the most updated guidance for the assessment of sleep disturbance. The NPI recommends a maximum noise level assessment to assess the potential for sleep disturbance impacts which include awakenings and disturbance to sleep stages. An initial screening test for the maximum noise levels events should be assessed to the following levels.

- $L_{Aeq(15\ min)}$ 40 dBA or the prevailing RBL plus 5 dB, whichever is greater, and/or
- L_{AFmax} 52 dBA or the prevailing RBL plus 15 dB, whichever is greater.

If the screening test indicates there is a potential for sleep disturbance then a detailed maximum noise level assessment should be undertaken. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the rating background noise level, and the number of times this happens during the night-time period.

3.1.4 Proposal noise management levels

A summary of the proposal construction noise management levels for each identified sensitive receiver type is provided in Table 3-4. The noise levels from location two has been used for a conservative assessment

Table 3-4 Proposal construction noise management levels, dBA

Receiver Type	Time of day	Management level
Residential	Recommended standard hours	Noise affected: 45[2]
		Highly affected: 75
	Outside recommended standard hours[1]	Day: 40[2]
		Evening: 38
		Night: 35[3]
Commercial	When in use	70 dBA (external)
Educational institutes		45 dBA (internal)
Hospital wards and operating theatres		45 dBA (internal)
Places of worship		45 dBA (internal)
Active recreation areas		65 dBA (external)

Note 1: The *Noise Policy for Industry* (EPA, 2018) defines day, evening and night time periods as:

- Day: the period from 7 am to 6 pm Monday to Saturday or 8 am to 6 pm on Sundays and public holidays.
- Evening: the period from 6 pm to 10 pm.
- Night: the remaining periods.

Note 2: Measured background levels during the day were below the minimum background noise level from the *Noise Policy for Industry* (EPA, 2017). The minimum background level of 35 dBA has been used to calculate the noise management levels during the day-time period

Note 3: Measured background levels during the night were below the minimum background noise level from the *Noise Policy for Industry* (EPA, 2017). The minimum background level of 30 dBA has been used to calculate the noise management levels during the night-time period

3.2 Construction traffic

The *Road Noise Policy* (RNP) (DECCW, 2011) provides road traffic noise criteria for residential land uses affected by construction traffic on the public road network.

The *Road Noise Policy application notes* state that any increase in the total noise level at existing residences and other sensitive land uses affected by traffic generation on existing roads should be limited to 2 dBA above current levels. This limit only applies when the noise level without the development is within 2 dBA or exceeds the road traffic noise criterion provided in the RNP.

This has been used to identify potential impacts as a result of noise produced by construction traffic. If road traffic noise increases as a result of construction works within 2 dBA of current levels then the objectives of the RNP are considered to be met and no specific mitigation measures would be required.

Where construction traffic increases the existing road traffic noise levels by more than 2 dBA then further assessment against the road traffic noise criteria in Table 3-5 is required.

Table 3-5 Road traffic noise criteria, dBA

Type of development	Day 7 am to 10 pm	Night 10 pm to 7 am
Existing residence affected by additional traffic on arterial roads generated by land use developments	60 $L_{Aeq(15\ hour)}$	55 $L_{Aeq(9\ hour)}$
Existing residence affected by additional traffic on local roads generated by land use developments	55 $L_{Aeq(1\ hour)}$	50 $L_{Aeq(1\ hour)}$

3.3 Construction vibration

3.3.1 Human comfort

Acceptable vibration levels for human comfort have been set with consideration to Assessing Vibration: a technical guideline (DEC, 2006) which is based on the guidelines contained in British Standard *BS 6472 – 1992, Guide to Evaluation of Human Exposure to Vibration in Buildings (1 Hz to 80 Hz)*.

Typically, construction activities generate ground vibration of an intermittent nature. Intermittent vibration is assessed using the vibration dose value. Acceptable values of vibration dose are presented in for sensitive receivers.

Table 3-6 Human comfort intermittent vibration limits

Receiver type	Period	Intermittent vibration dose value ($m/s^{1.75}$)	
		Preferred value	Maximum value
Residential	Day (7 am and 10 pm)	0.2	0.4
	Night (10 pm and 7 am)	0.13	0.26
Offices, schools, educational institutes and places of worship	When in use	0.4	0.8

Whilst the assessment of response to vibration in *BS 6472:1992* is based on vibration dose value (refer to) and weighted acceleration, for construction related vibration, it is considered more appropriate to provide guidance in terms of a peak value, since this parameter is likely to be more routinely measured based on the more usual concern over potential building damage.

Humans are capable of detecting vibration at levels which are well below those causing risk of damage to a building. The degrees of perception for humans are suggested by the vibration level categories given in British Standard, BS 5228.2 – 2009, Code of Practice Part 2 Vibration for noise and vibration on construction and open sites – Part 2: Vibration and are shown below in Table 3-7.

Table 3-7 Guidance on effects of vibration levels for human comfort

Vibration level	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration at this level in residential environments will cause complaints, but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure.

3.3.2 Guidelines for general structures

The effects of transient vibration on structures is considered in *BS 7385 Part 2 – 1993 Evaluation and measurement for vibration in buildings*. The criteria provided in BS 7385 are presented in Table 3-8.

Table 3-8 Transient vibration guide values – minimal risk of cosmetic damage

Type of building	Peak component particle velocity in frequency range of predominant pulse	
	4 Hz to 15 Hz	15 Hz and above
Reinforced or framed structures. Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	50 mm/s at 4 Hz and above
Unreinforced or light framed structures. Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above.

The guide values in Table 3-8 relate predominantly to transient vibration which does not give rise to resonant responses in structures and low-rise buildings. Where the dynamic loading caused by continuous vibration may give rise to dynamic magnification due to resonance, especially at lower frequencies, then the guide values may need to be reduced by up to 50 per cent.

The predominant vibration for most construction activities involving intermittent vibration sources such as rock breakers, piling pigs, vibratory rollers and excavators occurs at frequencies greater than 4 Hz (and usually in the 10 Hz to 100 Hz range). On this basis, a conservative vibration damage screening level per receiver type is given below:

- Reinforced or framed structures: 25.0 mm/s
- Unreinforced or light framed structures: 7.5 mm/s

3.3.3 Guidelines for vibration sensitive structures

Heritage buildings and structures would be assessed using the guide values in Table 3-8. A heritage building or structure should not be assumed to be more sensitive to vibration unless they are found to be structurally unsound. If a heritage building or structure is found to be structurally unsound (following inspection) a more conservative cosmetic damage criterion of 2.5 mm/s peak component particle velocity (from DIN 4150) should be considered.

3.4 Operational noise criteria

Operational noise is assessed in accordance with the *Rail Infrastructure Noise Guideline* (RING) (EPA, 2013). The RING refers to the *NSW Industrial Noise Policy* (INP) (EPA, 2000) for the assessment of fixed facilities including railway stations. The INP has since been superseded by the *Noise Policy for Industry* (NPI) (EPA, 2017).

Operational noise is assessed in accordance with the *Noise Policy for Industry* (NPI) (EPA, 2017). The NPI addresses noise emanating from fixed facilities through assessing its intrusiveness based on the rating background noise level, and is presented below in Table 3-9.

Table 3-9 NPI Noise intrusiveness criteria

Time of Day	RBL ($L_{A90,15min}$), dBA	Intrusiveness trigger level
7 am to 6 pm (daytime)	35	40 (BG + 5 dB)
6 pm to 10 pm (evening)	33	38 (BG + 5 dB)
10 pm to 7 am (night time)	30	35 (BG + 5 dB)

Table 3-10 presents the recommended amenity noise levels from the NPI.

Table 3-10 Amenity noise levels

Receiver	Noise amenity area	Time of day	L_{Aeq}, dBA
Residential	Suburban	Day	55
		Evening	45
		Night	40
Commercial	All	When in use	65
Industrial	All	When in use	70
Educational	All	Noisiest 1 hour	35 (internal)
Hospital/Medical	All	When in use	35 (internal) 50 (external)
Place of Worship	All	When in use	40 (internal)
Passive recreation	All	When in use	50
Active recreation	All	When in use	55

4. Construction impacts assessment

4.1 Construction noise assessment

4.1.1 Construction works program

The plant and equipment likely to be required throughout each proposed stage of construction have been used to predict the noise levels that would be expected during construction works. The predicted noise levels were assessed against the construction noise management levels identified in Section 3.1.4.

Construction scenarios have been created based on construction equipment operating simultaneously at any given time. All works are located within or adjacent to the proposal site. It is unlikely that construction machinery would be operating at the same time (as the modelling assumes), but analysing the 'worse-case' scenario helps to identify where noise impacts could be a concern and assists in the formulation of mitigation areas.

Construction activities

The proposal is anticipated to involve the following work methodology and staging provided in Table 4-1.

Table 4-1 Construction methodology

Stage	Activities	Timeframe	Hours
Demolition	Site establishment	January 2019 to February 2020	Standard hours OOHW Period 1 OOHW Period 2
	Vegetation clearing		
	Services relocation		
Main works	Piling works	January 2019 to February 2020	Standard hours OOHW Period 1 OOHW Period 2
	Civil / footpath works		
	Underground HV		
	DDA car space works		
Platform works (possession dependant)	Lift structure installation	WE 30, 37 (2018/2019) WE 2, 17, 29, 44 (2019/2020)	Standard hours OOHW Period 1 OOHW Period 2
	Stair installation		
	Furniture installation		
	Roofing works		
Platform works	Lift pit excavation	January 2019 to February 2020	Standard hours OOHW Period 1 OOHW Period 2
	Station commissioning		
	Station power and systems installation		

The presented construction methodology has been simplified into the following construction scenarios, which will used to assess the potential construction noise impacts due to the proposed station upgrades. The resulting construction scenarios are presented in Table 4-2.

Table 4-2 Construction scenario staging

Construction scenario	Construction phase	Time frame
CS01	Site establishment and relocation of services	Standard hours OOHW Period 1 OOHW Period 2
CS02	Vegetation	Standard hours
CS03	Piling works	Standard hours
CS04	Stairs and lift upgrades	Standard hours OOHW Period 1 OOHW Period 2
CS05	Station fit out and systems	Standard hours OOHW Period 1 OOHW Period 2
CS06	Platform level works	Standard hours OOHW Period 1 OOHW Period 2
CS07	Construction compound	Standard hours OOHW Period 1 OOHW Period 2
CS08	Car park works	Standard hours OOHW Period 1 OOHW Period 2

Noise generating equipment

Plant and equipment needed for the proposal would be determined during the construction planning phase. However, likely equipment including typical sound levels are summarised in Table 4-3. Noise level data has been obtained from the Australian Standards *AS2436 – Guide to noise and vibration control on construction, demolition and maintenance sites*. Other equipment may be used, however, it is anticipated that they would produce similar net noise emissions when used concurrently with the equipment listed.

The magnitude of off-site noise impacts associated with construction is dependent upon a number of factors:

- the intensity and location of construction activities
- the type of equipment used
- existing background noise levels
- intervening terrain and structures
- the prevailing weather conditions.

Construction machinery would likely move about the Proposal site altering the received noise for individual receivers. During any given period, the machinery items to be used would operate at maximum sound power levels for only brief stages. At other times, the machinery would produce lower sound levels while carrying out activities not requiring full power. It is highly unlikely that all construction equipment would be operating at their maximum sound power levels at any one

time. Certain types of construction machinery would be present in the study area for only brief periods during construction. Therefore, noise predictions are considered conservative.

Table 4-3 below presents the number of construction equipment proposed for each construction scenario. The activity sound power level has been calculated based on the two noisiest plant to determine the worst-case noise impacts during construction. The activity noise levels have been used to predict the noise levels that would be expected during construction works.

Table 4-3 Construction equipment and sound power levels

Plant description	Sound power level	Construction scenario							
		CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08
Activity Sound Power Level		**106**	**110**	**113**	**112**	**118**	**120**	**99**	**110**
Cherry picker	105		1						
Concrete agitator truck	109			1		1			
Concrete pump truck	108			1		1			
Concrete saw (5 mins)	117						1		
Crane (mobile)	104	1	1						
Crane (tower)	105				1				
Excavator	107		1	1	1	1	1		1
Generator diesel	99							1	
Hand tools (electric)	102	1				1			1
Piling Rig (bored)	111			1	1	1			
Truck (> 20 tonne)	107		1		1	1			1
Truck (dump)	117						1		
Truck (water cart)	107					1			
Welder	105					1			

4.1.2 Noise modelling inputs

Noise modelling was undertaken using SoundPlan Version 7.4. SoundPlan is a computer program for the calculation, assessment and prognosis of noise exposure. SoundPlan calculates environmental noise propagation according to *ISO 9613-2 'Acoustics – Attenuation of sound during propagation outdoors'.*

The following noise modelling assumptions were made:

- surrounding land was modelled assuming a mix of soft and hard ground with a ground absorption coefficient of 0.5
- atmospheric absorption was based on an average temperature of 10°C and an average humidity of 70%

- atmospheric propagation conditions were modelled with noise enhancing wind conditions for noise propagation (downwind conditions) or an equivalently well-developed moderate ground based temperature inversions
- modelled scenarios take into account the shielding effect from surrounding buildings and structures on and adjacent to the site
- noise sources for each scenario are in some cases modelled at different locations. As such the noise modelling assesses the noise source at multiple locations and takes the maximum L_{Aeq} received noise level.

4.1.3 Construction noise impacts

Predicted noise levels from the construction scenarios outlined in Table 4-2 are presented in Appendix C. Construction noise contours for each modelled scenario is provided in Appendix D. A summary of the number of exceedances of the noise management levels for sensitive receivers is presented in Table 4-4 for residential receivers and Table 4-5 for non-residential receivers. Exceedances of the construction noise management levels are typical for construction projects of this scale. The noise impacts would be limited to the construction period only and would not have lasting effects on the community. The maximum noise impacts would be expected during works at the platform level involving the use of a concrete saw.

Impacts during standard hours

Residences located within 650 m of the proposal site are expected to be noise impacted at some point during construction. The noise management level is predicted to be exceeded by up to 37 dBA due to the low background noise levels and the receiver's proximity to the proposed construction.

The CNVS considers this level of exceedance as 'highly intrusive' and the additional mitigation measures discussed in Section 6.1.2 should be implemented at the affected receivers.

Impacts outside standard hours

Works outside standard construction hours are expected during rail possessions to complete installation works for the lift, stairs, roofing and anti-throw screens. Works during the rail possession have been assessed for all modelled scenarios during the day, evening and night-time assessment periods. The rail possessions would be required to limit the effect on normal rail operations and to improve worker safety.

Residences located within 1200 m of the proposal site are expected to be noise impacted at some stage during construction. The noise impacts would be experienced over a short term period limited to the proposed rail possession periods.

The predicted exceedance of the OOHW noise management levels are:

- 42 dBA during OOHW Period 1 (day)
- 45 dBA during OOHW Period 1 (evening)
- 47 dBA during OOHW Period 2 (night).

The CNVS considers the level of exceedances as 'highly intrusive' and the additional mitigation measures discussed in Section 6.1.2 should be implemented at the affected receivers.

Table 4-4 Residential exceedance summary

	Construction scenario							
	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08
Summary during standard construction hours								
Number of exceedances	175	255	224	204	291	295	7	198
Highest noise level	77	79	69	68	82	80	53	82
Highest exceedance	32	34	24	23	37	35	8	37
Worst affected receiver	R009	R014	R009	R009	R014	R009	R045	R009
Summary during OOHW Period 1 (Day)								
Number of exceedances	264	291	274	267	297	297	17	284
Highest noise level	77	79	69	68	82	80	53	82
Highest exceedance	37	39	29	28	42	40	13	42
Worst affected receiver	R009	R014	R009	R009	R014	R009	R045	R009
Summary during OOHW Period 1 (Evening)								
Number of exceedances	286	296	296	291	297	297	43	292
Highest noise level	77	79	69	68	82	80	53	82
Highest exceedance	40	42	32	31	45	43	16	45
Worst affected receiver	R009	R014	R009	R009	R014	R009	R045	R009
Summary during OOHW Period 2 (Night)								
Number of exceedances	293	297	297	296	297	297	64	296
Highest noise level	77	79	69	68	82	80	53	82
Highest exceedance	42	44	34	33	47	45	18	47
Worst affected receiver	R009	R014	R009	R009	R014	R009	R045	R009

Table 4-5 Non-residential receiver summary

	Construction scenario							
	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08
Commercial								
Number of exceedances	7	7	0	0	7	7	0	3
Highest noise level	77	83	68	67	79	91	62	82
Highest exceedance	7	13	-	-	9	21	-	12
Worst affected receiver	R008	R002	R006	R006	R004, R005	R006	R002	R008
Medical facility								
Number of exceedances	0	1	1	1	1	1	0	1
Highest noise level	53	57	59	58	64	67	41	55
Highest exceedance	-	2	4	3	9	12	-	-
Worst affected receiver	R255	R255	R255	R255	R255	R255	R255	R255
Educational institute								
Number of exceedances	0	0	0	0	2	3	0	0
Highest noise level	48	53	51	50	59	59	34	51
Highest exceedance	-	-	-	-	4	4	-	-
Worst affected receiver	R317	R317	R317	R317	R317	R317	R317	R317
Place of worship								
Number of exceedances	1	1	1	1	1	1	0	1
Highest noise level	58	62	62	61	68	71	49	57
Highest exceedance	3	7	7	6	13	16	-	2
Worst affected receiver	R252	R252	R252	R252	R252	R252	R252	R252
Active recreation								
Number of exceedances	0	0	0	0	0	0	0	0
Highest noise level	41	47	47	46	53	54	28	43
Highest exceedance	-	-	-	-	-	-	-	-
Worst affected receiver	R037	R037	R037	R037	R037	R037	R037	R037

4.1.4 Sleep disturbance impacts

Construction activities are expected outside standard construction hours to minimise the impacts on rail traffic during construction. There is the potential for maximum noise level events if the predicted maximum noise level is above the screening criteria of 52 dBA.

The screening criteria of 52 dBA is exceeded at 105 residential receivers. These properties are listed in Appendix E. Therefore a detailed maximum noise level assessment has been undertaken.

The RNP states that maximum internal noise levels between 50 to 55 dBA are unlikely to awaken people from sleep. Typically a window will provide a 10 dBA reduction when partially open and a 20 dBA reduction when closed. For a conservative assessment, the windows have been assumed to be partially open to assess sleep disturbance impacts.

Of the 105 residential receivers predicted to exceed the screening criteria, 27 receivers are predicted to exceed the external noise levels of 65 dBA (corresponding to internal noise levels of 55 dBA). The exceedances would be limited to during construction scenarios CS05 (Station fit out and systems) and CS06 (Platform level works). It is recommended that the use of noisier equipment (such as concrete saws) should be scheduled during the less sensitive parts of the night time period.

4.2 Construction traffic impacts

The RNP recommends that "*any increase in the total traffic noise level should be limited to 2 dB above that of the corresponding 'without construction' scenario."* Construction would generate heavy vehicle movements associated with the transportation of construction machinery, equipment and materials to the site. Light vehicle movements would be associated with employees and smaller deliveries. Construction traffic movements would be limited to along the Great Western Highway A44 and Railway Parade. Both of these already have significant existing traffic flows.

A significant increase in traffic volume would be needed in order to increase road traffic noise by 2 dBA (a doubling in traffic corresponds to about a 3 dBA increase). The construction traffic impacts on these roads would be less than 2 dBA and further assessment of construction traffic noise is not required.

4.3 Construction vibration impacts

4.3.1 Assessment methodology

The methodology for the construction vibration assessment included:

- vibration from surface construction plant and equipment was predicted and assessed with consideration to *Assessing Vibration: a Technical Guideline* and German Standard *DIN 4150-3: 1999 Structural Vibration – Part 3: Effects of vibration on structures*
- where noise and vibration levels were predicted to exceed the construction noise management levels, appropriate construction noise and vibration mitigation measures were provided to minimise impacts from each construction phase.

Energy from construction equipment is transmitted into the ground and transformed into vibrations, which attenuates with distance. The magnitude and attenuation of ground vibration is dependent on the following:

- the efficiency of the energy transfer mechanism of the equipment (i.e. impulsive; reciprocating, rolling or rotating equipment)

- the frequency content
- the impact medium stiffness
- the type of wave (surface or body)
- the ground type and topography.

Construction and demolition works have the potential to impact human comfort and / or cause structural damage to buildings. Potential vibration inducing activities identified during construction and demolition works include:

- piling, grinding and cutting will generate impulsive vibration emissions
- bulk earthworks, construction traffic movements and demolition works will be a source of intermittent or continuous vibration.

Safe working buffer distances to comply with the human comfort, cosmetic damage and heritage structural damage criteria were taken from the CNVS are provided in Table 4-6. Safe working buffer distances for heritage buildings were estimated by doubling the buffer distance for standard structures.

Table 4-6 Vibration safe working buffer distances, m

Activity	Human comfort	Structural damage	
		Heritage building/structure	Standard dwellings
Piling rig – Bored	N/A	4 m (nominal)	2 m (nominal)
Piling rig - Hammer	50 m	30 m	15 m
Vibratory roller (>18 tonnes)	100 m	50 m	25 m
Vibratory roller (13-18 tonnes)	100 m	40 m	20 m
Vibratory roller (7-13 tonnes)	100 m	30 m	15 m
Vibratory roller (4-6 tonnes)	40 m	24 m	12 m
Vibratory roller (2-4 tonnes)	20 m	12 m	6 m
Vibratory roller (1-2 tonnes)	15 m	10 m	5 m
Large hydraulic hammer (1600 kg, 18 to 34 tonne excavator)	73 m	44 m	22 m
Medium hydraulic hammer (900 kg, 12 to 18 tonne excavator)	23 m	14 m	7 m
Small hydraulic hammer 300 kg, 5 to 12 tonne excavator)	7 m	4 m	2 m
Jackhammer	Avoid contact with structure	2 m (nominal)	1 m (nominal)

4.3.2 Construction vibration impacts

Impacts for standard structures

The CNVS specifies a safe working buffer distance of 22 m for standard structures, based on an 18 to 34 tonne excavator. The following standard structures have been identified within 22 meters of the construction area:

- 35 – 53 Railway Parade
- 8 Addington Road.

The following residential structures have been identified within 100 m of the construction activities and could potentially experience human comfort impacts:

- 32 – 54 Railway Parade
- 1 – 19 Addington Road
- 3 Winbourne Road.

Impacts for heritage structures

Based on an 18-34 tonne excavator, Table 4-6 indicates that a safe working buffer distance of 44 m should apply for heritage listed structures. This safe working buffer distance could be reduced with smaller excavators. A search was undertaken on the Office of Environment and Heritage website to locate any heritage structures or items of local significance in the vicinity of the proposal area, and are listed in Table 4-7.

Table 4-7 Heritage listed structures

Heritage item	Address	Approximate distance from proposal site
H004: The Willows	15 Addington Road	40 m
H007: Hazelbrook Railway Station	Within proposal site	N/A
H008: Railway Parade Group	46, 47, 49, 51 Railway Parade	20 m
H009: Selwood House and Grounds	41 Railway Parade	20 m
H014: Edition and Shop	33-34 Railway Parade	40 m
H015: Store	35 Railway Parade	20 m
H016: Commercial Group of Buildings	37, 38, 39 Railway Parade	20 m
H020: Budgeecumbah	17-19 Addington Road	40 m
Masonry Retaining Wall	Great Western Highway, north side east of Falcon Street	35 m

A building dilapidation survey is required if an excavator is used within 44 m of the structures listed above. If the building dilapidation survey indicates that the heritage buildings are structurally unsound, then the conservative vibration criteria of 3 mm/s provided by DIN 4150-3 should be used. Otherwise the vibration criteria provided by BS 7385 should apply.

Vibration emissions may be reduced by using smaller equipment or alternative work methods. Site specific safe working distances would be established on-site prior to vibration generating works commencing. Vibration intensive work should not proceed within safe-working distances unless a permanent monitoring system is installed around one metre from the building footprint to warn operators in real-time when vibrations are approaching maximum criteria levels.

Mitigation measures for both standard and heritage listed structures have been provided in Section 6.2.

5. Operational impact assessment

The proposed station upgrades will not increase the operations of the rail line and there will be no increase from the rail noise of Hazelbrook station due to the operation of the station upgrades. All other operational noise impacts from the station (lift, plant, PA systems) are not expected to increase noise levels past the operational noise criteria presented in Section 3.4.

6. Mitigation measures

6.1 Construction noise

6.1.1 Standard mitigation measures

The following mitigation recommendations are provided in Table 6-1 to reduce the noise and vibration levels from the construction activities.

Table 6-1 Construction mitigation measures

Action required	Details
Management measures	
Implementation of any project specific mitigation measures required	In addition to the measures set out in this table, any project specific mitigation measures identified in the EIA documentation (e.g. REF, submissions or representations report) or approval or licence conditions must be implemented.
Implement stakeholder consultation measures	Periodic notification (monthly letterbox drop and website notification) detailing all upcoming construction activities delivered to sensitive receivers at least 7 days prior to commencement of relevant works. In addition to Periodic Notification, the following strategies may be adopted on a case-by-case basis: • Project specific Website • Project Infoline • Construction Response Line • Email Distribution List • Web-based Surveys • Social Media • Community and Stakeholder Meetings and • Community Based Forums (if required by approval conditions)
Register of noise and vibration sensitive receivers	A register of most affected noise and vibration sensitive receivers (NVSRs) would be kept on site. The register would include the following details for each NVSR: • Address of receiver • Category of receiver • Contact name and phone number The register may be included as part of the Proposal's Community Liaison Plan or similar document and maintained in accordance with the requirements of this plan.
Construction hours and scheduling	Where feasible and reasonable, construction should be carried out during the standard daytime working hours. Work generating noise with special audible characteristics and/or vibration levels should be scheduled during less sensitive time periods.
Construction respite period	Noise with special audible characteristics and vibration generating activities (including jack and rock hammering, sheet and pile driving, rock breaking and vibratory rolling) may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of one hour between each block. 'Continuous' includes any period during which there is less than 1 hour respite between ceasing and recommencing any of the work. No more than two consecutive nights of noise with special audible characteristics and/or vibration generating work may be undertaken in the same Noise Catchment Area (NCA) over any 7-day period, unless otherwise approved by the relevant authority.

Action required	Details
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: • All relevant project specific and standard noise and vibration mitigation measures • Relevant licence and approval conditions • Permissible hours of work • Any limitations on noise generating activities with special audible characteristics • Location of nearest sensitive receivers • Construction employee parking areas • Designated loading/unloading areas and procedures • Site opening/closing times (including deliveries) • Environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site. No dropping of materials from height, throwing of metal items and slamming of doors. No excessive revving of plant and vehicle engines. Controlled release of compressed air.
Monitoring	A noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration Management Plan and any approval and licence conditions.
Attended vibration measurements	Attended vibration measurements shall be undertaken at all buildings within 25 m of vibration generating activities when these activities commence to confirm that vibration levels are within the acceptable range to prevent cosmetic building damage.
Update Construction Environmental Management Plans	The Construction Environmental Management Plan (CEMP) must be regularly updated to account for changes in noise and vibration management issues and strategies.
Building condition surveys	Undertake building dilapidation surveys on all buildings located within the buffer zone prior to major project construction activities with the potential to cause property damage.
Source control measures	
Plan worksites and activities to minimise noise and vibration	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable. For example, when piling is required, bored piles rather than impact-driven piles will minimise noise and vibration impacts. Similarly, diaphragm wall construction techniques, in lieu of sheet piling, will have significant noise and vibration benefits.
Maximum noise levels	The noise of plant and equipment must have operating Sound Power or Sound Pressure Levels compliant with the allowable noise levels in Section 4.1 or Appendix C of the CNVS (TfNSW, 2018).
Use and siting of plant	Simultaneous operation of noisy plant within discernible range of a sensitive receiver is to be avoided. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Noise-emitting plant to be directed away from sensitive receivers.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) must be fitted and used on all construction vehicles and mobile plant regularly used on site and for any out of hours work, including delivery vehicles.

Action required	Details
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Select site access points and roads as far as possible away from sensitive receivers. Dedicated loading/unloading areas to be shielded if close to sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible.
Construction related traffic	Schedule and route vehicle movements away from sensitive receivers and during less sensitive times. Limit the speed of vehicles and avoid the use of engine compression brakes. Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.
Silencers on mobile plant	Where possible reduce noise from mobile plant through additional fittings including: • Residential grade mufflers • Damped hammers such as “City” Model Rammer Hammers • Air parking brake engagement is silenced.
Prefabrication of materials off-site	Where practicable, pre-fabricate and/or prepare materials off-site to reduce noise with special audible characteristics occurring on site. Materials can then be delivered to site for installation.
Engine compression brakes	Limit the use of engine compression brakes at night and in residential areas. Ensure vehicles are fitted with a maintained original equipment manufacturer exhaust silencer that complies with the National Transport Commissions ‘in-service test procedure’ and standard.
Path control measures	
Shield stationary noise sources such as pumps	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained. Appendix F of AS 2436:1981 lists materials suitable for shielding
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.

6.1.2 Additional mitigation measures

The CNVS (TfNSW) provides the following information regarding further mitigation measures for certain receivers exceeding noise management levels, and are presented below in Table 6-2. The Additional Mitigation Measures Matrices (AMMM) shall be used to determine the additional measures after the application of standard mitigation measures where reasonable and feasible.

Table 6-2 Additional management measures

Measure	Description	Abbreviation
Periodic Notification	For each I&S project, a notification entitled ‘Project Update’ or ‘Construction Update’ is produced and distributed to stakeholders via letterbox drop and distributed to the Proposal postal and/or email mailing lists. Periodic notifications provide an overview of current and upcoming works across the Proposal and other topics of interest. The objective is to engage, inform and provide project-specific messages. Advanced warning of potential disruptions (e.g. traffic changes or noisy works) can assist in reducing the impact on stakeholders. The	PN

Measure	Description	Abbreviation
	approval conditions for projects specify requirements for notification to sensitive receivers where works may impact on them. Content and length is determined on a project-by-project basis and must be approved by TfNSW prior to distribution. Most projects distribute notifications on a monthly basis. Each notification is graphically designed within a branded template. In certain circumstances media advertising may also be used to supplement Periodic Notifications, where considered effective. Periodic Notification may be advised by the I&S Community Engagement Team in cases where AMMM are not triggered as shown in Tables 9 to 11, for example where community impacts extend beyond noise and vibration (traffic, light spill, parking etc). In these circumstances the I&S Community Engagement Team will determine the community engagement strategy on a case-by-case basis.	
Verification Monitoring	Verification monitoring of noise and/or vibration during construction may be conducted at the affected receiver(s) or a nominated representative location (typically the nearest receiver where more than one receiver has been identified). Monitoring can be in the form of either unattended logging (i.e. for vibration provided there is an immediate feedback mechanism such as SMS capabilities) or operator attended surveys (i.e. for specific periods of construction noise). The purpose of monitoring is to confirm that: • Construction noise and vibration from the Proposal are consistent with the predictions in the noise assessment • Mitigation and management of construction noise and vibration is appropriate for receivers affected by the works Where noise monitoring finds that the actual noise levels exceed those predicted in the noise assessment then immediate refinement of mitigation measures may be required and the Construction Noise and Vibration Impact Statement (CNVIS) amended.	V
Specific Notification	Specific notifications are in the form of a personalised letter or phone call to identified stakeholders no later than seven calendar days ahead of construction activities that are likely to exceed the noise objectives. Alternatively (or in addition to), communications representatives from the contractor would visit identified stakeholders at least 48 hours ahead of potentially disturbing construction activities and provide an individual briefing. • Letters may be letterbox dropped or hand distributed • Phone calls provide affected stakeholders with personalised contact and tailored advice, with the opportunity to provide comments on the proposed work and their specific needs • Individual briefings are used to inform stakeholders about the impacts of noisy activities and mitigation measures that will be implemented. Individual briefings provide affected stakeholders with personalised contact and tailored advice, with the opportunity to comment on the Proposal Specific notifications are used to support periodic notifications, or to advertise unscheduled works and must be approved by TfNSW prior to implementation/distribution.	SN
Respite Offer	The purpose of a project specific respite offer is to provide residents subjected to lengthy periods of noise or vibration respite from an ongoing impact. The offer could comprise prepurchased movie tickets, bowling activities, meal vouchers or similar offer. This measure is determined on a case-by-case basis, and may not be applicable to all I&S projects.	RO

Measure	Description	Abbreviation
Alternative Accommodation	Alternative accommodation options may be provided for residents living in close proximity to construction works that are likely to incur unreasonably high impacts. Alternative accommodation will be determined on a case-by-case basis and should provide a like-for-like replacement for permanent residents, including provisions for pets, where reasonable and feasible.	AA
Alternative construction methodology	Where the vibration assessment identifies that the proposed construction method has a high risk of causing structural damage to buildings near the works, the proponent will need to consider alternative construction options that achieve compliance with the Vibration Management Level (VMLs) for building damage. For example, replace large rock breaker with smaller rock breakers or rock saws.	AC
Respite Period	OOHW during evening and night periods will be restricted so that receivers are impacted for no more than 3 consecutive evenings and no more than 2 consecutive nights in the same NCA in any one week. A minimum respite period of 4 evenings/5 nights shall be implemented between periods of consecutive evening and/or night works. Strong justification must be provided where it is not reasonable and feasible to implement these period restrictions (e.g. to minimise impacts to rail operations), and approval must be given by TfNSW through the OOHW Approval Protocol. Note; this management measure does not apply to OOHW Period 1 – Days.	RP
Duration Reduction	Where Respite Periods (see management measure above) are considered to be counterproductive to reducing noise and vibration impacts to the community it may be beneficial to increase the number of consecutive evenings and/or nights through Duration Reduction to minimise the duration of the activity. This measure is determined on a project-by-project basis, and may not be applicable to all I&S projects. Impacted receivers must be consulted and evidence of community support for the Duration Reduction must be provided as justification for the Duration Reduction. A community engagement strategy must be agreed with and implemented in consultation with I&S Community Engagement Representatives.	DR

The CNVS outlines the various trigger levels to warrant these mitigation measures, and such is presented below in Table 6-3.

The predicted noise levels for each receiver and the required additional noise mitigation measures are presented in Appendix C. Construction noise management zones have been mapped and are provided in Appendix F to Appendix I.

Table 6-3 Triggers for Additional Mitigation Measures - Airborne Noise

Construction hours	Receiver perception	dBA above RBL	dBA above NML	Additional management measures
Standard hours Monday – Friday (7 am – 6 pm) Saturday (8 am – 1 pm)	Noticeable	5 to 10	0	-
	Clearly audible	> 10 to 20	< 10	-
	Moderately intrusive	> 20 to 30	> 10 to 20	PN, V
	Highly intrusive	> 30	> 30	PN, V
	75 dBA or greater	N/A	N/A	PN, V, SN
	Noticeable	0 to 10	< 5	-

Construction hours	Receiver perception	dBA above RBL	dBA above NML	Additional management measures
OOHW Period 1 Monday – Friday (6 pm – 10 pm) Saturday (7 am – 8 am, 1 pm – 10 pm) Sunday/PH (8 am – 6 pm)	Clearly audible	> 10 to 20	5 to 15	PN
	Moderately intrusive	> 20 to 30	> 15 to 25	PN, V, SN, RO
	Highly intrusive	> 30	> 25	PN, V, SN, RO, RP[1], DR[1]
OOHW Period 2 Monday – Saturday (12 am – 7 am, 10 pm – 12 am) Sunday/PH (12 am – 8 am, 6 pm – 12 am)	Noticeable	0 to 10	< 5	PN
	Clearly audible	> 10 to 20	5 to 15	PN, V
	Moderately intrusive	> 20 to 30	> 15 to 25	PN, V, SN, RP, DR
	Highly intrusive	> 30	> 25	PN, V, SN, AA, RP, DR

Note 1: Respite periods and duration reduction are not applicable when works are carried out during OOHW Period 1 Day only.

The predicted construction noise levels in Section 4.1 have been categorised into the noise perception categories to determine the additional mitigation measures required in accordance with the CNVS. The number of residential receivers that require additional mitigation measures for each modelled construction scenario is provided in Table 6-4.

6.2 Construction vibration

Where construction is required within the safe working buffer distance alternative work methods are required, such as smaller equipment should be considered. If no alternative work method is feasible or reasonable, then compliance vibration monitoring should be undertaken where works are required within the safe working buffer distance and include:

- Site tests to review of the measured frequency content to determine the structural damage criteria as per Table 3-8 for standard dwellings.
- Continuous vibration monitoring with a visual alarm installed to warn the equipment operator when the structural damage vibration criteria (considering frequency content) is exceeded.

These mitigation measures pertain to the structures identified within the safe working buffer distance as outlined in Section 4.3.2.

6.3 Operational noise

Operational noise levels are expected to comply with the operational noise criteria at the worst affected receiver. No specific operational mitigation measures are recommended.

Table 6-4 Number of receivers identified for additional mitigation measures

ID	Description	Standard construction hours			OOHW Period 1						OOHW Period 2			
					Day			Evening			Night			
		MI	HI	HNA	CA	MI	HI	CA	MI	HI	N	CA	MI	HI
		11-20 dBA	> 20 dBA	≥ 75 dBA	6-15 dBA	16-25 dBA	> 25 dBA	6-15 dBA	16-25 dBA	> 25 dBA	0-5 dBA	6-15 dBA	16-25 dBA	> 25 dBA
CS01	Site establishment and relocation of services	7	8	1	124	7	8	170	21	9	64	182	37	10
CS02	Vegetation	36	13	8	183	36	13	182	76	14	14	158	105	21
CS03	Piling works	27	2	0	172	27	2	178	59	5	32	175	84	6
CS04	Stairs and lift upgrades	18	2	0	164	18	2	174	50	4	45	175	74	6
CS05	Station fit out and systems	125	11	5	157	125	11	100	171	25	0	68	184	50
CS06	Platform level works	159	22	2	112	159	22	65	187	47	0	32	188	78
CS07	Construction compound	0	0	0	4	0	0	8	1	0	48	12	1	0
CS08	Car park works	10	4	1	150	10	4	207	19	5	27	216	50	6

Notes:
N refers to Noticeable
CA refers to Clearly Audible
MI refers to Moderately Intrusive
HI refers to Highly Intrusive
HNA refers to Highly Noise Affected

7. Conclusion

Noise and vibration impacts for the construction and operational phases of the proposal have been assessed. Existing noise levels were identified through unattended noise measurements and used to establish construction and operational noise management levels.

7.1 Construction noise

Construction for the proposal is expected to commence in early 2019 and would take around 18 months to complete. Construction activities are proposed to be undertaken during and outside standard construction hours and have been developed based on the proposal construction staging.

The predicted noise levels are expected to exceed the noise management levels during standard construction hours, and some residential receivers are expected to experience noise levels above the highly affected noise level of 75 dBA during these hours. Any construction activities undertaken outside standard construction hours would impact the surrounding environment due to low existing background noise levels.

Traffic noise impact due to construction are not expected as noise levels along the construction traffic routes are not predicted to significantly increase road traffic noise levels.

It is typical for construction projects to exceed the construction noise management levels. Any impacts due to construction works are temporary in nature and would not represent a permanent impact on the community and surrounding environment. The predicted noise levels are generally conservative and would only be experienced for limited periods during construction. Impacts may be reduced through the introduction of feasible and reasonable mitigation measures which have been recommended. However, these mitigation measures are unlikely to reduce noise levels below the construction noise management levels.

7.2 Construction vibration

Safe working distances for vibration activities have been identified for standard structures and heritage listed structures. Site specific safe working distances are to be established on-site prior to vibration generating works commencing.

Residential buildings have been identified within the safe working distances. A dilapidation survey is required for heritage buildings listed in Table 4-7. Vibration monitoring is recommended for any structure that is located within the safe working distances.

7.3 Operational noise

Operation noise emission is not expected to change as a result of construction of the proposal and would be expected to comply with the operational noise criteria at all sensitive receivers. Therefore, no operational mitigation measures are required.

8. References

Australian Standards (1997), *AS1055.1:1997 Acoustics – Description and measurement of environmental noise*

Australian Standards (2010), *AS2436:2010 Guide to noise and vibration control on construction, demolition and maintenance sites*

British Standards (1993), *BS7385-2:1993 Evaluation and measurement for vibration in buildings*

DECC (2009), *Interim Construction Noise Guideline*

DECCW (2011), *Road Noise Policy*

EPA (2017), *Noise Policy for Industry*

EPA (2013), *Rail Infrastructure Noise Guideline*

German Standards (1999), *DIN 4150-3 Structural Vibration Part 3: Effects of vibration on structures*

Transport for NSW (2018), *Construction Noise and Vibration Strategy*

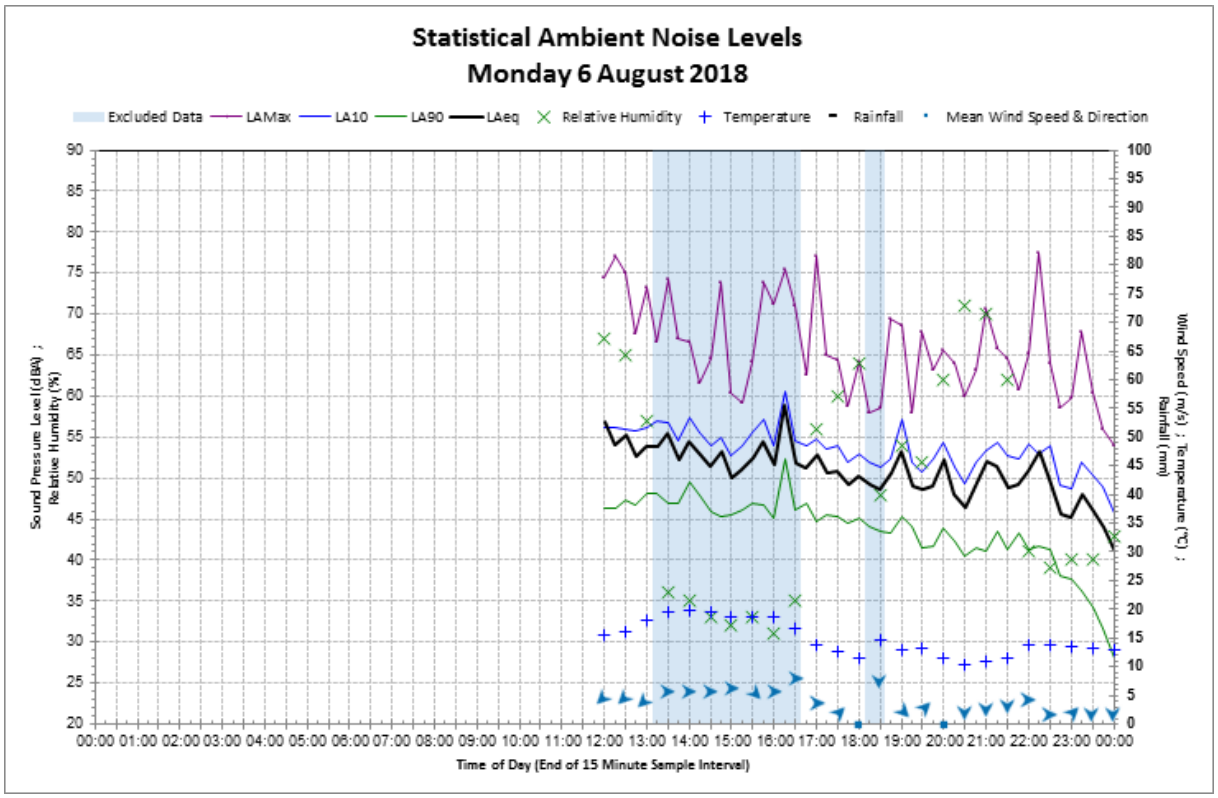
Appendices

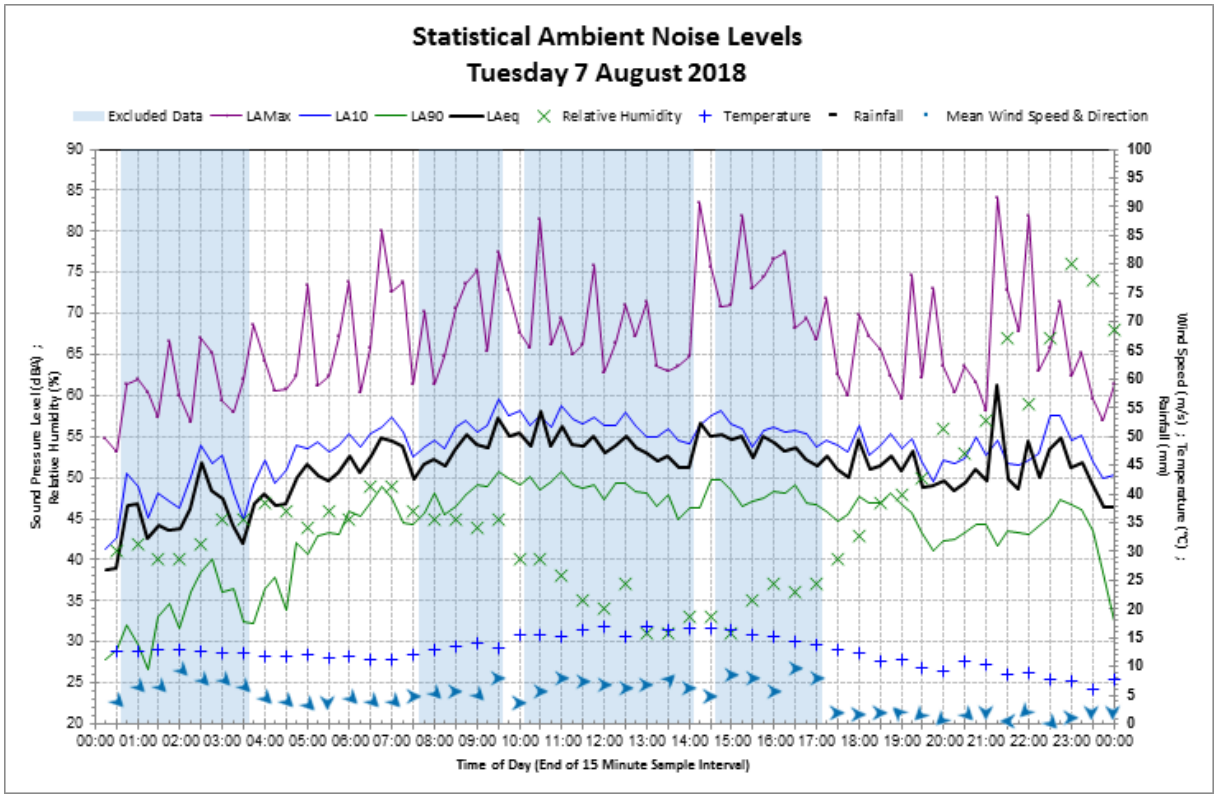
Appendix A – Glossary

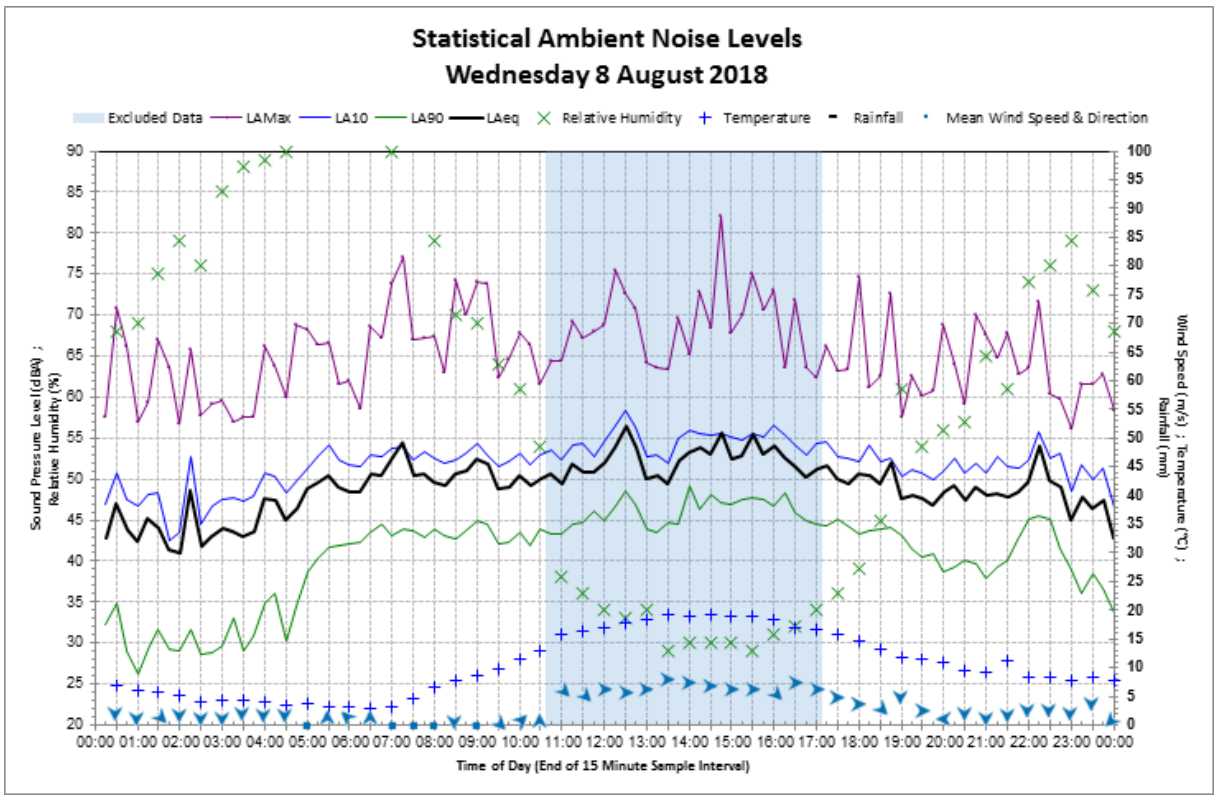
Abbreviation	Definition
Ambient noise	The all-encompassing noise associated within a given environment. It is the composite of sounds from many sources, both near and far.
ANMM	Additional Mitigation Measures Matrices
Background noise	The underlying level of noise present in the ambient noise, excluding the noise source under investigation, when extraneous noise is removed. This is described using the L_{A90} descriptor.
CNVS	*Construction Noise and Vibration Strategy* (TfNSW, 2018)
dB	Decibel is the logarithmic unit used for expressing the sound pressure level (SPL) or power level (SWL) in acoustics.
dBA	Frequency weighting filter used to measure 'A-weighted' sound pressure levels, which conforms approximately to the human ear response, as our hearing is less sensitive at very low and very high frequencies.
dBC	Frequency weighting filter used to measure 'C-weighted' sound pressure levels, which is designed to be more response to low frequency noise
DECCW	Department of Environment, Climate Change and Water
EPA	Environment Protection Authority
ICNG	*Interim Construction Noise Guideline* (DECCW, 2009)
L_{Aeq}(period)	Equivalent sound pressure level: the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
$L_{A90(period)}$	The sound pressure level exceeded for 90% of the measurement period.
L_{Amax}	The maximum sound level recorded during the measurement period.
$L_{Aeq(15hr)}$)	The L_{Aeq} noise level for the period 7 am to 10 pm.
$L_{Aeq(9hr)}$	The L_{Aeq} noise level for the period 10 pm to 7 am.
$L_{Aeq(1hr)}$	The highest hourly L_{Aeq} noise level during the day and night periods.
Noise sensitive receiver	An area or place potentially affected by noise including residential dwellings, schools, child care centres, places of worship, health care institutions and active or passive recreational areas.
NPI	*Noise Policy for Industry* (EPA, 2017)
Rating background level (RBL)	The overall single-figure background level representing each assessment period (day/evening/night) over the whole monitoring period.
RNP	*Road Noise Policy* (DECWW, 2011)
TfNSW	Transport for New South Wales

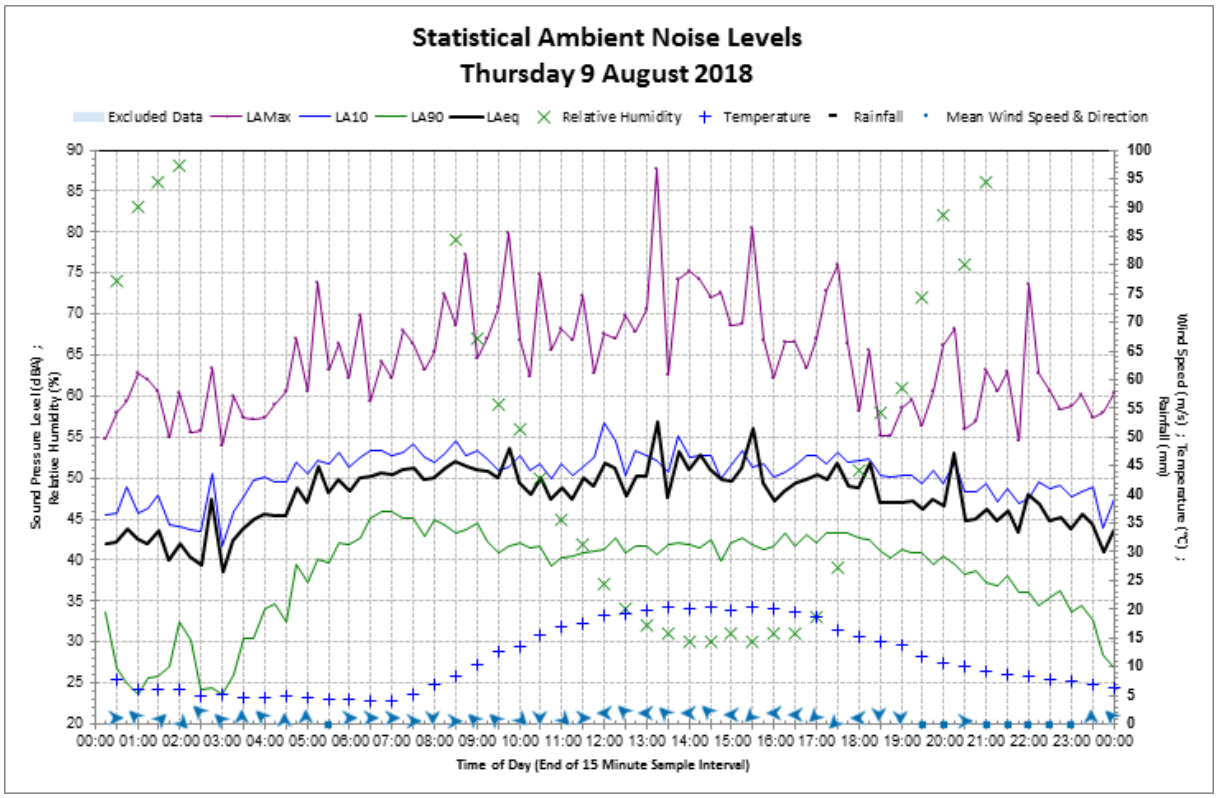
Appendix B – Noise monitoring charts

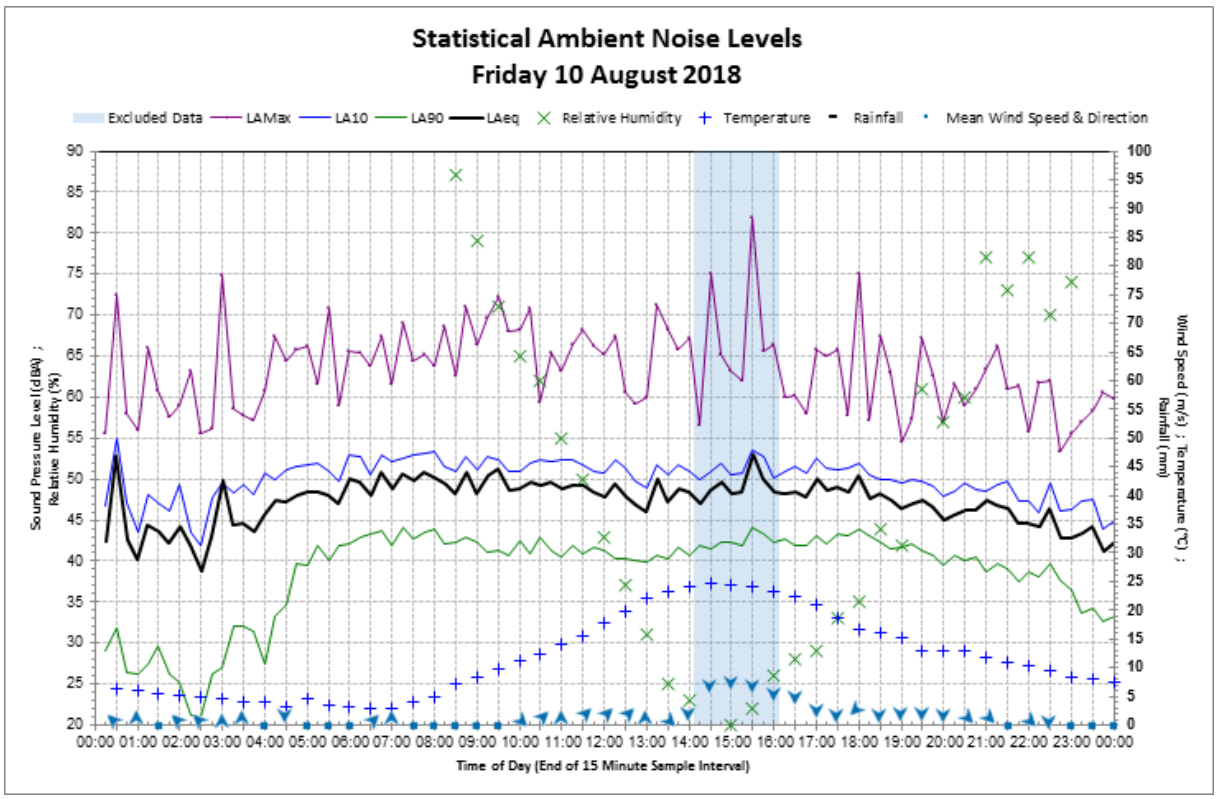
Location 1 – 7 Falcon Street

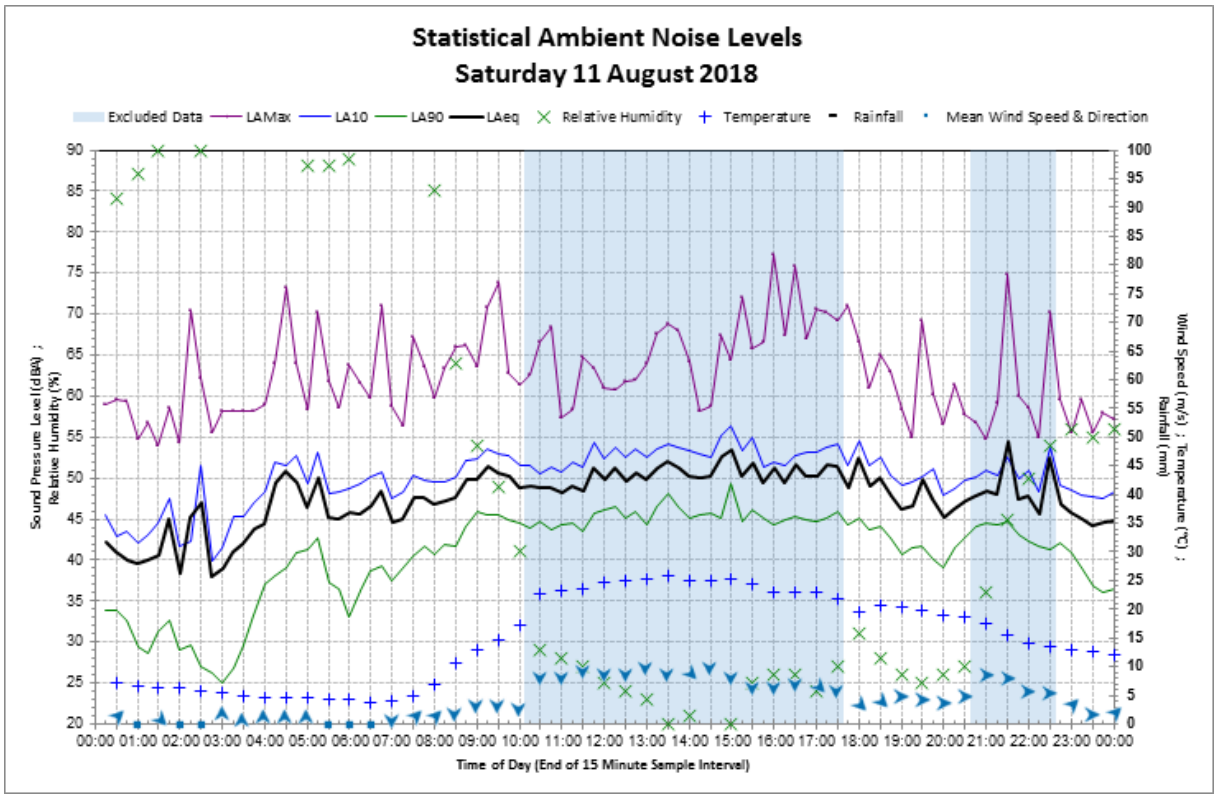


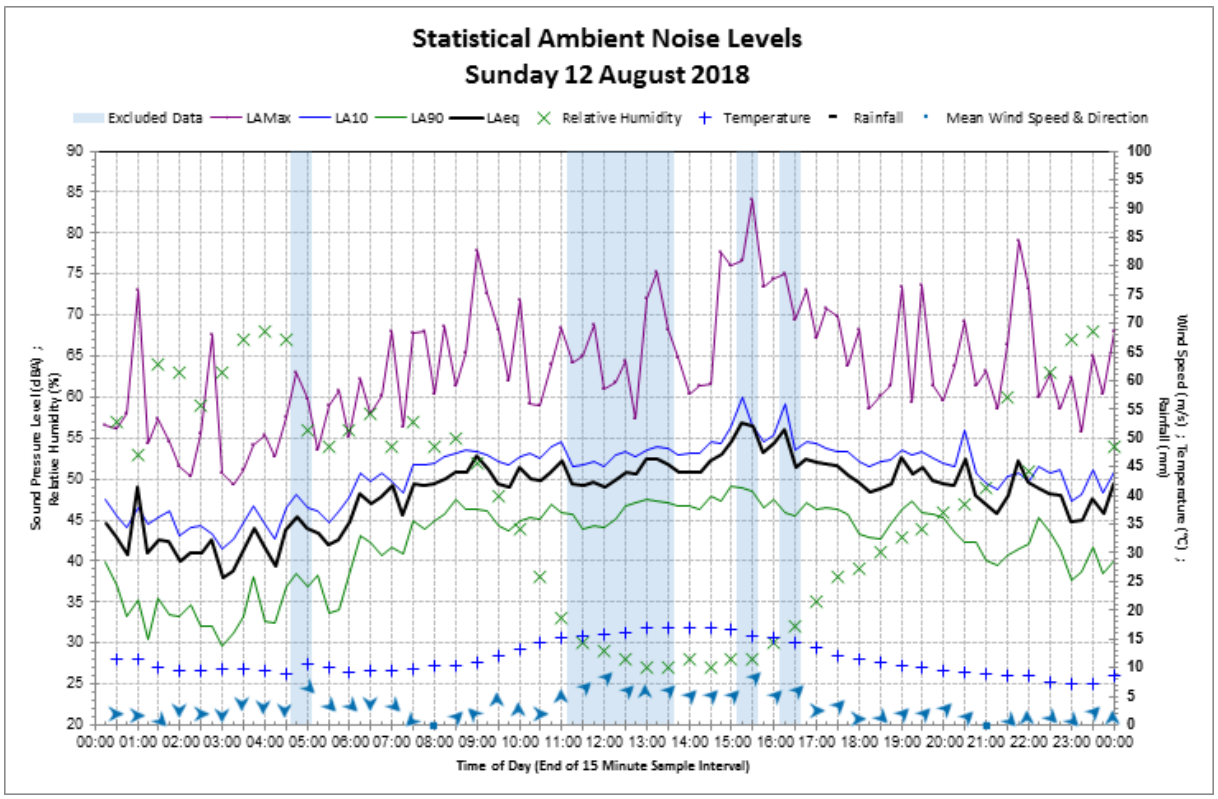


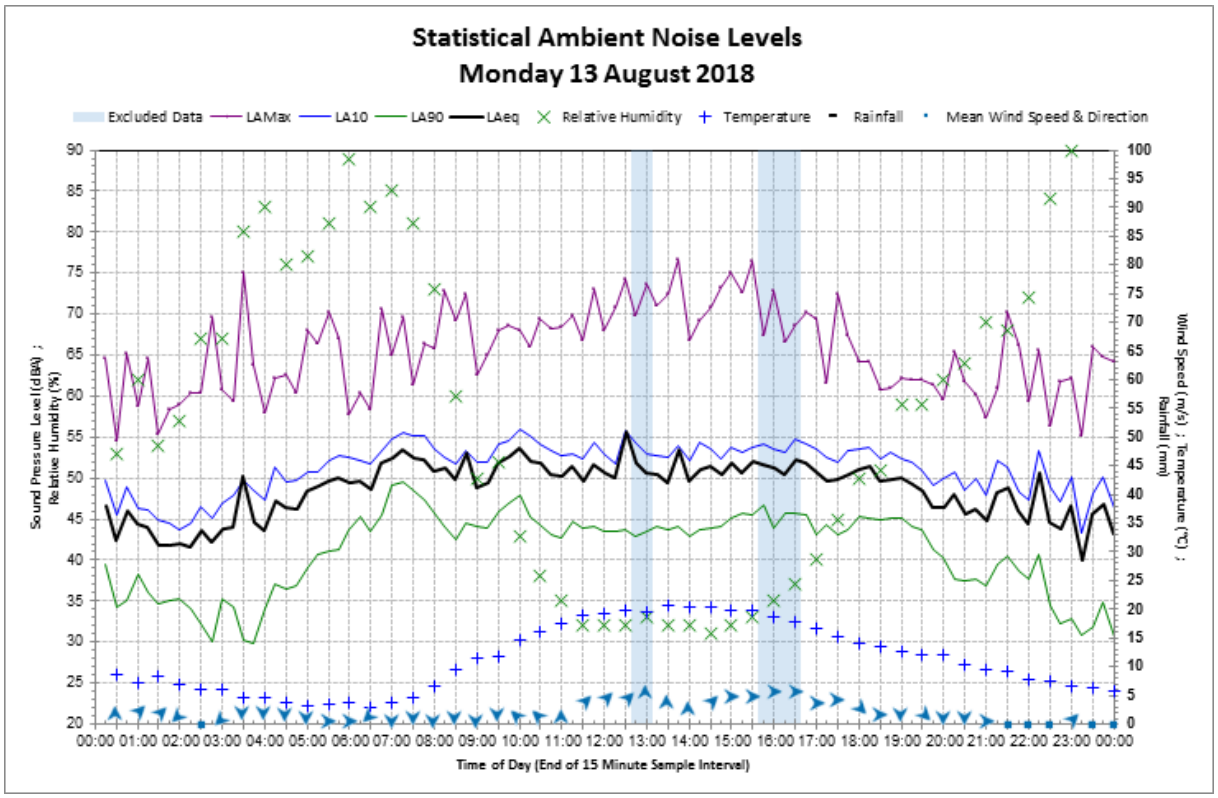

Statistical Ambient Noise Levels
Wednesday 8 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

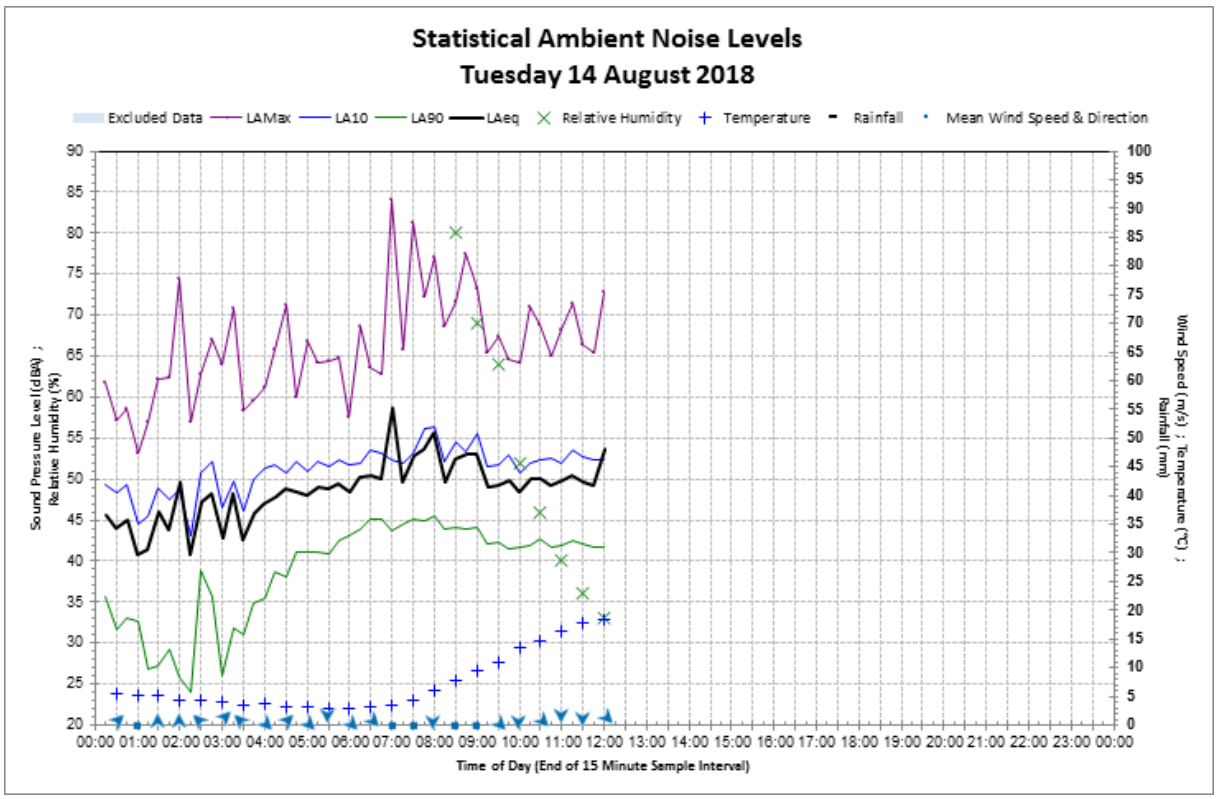

Statistical Ambient Noise Levels
Thursday 9 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Friday 10 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

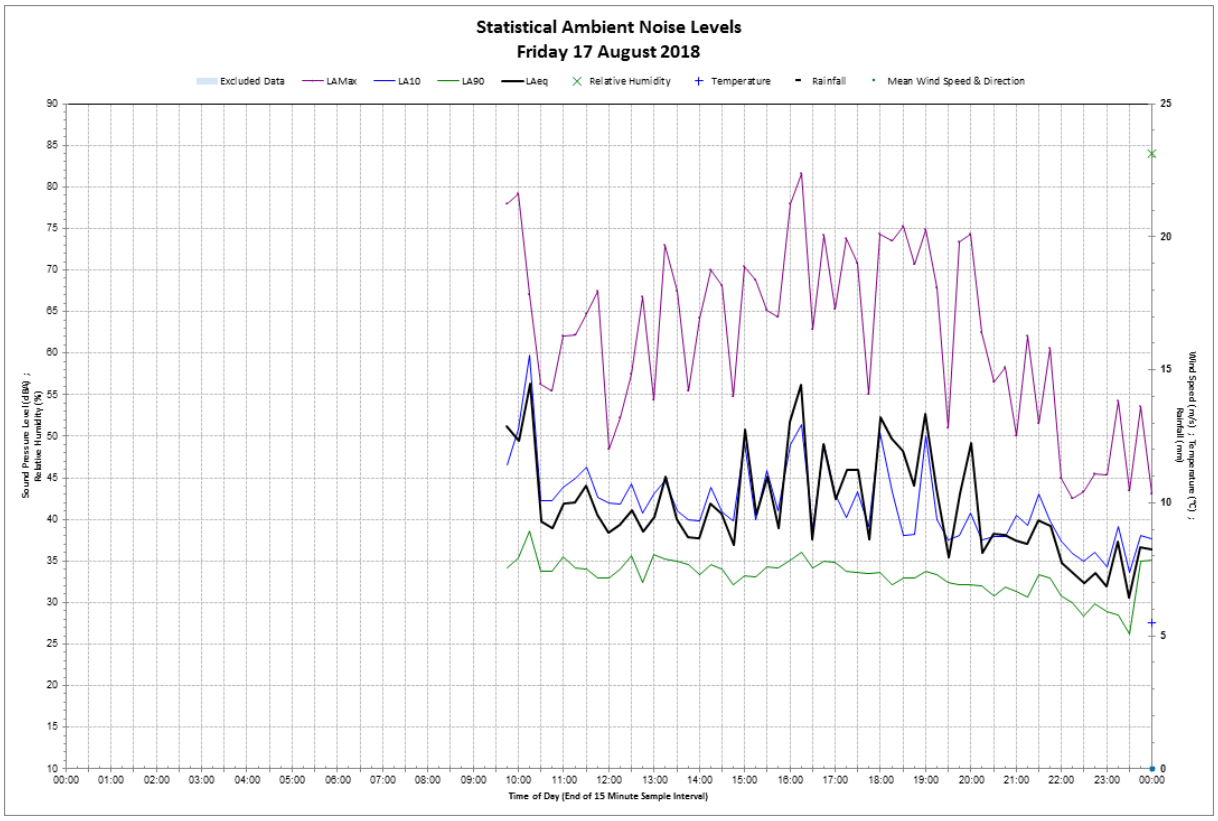

Statistical Ambient Noise Levels
Saturday 11 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

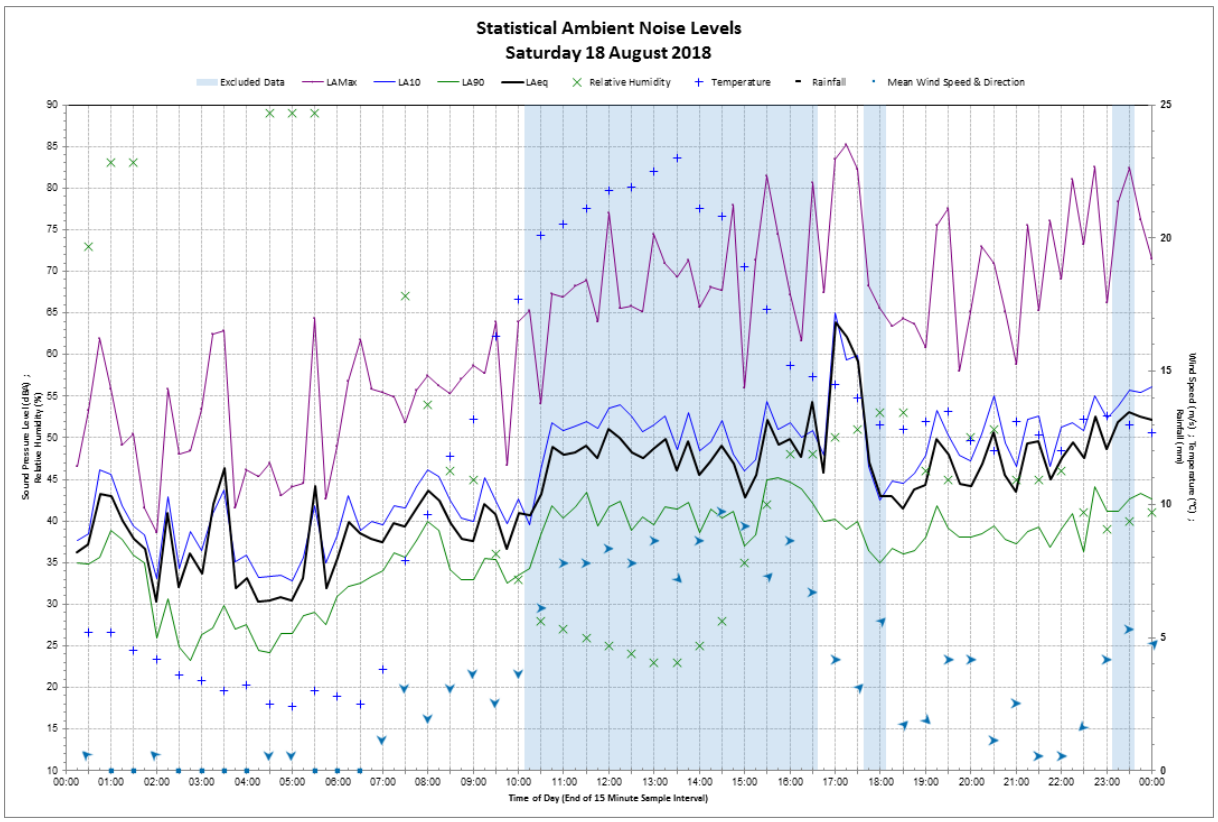

Statistical Ambient Noise Levels
Sunday 12 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

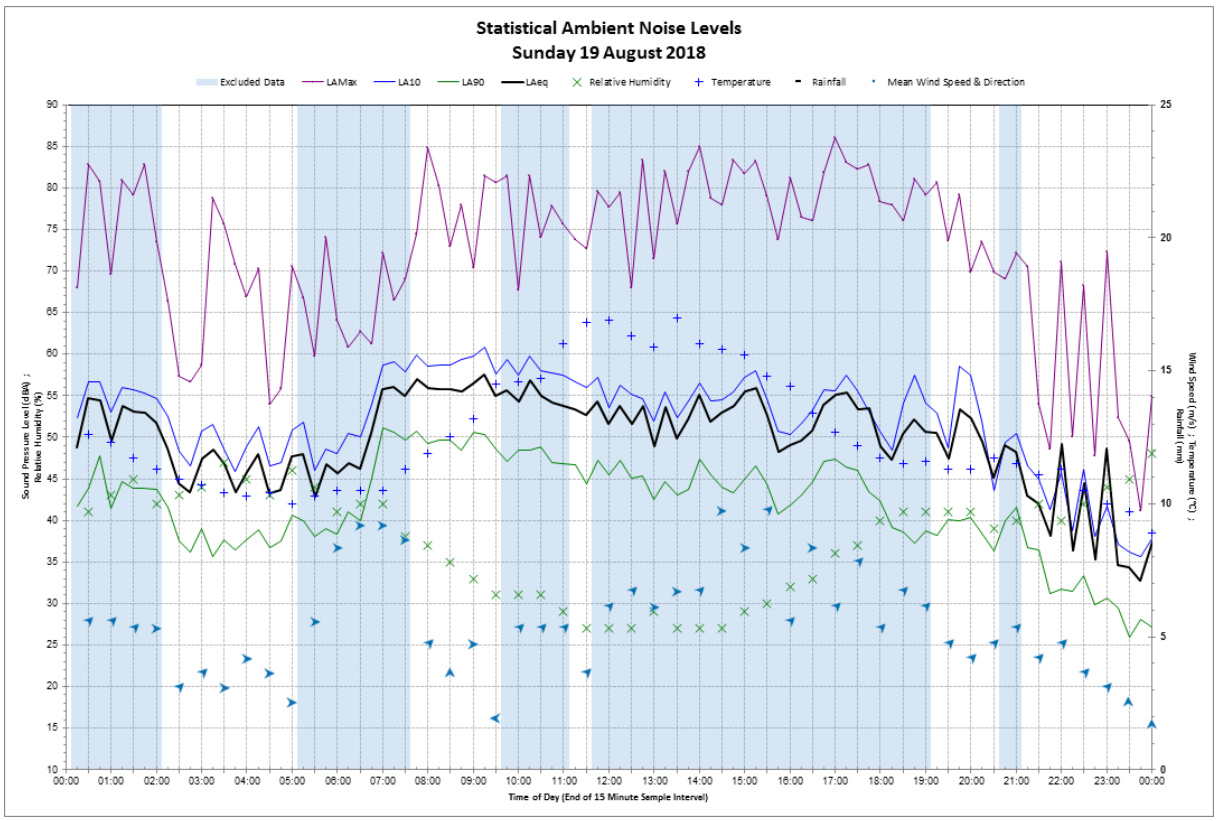

Statistical Ambient Noise Levels
Monday 13 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

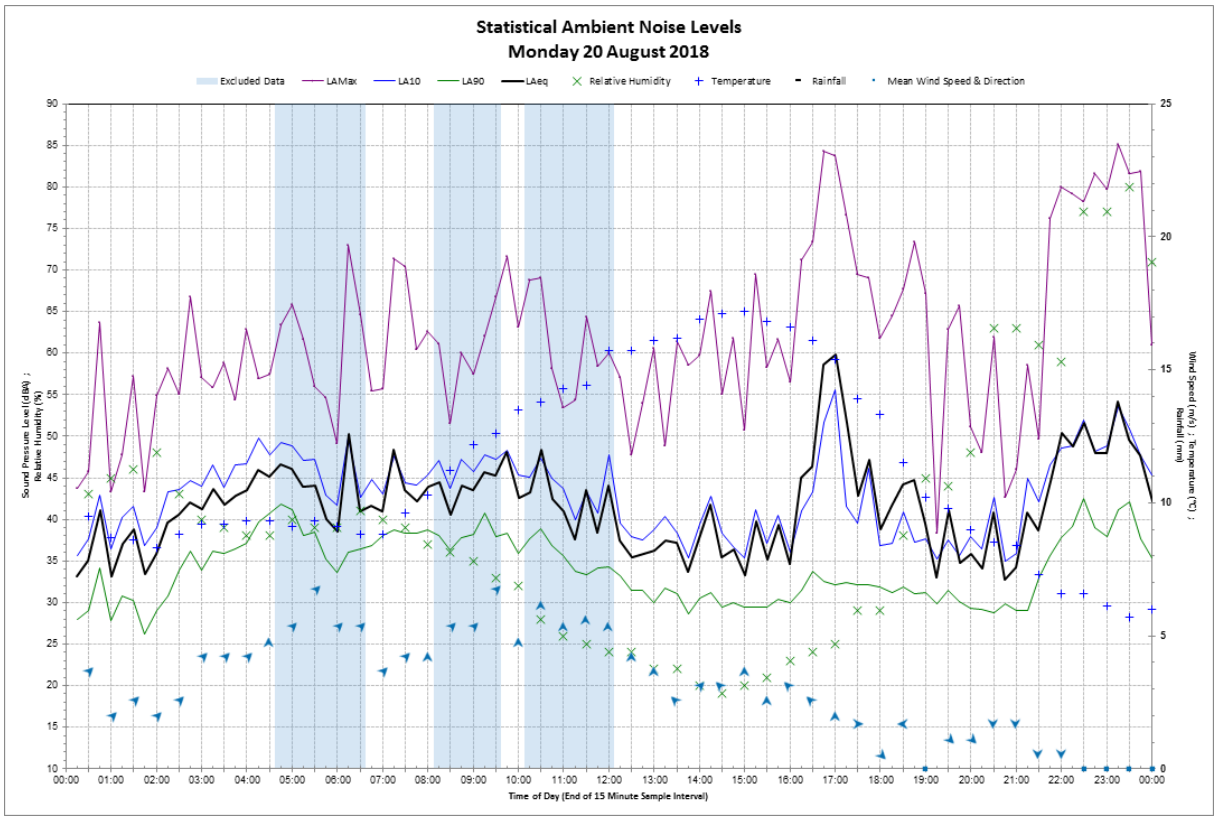

Statistical Ambient Noise Levels
Tuesday 14 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

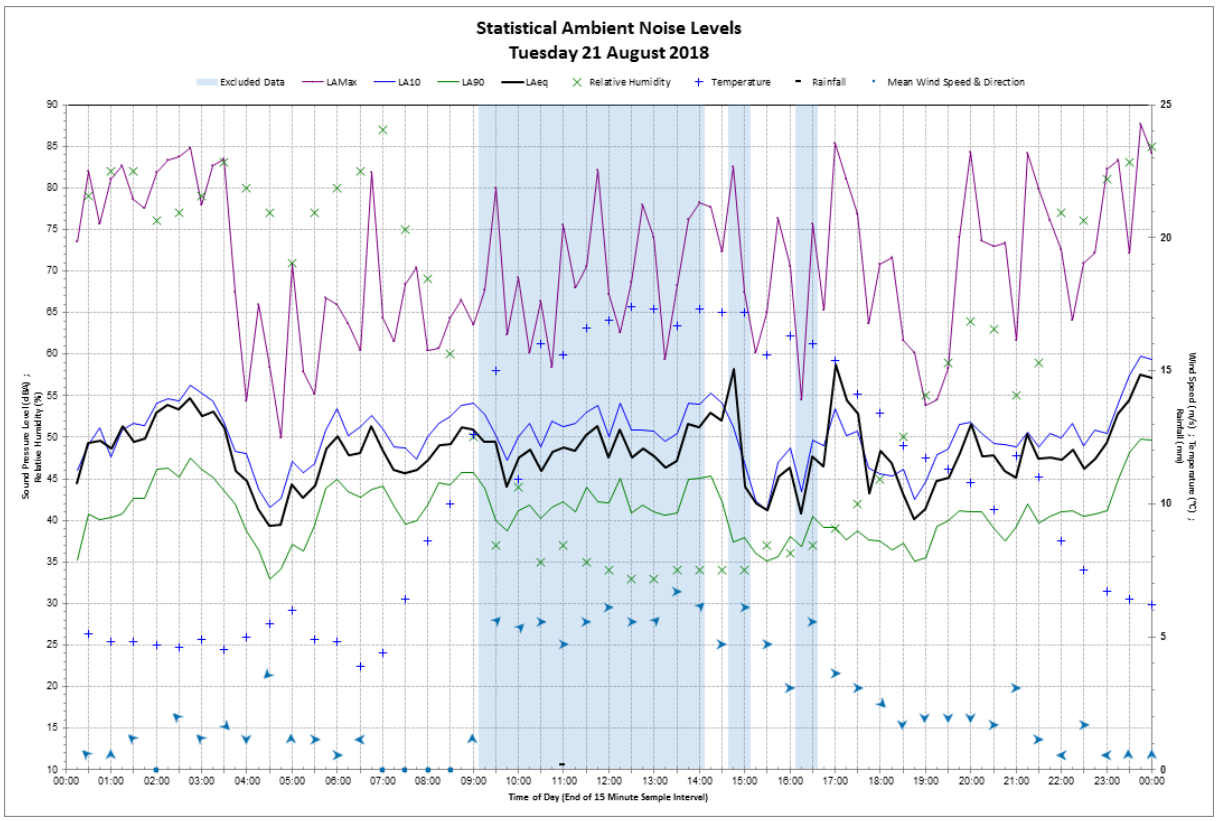
Location 2 – 9 Landseer Road

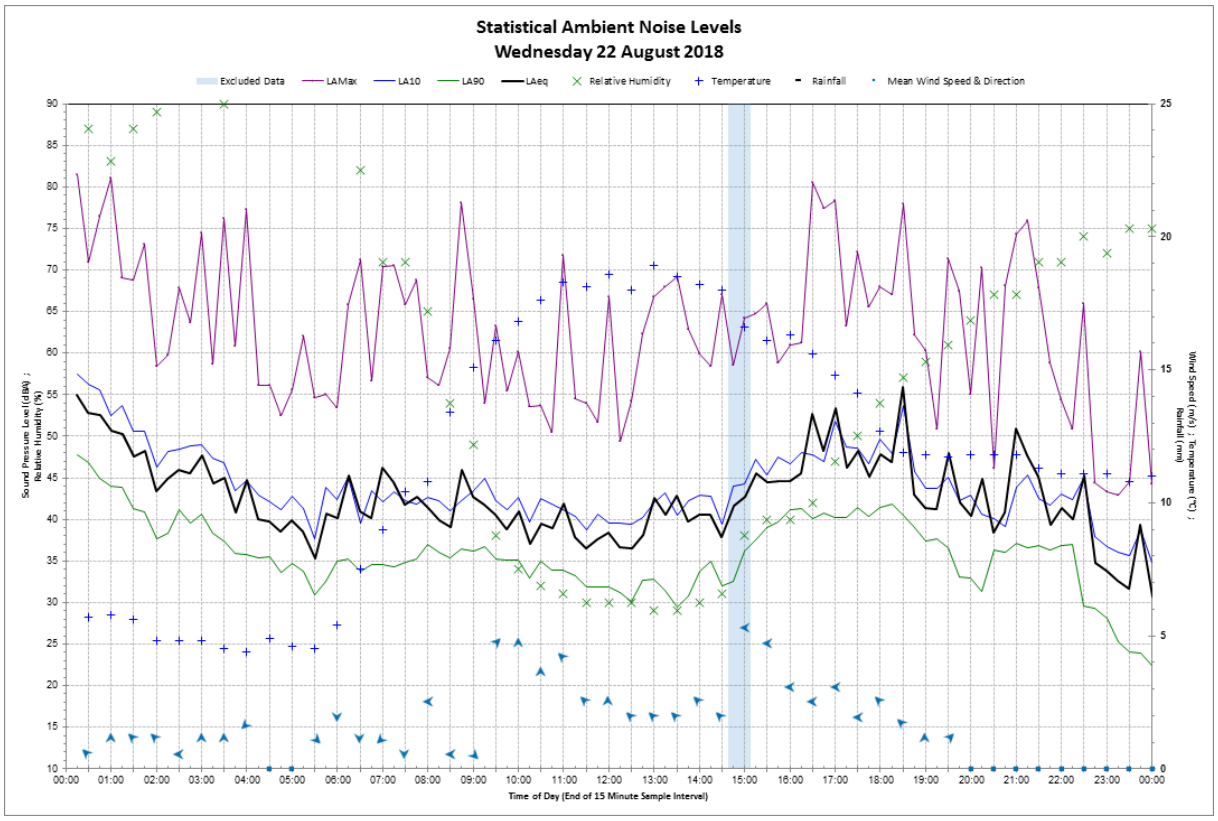


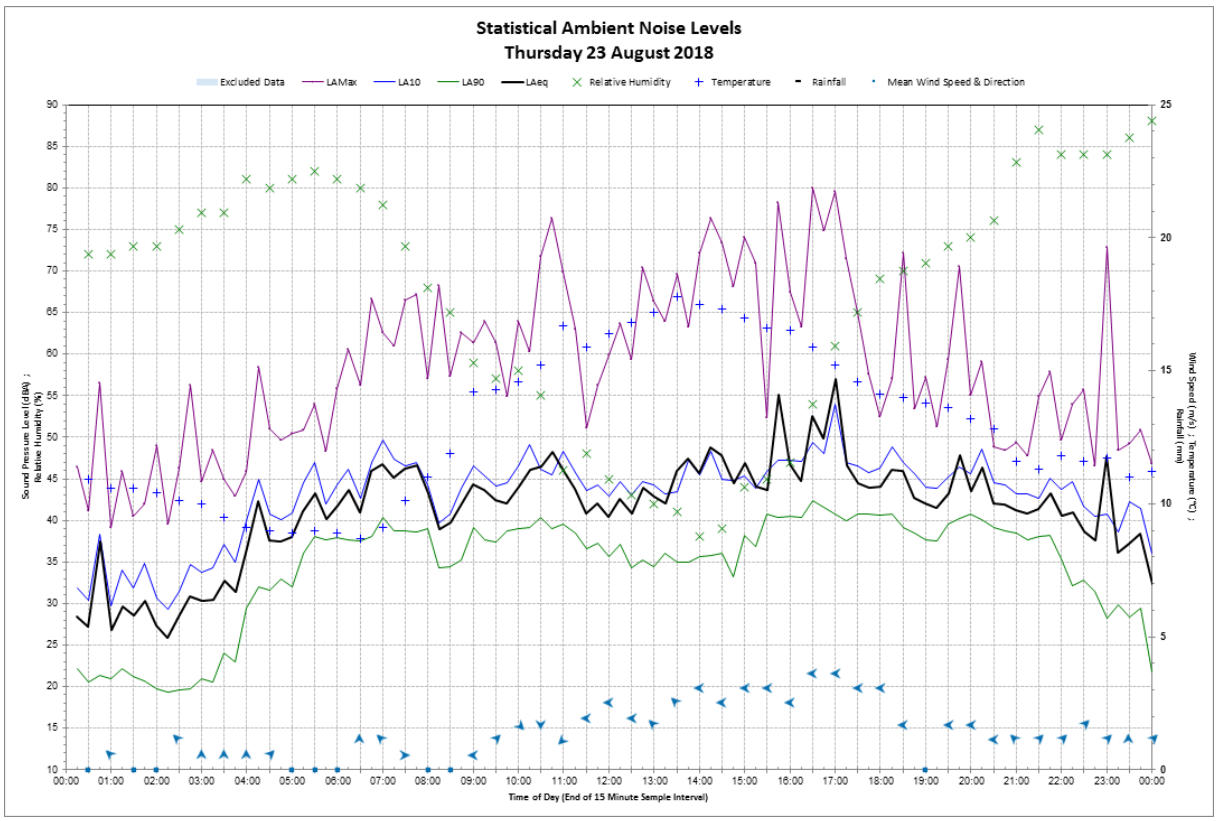


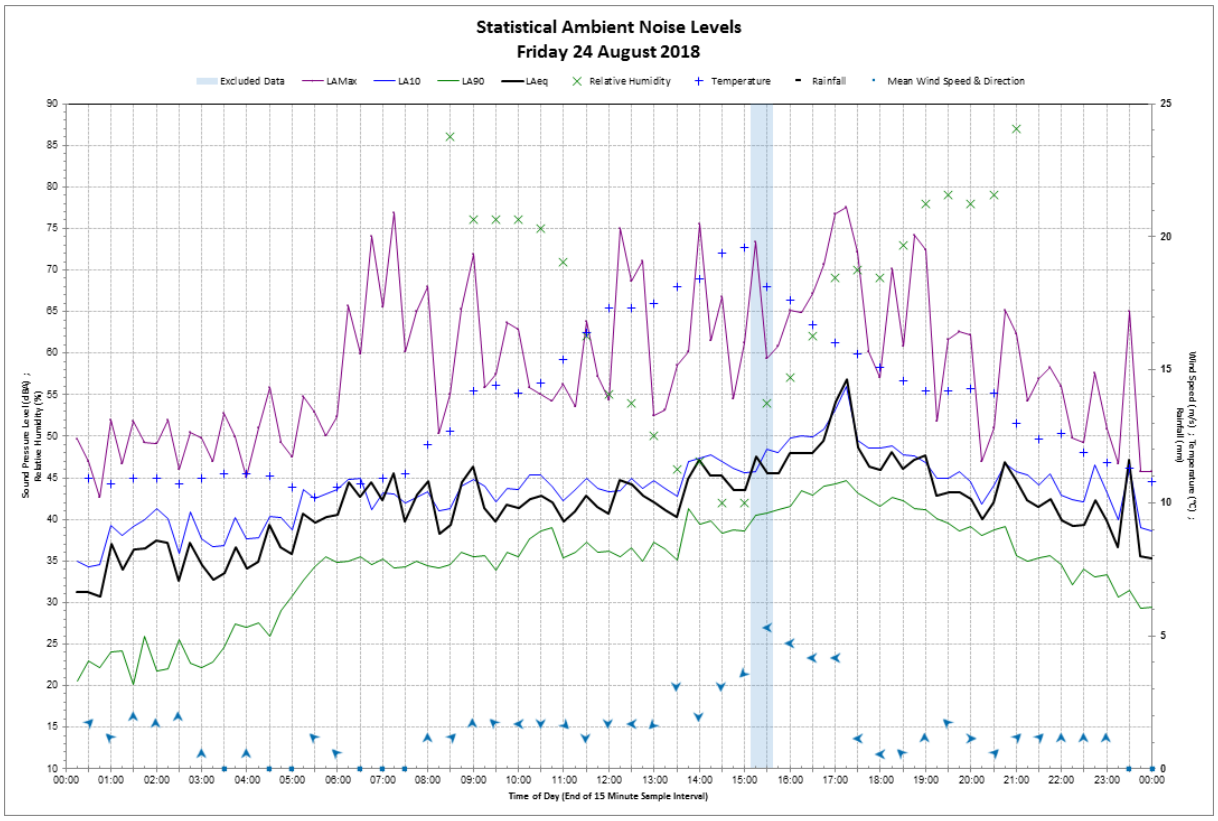

Statistical Ambient Noise Levels
Sunday 19 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

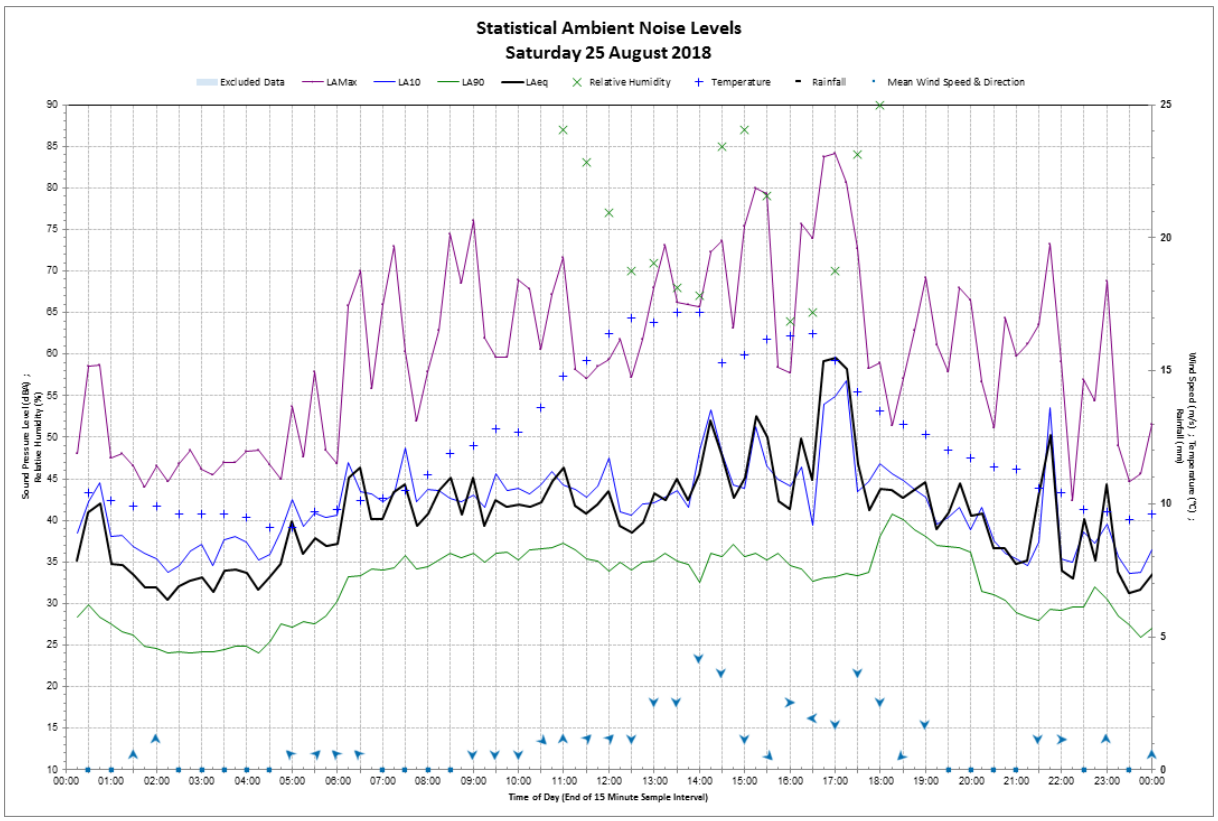

Statistical Ambient Noise Levels
Monday 20 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

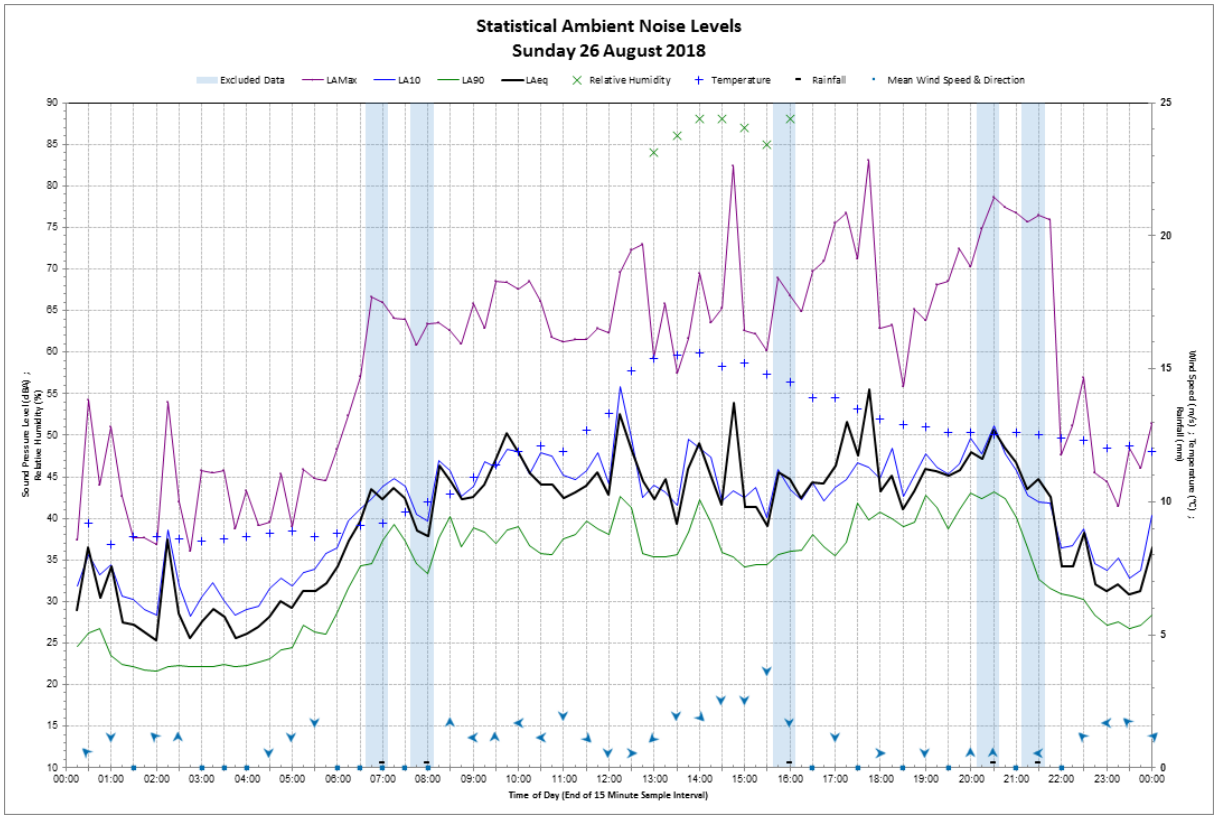

Statistical Ambient Noise Levels
Tuesday 21 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

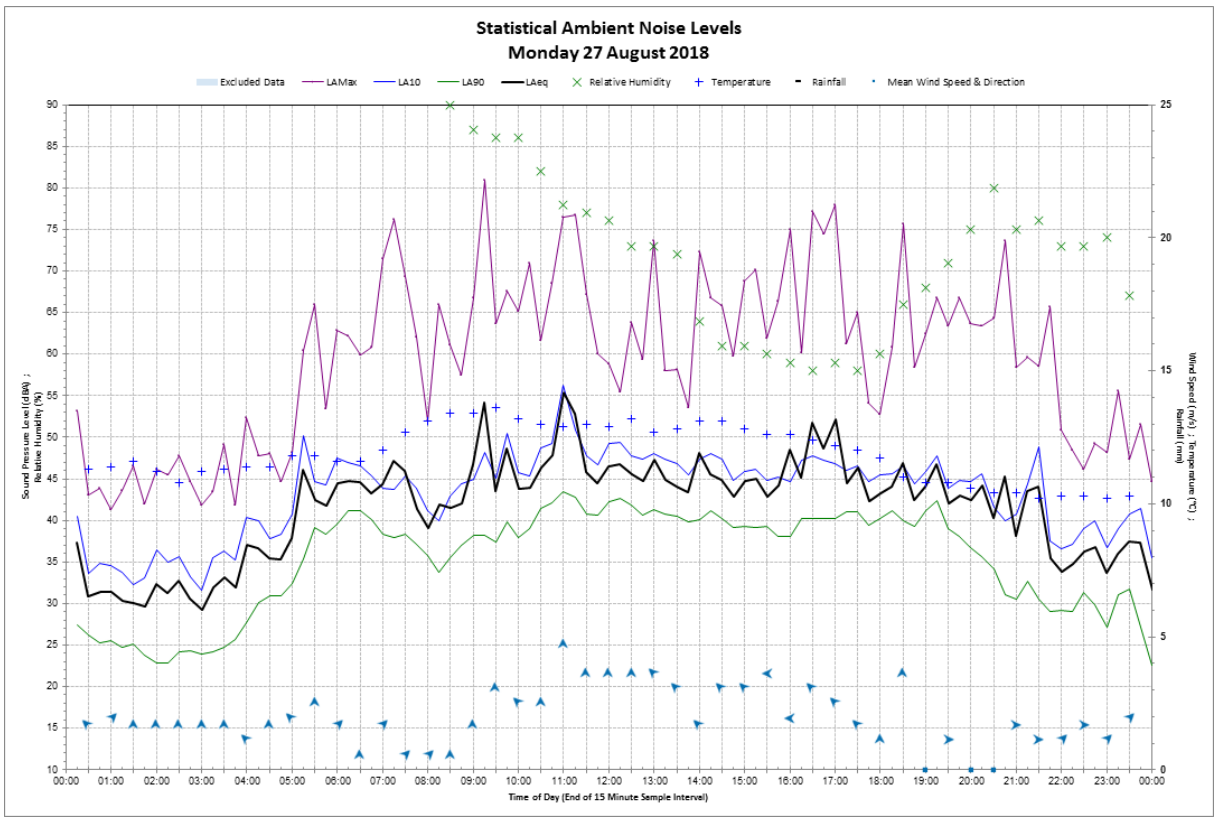

Statistical Ambient Noise Levels
Wednesday 22 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)

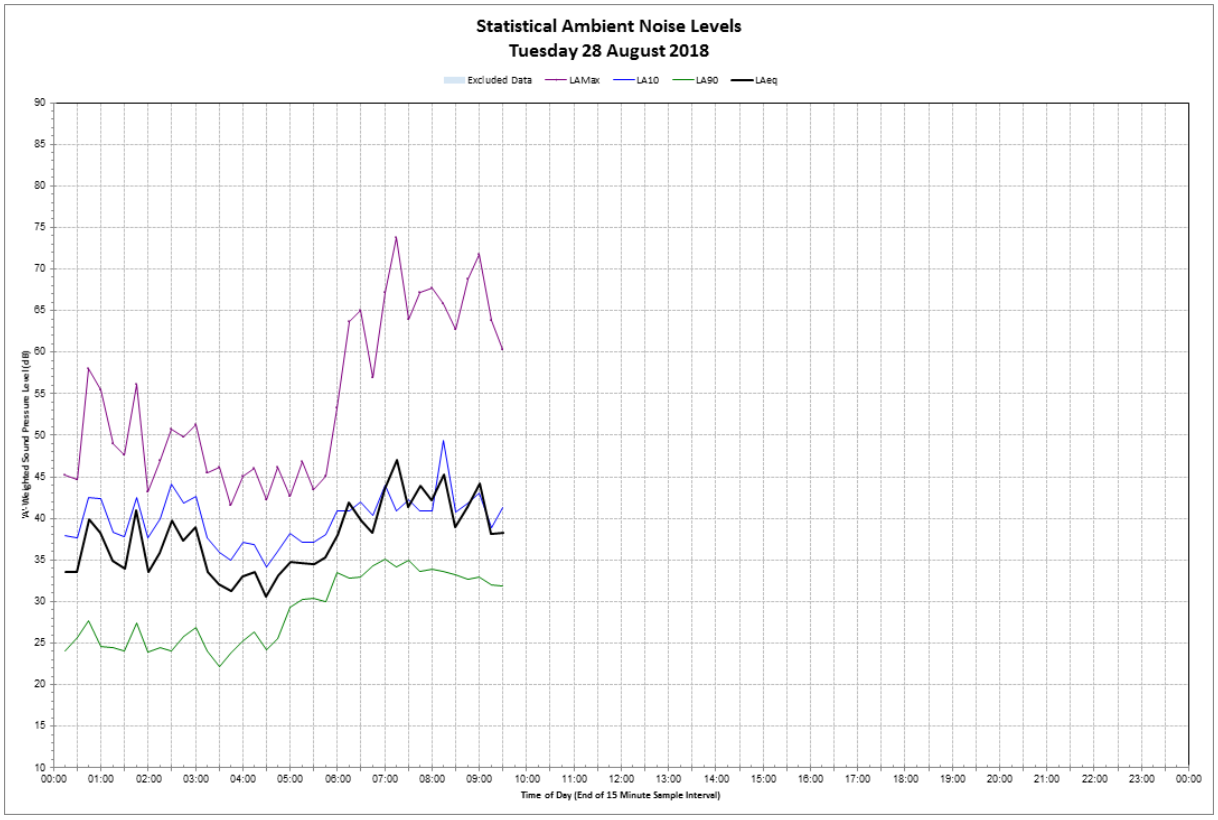

Statistical Ambient Noise Levels
Thursday 23 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Friday 24 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Saturday 25 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Sunday 26 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Monday 27 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
Relative Humidity
Temperature
Rainfall
Mean Wind Speed & Direction
Sound Pressure Level (dBA) ; Relative Humidity (%)
Wind Speed (m/s) ; Temperature (°C) ; Rainfall (mm)
Time of Day (End of 15 Minute Sample Interval)


Statistical Ambient Noise Levels
Tuesday 28 August 2018
Excluded Data
LAMax
LA10
LA90
LAeq
'A' Weighted Sound Pressure Level (dB)
Time of Day (End of 15 Minute Sample Interval)

Appendix C – Predicted construction noise levels, dBA

Predicted construction noise levels: Standard construction hours

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable / Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R001	Residential	44	50	48	47	54	55	30	45	N, V
R002	Commercial	71	83	64	63	76	79	62	59	-
R003	Commercial	73	82	65	64	77	81	61	60	-
R004	Commercial	76	82	65	64	79	84	60	61	-
R005	Commercial	77	81	67	66	79	86	58	63	-
R006	Commercial	77	81	68	67	78	91	56	71	-
R007	Commercial	73	77	65	64	75	89	47	73	-
R008	Commercial	77	75	67	66	72	86	50	82	-
R009	Residential	**77**	**75**	69	68	**75**	**80**	46	**82**	N, V
R010	Residential	71	**76**	68	67	**75**	**77**	42	72	N, V
R011	Residential	71	**77**	66	65	**75**	73	40	67	N, V
R012	Residential	73	**78**	65	64	**78**	73	39	65	N, V
R013	Residential	73	**79**	63	62	**81**	70	38	62	N, V
R014	Residential	74	**79**	62	61	**82**	69	38	59	N, V
R015	Residential	74	**79**	60	59	**81**	69	38	57	N, V
R016	Residential	73	**78**	58	57	74	65	40	58	N, V
R017	Residential	64	72	52	51	66	57	33	47	N, V
R018	Residential	61	68	54	53	65	61	36	53	N, V
R019	Residential	56	63	51	50	61	57	33	46	N, V
R020	Residential	49	54	47	46	56	55	26	48	N, V
R021	Residential	52	58	48	47	57	56	29	46	N, V
R022	Residential	45	50	43	42	52	51	23	43	-
R023	Residential	48	52	44	43	54	52	25	42	-
R024	Residential	48	53	47	46	56	54	30	44	N, V
R025	Residential	47	52	50	49	57	57	31	47	N, V
R026	Residential	47	51	48	47	57	56	31	46	N, V
R027	Residential	47	51	49	48	55	57	30	46	N, V
R028	Residential	46	51	48	47	55	56	30	45	N, V
R029	Residential	44	48	47	46	54	55	30	46	-
R030	Residential	40	44	44	43	51	51	26	42	-
R031	Residential	43	47	46	45	53	53	29	44	-
R032	Residential	44	49	46	45	53	54	26	44	-
R033	Residential	46	50	46	45	53	53	25	44	-
R034	Residential	46	50	47	46	54	54	26	44	-
R035	Residential	43	49	45	44	52	53	24	43	-
R036	Residential	42	48	45	44	52	53	24	43	-
R037	Active recreation	41	47	47	46	53	54	28	43	-
R038	Residential	40	45	45	44	51	52	26	42	-
R039	Residential	61	63	57	56	65	72	35	66	N, V
R040	Residential	53	56	51	50	57	62	32	58	N, V
R041	Residential	50	57	50	49	60	62	30	55	N, V
R042	Residential	46	52	45	44	57	52	25	46	N, V
R043	Residential	43	47	45	44	52	55	26	48	N, V
R044	Residential	52	57	50	49	60	61	28	53	N, V
R045	Residential	59	74	55	54	69	67	53	52	N, V
R046	Residential	53	68	52	51	62	65	48	50	N, V
R047	Residential	51	62	51	50	60	64	39	52	N, V
R048	Residential	56	64	50	49	59	71	39	56	N, V
R049	Residential	55	62	49	48	57	71	36	55	N, V
R050	Residential	53	61	51	50	57	67	36	59	N, V
R051	Residential	55	59	52	51	57	68	33	58	N, V
R052	Residential	51	55	49	48	55	65	32	56	N, V
R053	Residential	49	53	48	47	54	63	28	54	N, V
R054	Residential	47	50	46	45	52	62	27	52	N, V
R055	Residential	46	53	46	45	52	63	29	51	N, V
R056	Residential	46	49	44	43	50	59	28	51	N, V
R057	Residential	46	51	45	44	53	60	30	50	N, V
R058	Residential	40	48	42	41	49	53	26	44	-
R059	Residential	40	46	43	42	49	54	26	45	-
R060	Residential	39	46	41	40	48	53	25	41	-
R061	Residential	39	45	41	40	47	54	25	43	-
R062	Residential	40	48	40	39	48	55	27	43	N, V
R063	Residential	40	47	40	39	49	54	27	41	-
R064	Residential	40	47	42	41	49	54	29	41	-
R065	Residential	40	46	43	42	49	53	29	41	-

Predicted construction noise levels: Standard construction hours

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable / Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R066	Residential	40	48	43	42	49	54	29	43	-
R067	Residential	46	51	46	45	53	59	30	45	N, V
R068	Residential	47	60	47	46	56	60	44	48	N, V
R069	Residential	59	70	59	58	67	71	49	51	N, V
R070	Commercial	57	66	58	57	66	69	48	50	-
R071	Residential	50	62	48	47	60	62	43	46	N, V
R072	Residential	47	57	48	47	56	61	36	45	N, V
R073	Residential	47	55	46	45	55	59	34	44	N, V
R074	Residential	42	54	44	43	52	56	34	42	N, V
R075	Residential	41	53	43	42	50	55	32	43	N, V
R076	Residential	40	47	42	41	47	53	27	40	-
R077	Residential	54	62	56	55	63	67	44	51	N, V
R078	Residential	48	55	50	49	58	60	39	45	N, V
R079	Residential	51	58	55	54	61	64	42	46	N, V
R080	Residential	43	48	46	45	53	57	31	44	N, V
R081	Residential	48	54	52	51	59	61	39	48	N, V
R082	Residential	47	53	48	47	57	59	36	42	N, V
R083	Residential	47	55	52	51	57	63	38	48	N, V
R084	Residential	44	49	49	48	55	57	35	45	N, V
R085	Residential	43	47	48	47	53	57	34	44	N, V
R086	Residential	42	47	47	46	53	55	34	41	N, V
R087	Residential	40	46	39	38	48	53	25	44	-
R088	Residential	40	45	42	41	48	55	25	46	-
R089	Residential	43	48	44	43	49	58	26	47	N, V
R090	Residential	44	48	45	44	50	57	26	49	N, V
R091	Residential	44	49	45	44	52	58	26	48	N, V
R092	Residential	43	46	44	43	50	58	25	47	N, V
R093	Residential	46	50	45	44	51	56	25	51	N, V
R094	Residential	45	50	44	43	52	56	27	50	N, V
R095	Residential	48	52	42	41	52	52	24	44	-
R096	Residential	48	52	43	42	56	54	22	47	N, V
R097	Residential	48	52	43	42	57	56	22	48	N, V
R098	Residential	48	52	42	41	55	52	23	43	N, V
R099	Residential	46	51	43	42	54	51	21	42	-
R100	Residential	45	50	44	43	52	51	21	42	-
R101	Residential	47	55	43	42	52	51	23	42	-
R102	Residential	47	55	40	39	51	49	21	41	N, V
R103	Residential	48	53	42	41	52	49	20	40	-
R104	Residential	41	46	42	41	48	56	23	44	N, V
R105	Residential	42	47	42	41	48	57	26	46	N, V
R106	Residential	41	45	42	41	48	54	23	45	-
R107	Residential	42	47	42	41	48	56	23	46	N, V
R108	Residential	41	46	41	40	51	56	23	45	N, V
R109	Residential	41	45	39	38	48	51	20	41	-
R110	Residential	39	43	39	38	48	50	18	42	-
R111	Residential	41	45	39	38	48	53	20	43	-
R112	Residential	40	44	38	37	48	53	19	43	-
R113	Residential	40	43	37	36	49	50	17	41	-
R114	Residential	41	44	38	37	49	53	19	43	-
R115	Residential	40	44	37	36	50	52	19	43	-
R116	Residential	40	43	38	37	50	50	19	44	-
R117	Residential	37	41	35	34	43	44	15	36	-
R118	Residential	39	43	39	38	49	52	20	42	-
R119	Residential	40	44	38	37	47	52	20	42	-
R120	Residential	40	43	39	38	47	52	20	43	-
R121	Residential	38	43	38	37	45	50	17	40	-
R122	Residential	39	44	38	37	47	51	20	40	-
R123	Residential	38	43	38	37	44	50	20	42	-
R124	Residential	36	43	38	37	45	51	21	41	-
R125	Residential	42	46	38	37	49	48	17	40	-
R126	Residential	53	58	57	56	63	65	34	52	N, V
R127	Residential	52	57	56	55	63	64	32	51	N, V
R128	Residential	52	57	55	54	62	64	32	51	N, V
R129	Residential	52	56	56	55	62	63	31	52	N, V
R130	Residential	52	56	54	53	63	59	29	51	N, V

Predicted construction noise levels: Standard construction hours

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable / Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R131	Residential	52	56	56	55	63	62	32	52	N, V
R132	Residential	52	55	56	55	62	62	32	52	N, V
R133	Residential	54	57	56	55	63	64	36	51	N, V
R134	Residential	51	55	55	54	61	63	35	51	N, V
R135	Residential	50	54	54	53	59	62	34	51	N, V
R136	Residential	51	55	52	51	62	59	31	51	N, V
R137	Residential	51	55	55	54	62	64	35	51	N, V
R138	Residential	50	54	55	54	61	63	35	51	N, V
R139	Residential	51	55	53	52	60	61	36	51	N, V
R140	Residential	52	57	58	57	63	66	40	52	N, V
R141	Residential	51	55	56	55	62	64	34	51	N, V
R142	Residential	53	56	57	56	63	65	34	54	N, V
R143	Residential	50	54	55	54	61	63	30	51	N, V
R144	Residential	51	54	54	53	61	62	31	51	N, V
R145	Residential	51	54	54	53	61	62	32	50	N, V
R146	Residential	50	53	54	53	59	63	31	50	N, V
R147	Residential	50	53	54	53	59	62	32	51	N, V
R148	Residential	50	53	53	52	60	62	31	50	N, V
R149	Residential	48	52	53	52	59	62	33	49	N, V
R150	Residential	48	52	50	49	58	60	30	49	N, V
R151	Residential	47	52	53	52	59	61	32	49	N, V
R152	Residential	47	52	51	50	57	60	32	46	N, V
R153	Residential	47	50	49	48	57	59	32	47	N, V
R154	Residential	45	50	50	49	56	59	31	47	N, V
R155	Residential	44	49	50	49	56	59	29	46	N, V
R156	Residential	56	61	61	60	67	71	45	57	N, V
R157	Residential	52	57	57	56	64	63	41	51	N, V
R158	Residential	53	58	58	57	63	68	37	53	N, V
R159	Residential	53	57	56	55	62	66	38	52	N, V
R160	Residential	53	57	57	56	64	66	34	53	N, V
R161	Residential	53	58	57	56	62	67	38	53	N, V
R162	Residential	50	55	55	54	62	62	34	51	N, V
R163	Residential	50	55	56	55	61	64	39	50	N, V
R164	Residential	50	54	53	52	60	60	37	50	N, V
R165	Residential	50	54	55	54	61	63	34	50	N, V
R166	Residential	49	53	54	53	59	63	34	50	N, V
R167	Residential	48	53	52	51	59	60	34	49	N, V
R168	Residential	46	50	53	52	58	59	30	49	N, V
R169	Residential	49	54	53	52	60	60	33	50	N, V
R170	Residential	47	51	50	49	56	57	29	46	N, V
R171	Residential	47	52	53	52	58	61	34	48	N, V
R172	Residential	51	56	56	55	61	64	39	53	N, V
R173	Residential	53	57	57	56	63	63	39	51	N, V
R174	Residential	52	56	57	56	63	64	33	53	N, V
R175	Residential	51	55	54	53	60	64	36	50	N, V
R176	Residential	51	55	55	54	61	62	36	51	N, V
R177	Residential	51	54	56	55	61	65	37	51	N, V
R178	Residential	50	55	55	54	61	64	37	50	N, V
R179	Residential	50	54	50	49	60	61	33	49	N, V
R180	Residential	48	53	50	49	59	60	35	49	N, V
R181	Residential	49	53	49	48	59	59	32	48	N, V
R182	Residential	48	52	52	51	58	61	29	48	N, V
R183	Residential	45	48	51	50	56	58	35	47	N, V
R184	Residential	48	52	52	51	57	61	36	48	N, V
R185	Residential	47	51	51	50	57	60	34	47	N, V
R186	Residential	46	51	51	50	57	57	30	47	N, V
R187	Residential	47	50	50	49	57	59	33	47	N, V
R188	Residential	45	50	49	48	56	58	32	46	N, V
R189	Residential	45	49	49	48	55	57	32	46	N, V
R190	Residential	44	48	48	47	55	57	29	46	N, V
R191	Residential	43	47	47	46	53	55	28	45	N, V
R192	Residential	37	42	42	41	48	49	21	39	-
R193	Residential	43	47	47	46	54	55	23	44	-
R194	Residential	43	47	48	47	54	55	28	45	N, V
R195	Residential	38	43	45	44	50	51	25	41	-

Predicted construction noise levels: Standard construction hours

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable / Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R196	Residential	43	47	47	46	53	55	29	44	N, V
R197	Residential	40	45	45	44	51	52	27	42	-
R198	Residential	40	44	44	43	50	51	25	40	-
R199	Residential	42	46	45	44	53	52	28	41	-
R200	Residential	43	47	45	44	54	53	27	42	-
R201	Residential	39	45	46	45	51	54	26	40	-
R202	Residential	40	45	46	45	51	52	27	43	-
R203	Residential	41	45	47	46	52	53	29	45	-
R204	Residential	41	45	47	46	53	55	30	43	N, V
R205	Residential	41	45	47	46	53	53	24	43	-
R206	Residential	45	49	51	50	56	59	33	47	N, V
R207	Residential	45	49	50	49	56	58	33	47	N, V
R208	Residential	44	49	50	49	55	58	33	47	N, V
R209	Residential	43	47	48	47	54	55	29	45	N, V
R210	Residential	46	50	51	50	56	59	34	48	N, V
R211	Residential	42	47	45	44	51	52	29	42	-
R212	Residential	45	50	49	48	56	58	33	45	N, V
R213	Residential	45	50	51	50	56	59	33	47	N, V
R214	Residential	47	52	53	52	58	60	35	49	N, V
R215	Residential	46	51	53	52	58	60	34	49	N, V
R216	Residential	45	49	51	50	56	59	34	48	N, V
R217	Residential	47	52	52	51	58	60	35	49	N, V
R218	Residential	40	45	46	45	51	53	31	42	-
R219	Residential	39	43	45	44	51	54	28	41	-
R220	Residential	40	44	46	45	51	52	22	43	-
R221	Residential	42	46	48	47	54	55	31	46	N, V
R222	Residential	37	41	43	42	48	50	22	40	-
R223	Residential	35	39	40	39	47	48	20	37	-
R224	Residential	36	40	43	42	48	49	22	38	-
R225	Residential	36	40	42	41	48	49	22	39	-
R226	Residential	35	39	40	39	47	49	20	38	-
R227	Residential	33	38	38	37	45	46	20	36	-
R228	Residential	30	35	37	36	42	45	19	35	-
R229	Residential	33	39	37	36	42	46	22	35	-
R230	Residential	36	40	40	39	45	50	22	39	-
R231	Residential	38	42	43	42	48	52	26	42	-
R232	Residential	38	42	43	42	48	52	26	41	-
R233	Commercial	42	47	48	47	53	55	34	46	-
R234	Commercial	42	45	47	46	53	55	33	45	-
R235	Commercial	41	46	47	46	52	55	32	44	-
R236	Commercial	39	43	44	43	50	53	27	42	-
R237	Residential	37	42	40	39	47	50	24	40	-
R238	Residential	45	49	49	48	55	59	37	48	N, V
R239	Residential	47	52	50	49	56	60	36	51	N, V
R240	Residential	52	57	53	52	62	66	41	53	N, V
R241	Residential	44	49	50	49	56	58	34	47	N, V
R242	Residential	55	60	59	58	65	68	47	56	N, V
R243	Commercial	43	48	48	47	53	58	34	47	-
R244	Commercial	46	51	48	47	55	61	34	50	-
R245	Residential	38	43	45	44	50	53	27	43	-
R246	Residential	38	42	42	41	49	51	25	41	-
R247	Residential	37	41	42	41	48	51	26	41	-
R248	Residential	37	41	41	40	48	51	24	41	-
R249	Residential	36	40	39	38	44	49	22	39	-
R250	Residential	32	38	37	36	42	44	21	34	-
R251	Residential	37	41	43	42	48	50	24	39	-
R252	Place of worship	58	62	62	61	68	71	49	57	-
R253	Residential	54	58	60	59	65	67	45	53	N, V
R254	Residential	53	58	59	58	65	66	39	56	N, V
R255	Medical facility	53	57	59	58	64	67	41	55	-
R256	Commercial	48	53	53	52	60	61	32	51	-
R257	Residential	47	51	53	52	58	61	34	50	N, V
R258	Residential	49	53	54	53	60	63	38	53	N, V
R259	Residential	40	44	45	44	51	52	26	43	-
R260	Residential	48	52	55	54	60	62	38	52	N, V

Predicted construction noise levels: Standard construction hours

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable / Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R261	Residential	46	50	52	51	57	58	36	47	N, V
R262	Residential	50	55	55	54	60	63	38	51	N, V
R263	Residential	50	55	56	55	61	64	39	52	N, V
R264	Residential	47	52	52	51	58	60	37	48	N, V
R265	Residential	48	53	55	54	60	62	37	50	N, V
R266	Residential	48	51	52	51	58	59	28	48	N, V
R267	Residential	47	51	52	51	58	59	27	48	N, V
R268	Residential	47	51	52	51	58	58	29	49	N, V
R269	Residential	47	51	49	48	58	57	26	47	N, V
R270	Residential	48	53	50	49	59	58	32	47	N, V
R271	Residential	48	53	52	51	59	58	34	49	N, V
R272	Residential	45	49	51	50	57	58	30	48	N, V
R273	Residential	46	50	51	50	57	58	32	48	N, V
R274	Residential	46	50	50	49	57	59	32	47	N, V
R275	Residential	46	50	50	49	56	58	32	47	N, V
R276	Residential	45	50	50	49	57	58	32	49	N, V
R277	Residential	46	50	50	49	55	58	32	49	N, V
R278	Residential	45	51	50	49	56	58	32	48	N, V
R279	Residential	48	53	51	50	60	58	34	50	N, V
R280	Residential	45	49	49	48	55	56	31	47	N, V
R281	Residential	45	50	51	50	57	59	32	49	N, V
R282	Residential	44	48	47	46	55	54	29	45	N, V
R283	Residential	45	49	49	48	56	57	31	47	N, V
R284	Residential	46	50	49	48	57	58	31	48	N, V
R285	Residential	47	50	49	48	56	58	31	48	N, V
R286	Residential	46	50	50	49	57	58	32	48	N, V
R287	Residential	46	50	51	50	57	58	32	48	N, V
R288	Residential	45	49	49	48	56	57	31	48	N, V
R289	Residential	45	50	50	49	57	58	32	48	N, V
R290	Residential	43	48	48	47	54	54	28	45	-
R291	Residential	45	49	49	48	56	57	30	46	N, V
R292	Residential	43	47	49	48	54	56	29	46	N, V
R293	Residential	44	48	49	48	55	58	30	47	N, V
R294	Residential	40	44	45	44	50	54	25	43	-
R295	Residential	43	47	48	47	54	57	29	45	N, V
R296	Residential	44	48	48	47	54	57	29	46	N, V
R297	Residential	40	45	45	44	52	54	25	43	-
R298	Residential	39	43	42	41	50	53	23	42	-
R299	Residential	41	45	47	46	52	55	29	43	N, V
R300	Residential	44	48	47	46	54	58	30	45	N, V
R301	Residential	43	48	46	45	54	56	30	44	N, V
R302	Residential	43	48	47	46	53	57	30	44	N, V
R303	Residential	42	46	47	46	53	55	29	43	N, V
R304	Residential	42	47	47	46	53	56	29	45	N, V
R305	Residential	41	46	47	46	52	55	29	44	N, V
R306	Residential	43	47	48	47	54	56	30	45	N, V
R307	Residential	43	47	48	47	54	57	30	45	N, V
R308	Residential	46	50	50	49	55	58	31	47	N, V
R309	Residential	45	50	49	48	55	57	30	47	N, V
R310	Residential	44	49	48	47	55	57	30	46	N, V
R311	Residential	44	49	49	48	55	58	31	46	N, V
R312	Residential	44	48	48	47	54	58	32	46	N, V
R313	Residential	42	46	47	46	52	56	30	43	N, V
R314	Residential	40	45	45	44	51	52	23	42	-
R315	Residential	44	49	48	47	55	57	30	46	N, V
R316	Educational institute	44	48	48	47	55	55	30	46	-
R317	Educational institute	48	53	51	50	59	59	34	51	-
R318	Educational institute	43	47	47	46	54	54	31	45	-
R319	Educational institute	42	47	48	47	53	55	32	45	-
R320	Educational institute	36	40	42	41	47	49	24	39	-
R321	Educational institute	37	41	42	41	48	50	24	41	-
R322	Educational institute	43	48	48	47	54	54	30	46	-
R323	Educational institute	39	43	44	43	50	51	27	42	-

Predicted construction noise levels: OOHW Period 1 (Day)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R001	Residential	44	50	48	47	54	55	30	45	PN, V, SN, RO
R002	Commercial	71	83	64	63	76	79	62	59	-
R003	Commercial	73	82	65	64	77	81	61	60	-
R004	Commercial	76	82	65	64	79	84	60	61	-
R005	Commercial	77	81	67	66	79	86	58	63	-
R006	Commercial	77	81	68	67	78	91	56	71	-
R007	Commercial	73	77	65	64	75	89	47	73	-
R008	Commercial	77	75	67	66	72	86	50	82	-
R009	Residential	**77**	**75**	69	68	**75**	**80**	46	**82**	PN, V, SN, RO, RP, DR
R010	Residential	71	**76**	68	67	**75**	**77**	42	72	PN, V, SN, RO, RP, DR
R011	Residential	71	**77**	66	65	**75**	73	40	67	PN, V, SN, RO, RP, DR
R012	Residential	73	**78**	65	64	**78**	73	39	65	PN, V, SN, RO, RP, DR
R013	Residential	73	**79**	63	62	**81**	70	38	62	PN, V, SN, RO, RP, DR
R014	Residential	74	**79**	62	61	**82**	69	38	59	PN, V, SN, RO, RP, DR
R015	Residential	74	**79**	60	59	**81**	69	38	57	PN, V, SN, RO, RP, DR
R016	Residential	73	**78**	58	57	74	65	40	58	PN, V, SN, RO, RP, DR
R017	Residential	64	72	52	51	66	57	33	47	PN, V, SN, RO, RP, DR
R018	Residential	61	68	54	53	65	61	36	53	PN, V, SN, RO, RP, DR
R019	Residential	56	63	51	50	61	57	33	46	PN, V, SN, RO
R020	Residential	49	54	47	46	56	55	26	48	PN, V, SN, RO
R021	Residential	52	58	48	47	57	56	29	46	PN, V, SN, RO
R022	Residential	45	50	43	42	52	51	23	43	PN
R023	Residential	48	52	44	43	54	52	25	42	PN
R024	Residential	48	53	47	46	56	54	30	44	PN, V, SN, RO
R025	Residential	47	52	50	49	57	57	31	47	PN, V, SN, RO
R026	Residential	47	51	48	47	57	56	31	46	PN, V, SN, RO
R027	Residential	47	51	49	48	55	57	30	46	PN, V, SN, RO
R028	Residential	46	51	48	47	55	56	30	45	PN, V, SN, RO
R029	Residential	44	48	47	46	54	55	30	46	PN
R030	Residential	40	44	44	43	51	51	26	42	PN
R031	Residential	43	47	46	45	53	53	29	44	PN
R032	Residential	44	49	46	45	53	54	26	44	PN
R033	Residential	46	50	46	45	53	53	25	44	PN
R034	Residential	46	50	47	46	54	54	26	44	PN
R035	Residential	43	49	45	44	52	53	24	43	PN
R036	Residential	42	48	45	44	52	53	24	43	PN
R037	Active recreation	41	47	47	46	53	54	28	43	-
R038	Residential	40	45	45	44	51	52	26	42	PN
R039	Residential	61	63	57	56	65	72	35	66	PN, V, SN, RO, RP, DR
R040	Residential	53	56	51	50	57	62	32	58	PN, V, SN, RO
R041	Residential	50	57	50	49	60	62	30	55	PN, V, SN, RO
R042	Residential	46	52	45	44	57	52	25	46	PN, V, SN, RO
R043	Residential	43	47	45	44	52	55	26	48	PN, V, SN, RO
R044	Residential	52	57	50	49	60	61	28	53	PN, V, SN, RO
R045	Residential	59	74	55	54	69	67	53	52	PN, V, SN, RO, RP, DR
R046	Residential	53	68	52	51	62	65	48	50	PN, V, SN, RO, RP, DR
R047	Residential	51	62	51	50	60	64	39	52	PN, V, SN, RO
R048	Residential	56	64	50	49	59	71	39	56	PN, V, SN, RO, RP, DR
R049	Residential	55	62	49	48	57	71	36	55	PN, V, SN, RO, RP, DR
R050	Residential	53	61	51	50	57	67	36	59	PN, V, SN, RO, RP, DR
R051	Residential	55	59	52	51	57	68	33	58	PN, V, SN, RO, RP, DR
R052	Residential	51	55	49	48	55	65	32	56	PN, V, SN, RO, RP, DR
R053	Residential	49	53	48	47	54	63	28	54	PN, V, SN, RO
R054	Residential	47	50	46	45	52	62	27	52	PN, V, SN, RO
R055	Residential	46	53	46	45	52	63	29	51	PN, V, SN, RO
R056	Residential	46	49	44	43	50	59	28	51	PN, V, SN, RO
R057	Residential	46	51	45	44	53	60	30	50	PN, V, SN, RO
R058	Residential	40	48	42	41	49	53	26	44	PN
R059	Residential	40	46	43	42	49	54	26	45	PN
R060	Residential	39	46	41	40	48	53	25	41	PN
R061	Residential	39	45	41	40	47	54	25	43	PN
R062	Residential	40	48	40	39	48	55	27	43	PN, V, SN, RO
R063	Residential	40	47	40	39	49	54	27	41	PN
R064	Residential	40	47	42	41	49	54	29	41	PN
R065	Residential	40	46	43	42	49	53	29	41	PN

Predicted construction noise levels: OOHW Period 1 (Day)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R066	Residential	40	48	43	42	49	54	29	43	PN
R067	Residential	46	51	46	45	53	59	30	45	PN, V, SN, RO
R068	Residential	47	60	47	46	56	60	44	48	PN, V, SN, RO
R069	Residential	59	70	59	58	67	71	49	51	PN, V, SN, RO, RP, DR
R070	Commercial	57	66	58	57	66	69	48	50	-
R071	Residential	50	62	48	47	60	62	43	46	PN, V, SN, RO
R072	Residential	47	57	48	47	56	61	36	45	PN, V, SN, RO
R073	Residential	47	55	46	45	55	59	34	44	PN, V, SN, RO
R074	Residential	42	54	44	43	52	56	34	42	PN, V, SN, RO
R075	Residential	41	53	43	42	50	55	32	43	PN, V, SN, RO
R076	Residential	40	47	42	41	47	53	27	40	PN
R077	Residential	54	62	56	55	63	67	44	51	PN, V, SN, RO, RP, DR
R078	Residential	48	55	50	49	58	60	39	45	PN, V, SN, RO
R079	Residential	51	58	55	54	61	64	42	46	PN, V, SN, RO
R080	Residential	43	48	46	45	53	57	31	44	PN, V, SN, RO
R081	Residential	48	54	52	51	59	61	39	48	PN, V, SN, RO
R082	Residential	47	53	48	47	57	59	36	42	PN, V, SN, RO
R083	Residential	47	55	52	51	57	63	38	48	PN, V, SN, RO
R084	Residential	44	49	49	48	55	57	35	45	PN, V, SN, RO
R085	Residential	43	47	48	47	53	57	34	44	PN, V, SN, RO
R086	Residential	42	47	47	46	53	55	34	41	PN, V, SN, RO
R087	Residential	40	46	39	38	48	53	25	44	PN
R088	Residential	40	45	42	41	48	55	25	46	PN
R089	Residential	43	48	44	43	49	58	26	47	PN, V, SN, RO
R090	Residential	44	48	45	44	50	57	26	49	PN, V, SN, RO
R091	Residential	44	49	45	44	52	58	26	48	PN, V, SN, RO
R092	Residential	43	46	44	43	50	58	25	47	PN, V, SN, RO
R093	Residential	46	50	45	44	51	56	25	51	PN, V, SN, RO
R094	Residential	45	50	44	43	52	56	27	50	PN, V, SN, RO
R095	Residential	48	52	42	41	52	52	24	44	PN
R096	Residential	48	52	43	42	56	54	22	47	PN, V, SN, RO
R097	Residential	48	52	43	42	57	56	22	48	PN, V, SN, RO
R098	Residential	48	52	42	41	55	52	23	43	PN, V, SN, RO
R099	Residential	46	51	43	42	54	51	21	42	PN
R100	Residential	45	50	44	43	52	51	21	42	PN
R101	Residential	47	55	43	42	52	51	23	42	PN
R102	Residential	47	55	40	39	51	49	21	41	PN, V, SN, RO
R103	Residential	48	53	42	41	52	49	20	40	PN
R104	Residential	41	46	42	41	48	56	23	44	PN, V, SN, RO
R105	Residential	42	47	42	41	48	57	26	46	PN, V, SN, RO
R106	Residential	41	45	42	41	48	54	23	45	PN
R107	Residential	42	47	42	41	48	56	23	46	PN, V, SN, RO
R108	Residential	41	46	41	40	51	56	23	45	PN, V, SN, RO
R109	Residential	41	45	39	38	48	51	20	41	PN
R110	Residential	39	43	39	38	48	50	18	42	PN
R111	Residential	41	45	39	38	48	53	20	43	PN
R112	Residential	40	44	38	37	48	53	19	43	PN
R113	Residential	40	43	37	36	49	50	17	41	PN
R114	Residential	41	44	38	37	49	53	19	43	PN
R115	Residential	40	44	37	36	50	52	19	43	PN
R116	Residential	40	43	38	37	50	50	19	44	PN
R117	Residential	37	41	35	34	43	44	15	36	-
R118	Residential	39	43	39	38	49	52	20	42	PN
R119	Residential	40	44	38	37	47	52	20	42	PN
R120	Residential	40	43	39	38	47	52	20	43	PN
R121	Residential	38	43	38	37	45	50	17	40	PN
R122	Residential	39	44	38	37	47	51	20	40	PN
R123	Residential	38	43	38	37	44	50	20	42	PN
R124	Residential	36	43	38	37	45	51	21	41	PN
R125	Residential	42	46	38	37	49	48	17	40	PN
R126	Residential	53	58	57	56	63	65	34	52	PN, V, SN, RO, RP, DR
R127	Residential	52	57	56	55	63	64	32	51	PN, V, SN, RO
R128	Residential	52	57	55	54	62	64	32	51	PN, V, SN, RO
R129	Residential	52	56	56	55	62	63	31	52	PN, V, SN, RO
R130	Residential	52	56	54	53	63	59	29	51	PN, V, SN, RO

Predicted construction noise levels: OOHW Period 1 (Day)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R131	Residential	52	56	56	55	63	62	32	52	PN, V, SN, RO
R132	Residential	52	55	56	55	62	62	32	52	PN, V, SN, RO
R133	Residential	54	57	56	55	63	64	36	51	PN, V, SN, RO
R134	Residential	51	55	55	54	61	63	35	51	PN, V, SN, RO
R135	Residential	50	54	54	53	59	62	34	51	PN, V, SN, RO
R136	Residential	51	55	52	51	62	59	31	51	PN, V, SN, RO
R137	Residential	51	55	55	54	62	64	35	51	PN, V, SN, RO
R138	Residential	50	54	55	54	61	63	35	51	PN, V, SN, RO
R139	Residential	51	55	53	52	60	61	36	51	PN, V, SN, RO
R140	Residential	52	57	58	57	63	66	40	52	PN, V, SN, RO, RP, DR
R141	Residential	51	55	56	55	62	64	34	51	PN, V, SN, RO
R142	Residential	53	56	57	56	63	65	34	54	PN, V, SN, RO, RP, DR
R143	Residential	50	54	55	54	61	63	30	51	PN, V, SN, RO
R144	Residential	51	54	54	53	61	62	31	51	PN, V, SN, RO
R145	Residential	51	54	54	53	61	62	32	50	PN, V, SN, RO
R146	Residential	50	53	54	53	59	63	31	50	PN, V, SN, RO
R147	Residential	50	53	54	53	59	62	32	51	PN, V, SN, RO
R148	Residential	50	53	53	52	60	62	31	50	PN, V, SN, RO
R149	Residential	48	52	53	52	59	62	33	49	PN, V, SN, RO
R150	Residential	48	52	50	49	58	60	30	49	PN, V, SN, RO
R151	Residential	47	52	53	52	59	61	32	49	PN, V, SN, RO
R152	Residential	47	52	51	50	57	60	32	46	PN, V, SN, RO
R153	Residential	47	50	49	48	57	59	32	47	PN, V, SN, RO
R154	Residential	45	50	50	49	56	59	31	47	PN, V, SN, RO
R155	Residential	44	49	50	49	56	59	29	46	PN, V, SN, RO
R156	Residential	56	61	61	60	67	71	45	57	PN, V, SN, RO, RP, DR
R157	Residential	52	57	57	56	64	63	41	51	PN, V, SN, RO
R158	Residential	53	58	58	57	63	68	37	53	PN, V, SN, RO, RP, DR
R159	Residential	53	57	56	55	62	66	38	52	PN, V, SN, RO, RP, DR
R160	Residential	53	57	57	56	64	66	34	53	PN, V, SN, RO, RP, DR
R161	Residential	53	58	57	56	62	67	38	53	PN, V, SN, RO, RP, DR
R162	Residential	50	55	55	54	62	62	34	51	PN, V, SN, RO
R163	Residential	50	55	56	55	61	64	39	50	PN, V, SN, RO
R164	Residential	50	54	53	52	60	60	37	50	PN, V, SN, RO
R165	Residential	50	54	55	54	61	63	34	50	PN, V, SN, RO
R166	Residential	49	53	54	53	59	63	34	50	PN, V, SN, RO
R167	Residential	48	53	52	51	59	60	34	49	PN, V, SN, RO
R168	Residential	46	50	53	52	58	59	30	49	PN, V, SN, RO
R169	Residential	49	54	53	52	60	60	33	50	PN, V, SN, RO
R170	Residential	47	51	50	49	56	57	29	46	PN, V, SN, RO
R171	Residential	47	52	53	52	58	61	34	48	PN, V, SN, RO
R172	Residential	51	56	56	55	61	64	39	53	PN, V, SN, RO
R173	Residential	53	57	57	56	63	63	39	51	PN, V, SN, RO
R174	Residential	52	56	57	56	63	64	33	53	PN, V, SN, RO
R175	Residential	51	55	54	53	60	64	36	50	PN, V, SN, RO
R176	Residential	51	55	55	54	61	62	36	51	PN, V, SN, RO
R177	Residential	51	54	56	55	61	65	37	51	PN, V, SN, RO, RP, DR
R178	Residential	50	55	55	54	61	64	37	50	PN, V, SN, RO
R179	Residential	50	54	50	49	60	61	33	49	PN, V, SN, RO
R180	Residential	48	53	50	49	59	60	35	49	PN, V, SN, RO
R181	Residential	49	53	49	48	59	59	32	48	PN, V, SN, RO
R182	Residential	48	52	52	51	58	61	29	48	PN, V, SN, RO
R183	Residential	45	48	51	50	56	58	35	47	PN, V, SN, RO
R184	Residential	48	52	52	51	57	61	36	48	PN, V, SN, RO
R185	Residential	47	51	51	50	57	60	34	47	PN, V, SN, RO
R186	Residential	46	51	51	50	57	57	30	47	PN, V, SN, RO
R187	Residential	47	50	50	49	57	59	33	47	PN, V, SN, RO
R188	Residential	45	50	49	48	56	58	32	46	PN, V, SN, RO
R189	Residential	45	49	49	48	55	57	32	46	PN, V, SN, RO
R190	Residential	44	48	48	47	55	57	29	46	PN, V, SN, RO
R191	Residential	43	47	47	46	53	55	28	45	PN, V, SN, RO
R192	Residential	37	42	42	41	48	49	21	39	PN
R193	Residential	43	47	47	46	54	55	23	44	PN
R194	Residential	43	47	48	47	54	55	28	45	PN, V, SN, RO
R195	Residential	38	43	45	44	50	51	25	41	PN

Predicted construction noise levels: OOHW Period 1 (Day)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R196	Residential	43	47	47	46	53	55	29	44	PN, V, SN, RO
R197	Residential	40	45	45	44	51	52	27	42	PN
R198	Residential	40	44	44	43	50	51	25	40	PN
R199	Residential	42	46	45	44	53	52	28	41	PN
R200	Residential	43	47	45	44	54	53	27	42	PN
R201	Residential	39	45	46	45	51	54	26	40	PN
R202	Residential	40	45	46	45	51	52	27	43	PN
R203	Residential	41	45	47	46	52	53	29	45	PN
R204	Residential	41	45	47	46	53	55	30	43	PN, V, SN, RO
R205	Residential	41	45	47	46	53	53	24	43	PN
R206	Residential	45	49	51	50	56	59	33	47	PN, V, SN, RO
R207	Residential	45	49	50	49	56	58	33	47	PN, V, SN, RO
R208	Residential	44	49	50	49	55	58	33	47	PN, V, SN, RO
R209	Residential	43	47	48	47	54	55	29	45	PN, V, SN, RO
R210	Residential	46	50	51	50	56	59	34	48	PN, V, SN, RO
R211	Residential	42	47	45	44	51	52	29	42	PN
R212	Residential	45	50	49	48	56	58	33	45	PN, V, SN, RO
R213	Residential	45	50	51	50	56	59	33	47	PN, V, SN, RO
R214	Residential	47	52	53	52	58	60	35	49	PN, V, SN, RO
R215	Residential	46	51	53	52	58	60	34	49	PN, V, SN, RO
R216	Residential	45	49	51	50	56	59	34	48	PN, V, SN, RO
R217	Residential	47	52	52	51	58	60	35	49	PN, V, SN, RO
R218	Residential	40	45	46	45	51	53	31	42	PN
R219	Residential	39	43	45	44	51	54	28	41	PN
R220	Residential	40	44	46	45	51	52	22	43	PN
R221	Residential	42	46	48	47	54	55	31	46	PN, V, SN, RO
R222	Residential	37	41	43	42	48	50	22	40	PN
R223	Residential	35	39	40	39	47	48	20	37	PN
R224	Residential	36	40	43	42	48	49	22	38	PN
R225	Residential	36	40	42	41	48	49	22	39	PN
R226	Residential	35	39	40	39	47	49	20	38	PN
R227	Residential	33	38	38	37	45	46	20	36	PN
R228	Residential	30	35	37	36	42	45	19	35	PN
R229	Residential	33	39	37	36	42	46	22	35	PN
R230	Residential	36	40	40	39	45	50	22	39	PN
R231	Residential	38	42	43	42	48	52	26	42	PN
R232	Residential	38	42	43	42	48	52	26	41	PN
R233	Commercial	42	47	48	47	53	55	34	46	-
R234	Commercial	42	45	47	46	53	55	33	45	-
R235	Commercial	41	46	47	46	52	55	32	44	-
R236	Commercial	39	43	44	43	50	53	27	42	-
R237	Residential	37	42	40	39	47	50	24	40	PN
R238	Residential	45	49	49	48	55	59	37	48	PN, V, SN, RO
R239	Residential	47	52	50	49	56	60	36	51	PN, V, SN, RO
R240	Residential	52	57	53	52	62	66	41	53	PN, V, SN, RO, RP, DR
R241	Residential	44	49	50	49	56	58	34	47	PN, V, SN, RO
R242	Residential	55	60	59	58	65	68	47	56	PN, V, SN, RO, RP, DR
R243	Commercial	43	48	48	47	53	58	34	47	-
R244	Commercial	46	51	48	47	55	61	34	50	-
R245	Residential	38	43	45	44	50	53	27	43	PN
R246	Residential	38	42	42	41	49	51	25	41	PN
R247	Residential	37	41	42	41	48	51	26	41	PN
R248	Residential	37	41	41	40	48	51	24	41	PN
R249	Residential	36	40	39	38	44	49	22	39	PN
R250	Residential	32	38	37	36	42	44	21	34	-
R251	Residential	37	41	43	42	48	50	24	39	PN
R252	Place of worship	58	62	62	61	68	71	49	57	-
R253	Residential	54	58	60	59	65	67	45	53	PN, V, SN, RO, RP, DR
R254	Residential	53	58	59	58	65	66	39	56	PN, V, SN, RO, RP, DR
R255	Medical facility	53	57	59	58	64	67	41	55	-
R256	Commercial	48	53	53	52	60	61	32	51	-
R257	Residential	47	51	53	52	58	61	34	50	PN, V, SN, RO
R258	Residential	49	53	54	53	60	63	38	53	PN, V, SN, RO
R259	Residential	40	44	45	44	51	52	26	43	PN
R260	Residential	48	52	55	54	60	62	38	52	PN, V, SN, RO

Predicted construction noise levels: OOHW Period 1 (Day)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R261	Residential	46	50	52	51	57	58	36	47	PN, V, SN, RO
R262	Residential	50	55	55	54	60	63	38	51	PN, V, SN, RO
R263	Residential	50	55	56	55	61	64	39	52	PN, V, SN, RO
R264	Residential	47	52	52	51	58	60	37	48	PN, V, SN, RO
R265	Residential	48	53	55	54	60	62	37	50	PN, V, SN, RO
R266	Residential	48	51	52	51	58	59	28	48	PN, V, SN, RO
R267	Residential	47	51	52	51	58	59	27	48	PN, V, SN, RO
R268	Residential	47	51	52	51	58	58	29	49	PN, V, SN, RO
R269	Residential	47	51	49	48	58	57	26	47	PN, V, SN, RO
R270	Residential	48	53	50	49	59	58	32	47	PN, V, SN, RO
R271	Residential	48	53	52	51	59	58	34	49	PN, V, SN, RO
R272	Residential	45	49	51	50	57	58	30	48	PN, V, SN, RO
R273	Residential	46	50	51	50	57	58	32	48	PN, V, SN, RO
R274	Residential	46	50	50	49	57	59	32	47	PN, V, SN, RO
R275	Residential	46	50	50	49	56	58	32	47	PN, V, SN, RO
R276	Residential	45	50	50	49	57	58	32	49	PN, V, SN, RO
R277	Residential	46	50	50	49	55	58	32	49	PN, V, SN, RO
R278	Residential	45	51	50	49	56	58	32	48	PN, V, SN, RO
R279	Residential	48	53	51	50	60	58	34	50	PN, V, SN, RO
R280	Residential	45	49	49	48	55	56	31	47	PN, V, SN, RO
R281	Residential	45	50	51	50	57	59	32	49	PN, V, SN, RO
R282	Residential	44	48	47	46	55	54	29	45	PN, V, SN, RO
R283	Residential	45	49	49	48	56	57	31	47	PN, V, SN, RO
R284	Residential	46	50	49	48	57	58	31	48	PN, V, SN, RO
R285	Residential	47	50	49	48	56	58	31	48	PN, V, SN, RO
R286	Residential	46	50	50	49	57	58	32	48	PN, V, SN, RO
R287	Residential	46	50	51	50	57	58	32	48	PN, V, SN, RO
R288	Residential	45	49	49	48	56	57	31	48	PN, V, SN, RO
R289	Residential	45	50	50	49	57	58	32	48	PN, V, SN, RO
R290	Residential	43	48	48	47	54	54	28	45	PN
R291	Residential	45	49	49	48	56	57	30	46	PN, V, SN, RO
R292	Residential	43	47	49	48	54	56	29	46	PN, V, SN, RO
R293	Residential	44	48	49	48	55	58	30	47	PN, V, SN, RO
R294	Residential	40	44	45	44	50	54	25	43	PN
R295	Residential	43	47	48	47	54	57	29	45	PN, V, SN, RO
R296	Residential	44	48	48	47	54	57	29	46	PN, V, SN, RO
R297	Residential	40	45	45	44	52	54	25	43	PN
R298	Residential	39	43	42	41	50	53	23	42	PN
R299	Residential	41	45	47	46	52	55	29	43	PN, V, SN, RO
R300	Residential	44	48	47	46	54	58	30	45	PN, V, SN, RO
R301	Residential	43	48	46	45	54	56	30	44	PN, V, SN, RO
R302	Residential	43	48	47	46	53	57	30	44	PN, V, SN, RO
R303	Residential	42	46	47	46	53	55	29	43	PN, V, SN, RO
R304	Residential	42	47	47	46	53	56	29	45	PN, V, SN, RO
R305	Residential	41	46	47	46	52	55	29	44	PN, V, SN, RO
R306	Residential	43	47	48	47	54	56	30	45	PN, V, SN, RO
R307	Residential	43	47	48	47	54	57	30	45	PN, V, SN, RO
R308	Residential	46	50	50	49	55	58	31	47	PN, V, SN, RO
R309	Residential	45	50	49	48	55	57	30	47	PN, V, SN, RO
R310	Residential	44	49	48	47	55	57	30	46	PN, V, SN, RO
R311	Residential	44	49	49	48	55	58	31	46	PN, V, SN, RO
R312	Residential	44	48	48	47	54	58	32	46	PN, V, SN, RO
R313	Residential	42	46	47	46	52	56	30	43	PN, V, SN, RO
R314	Residential	40	45	45	44	51	52	23	42	PN
R315	Residential	44	49	48	47	55	57	30	46	PN, V, SN, RO
R316	Educational institute	44	48	48	47	55	55	30	46	-
R317	Educational institute	48	53	51	50	59	59	34	51	-
R318	Educational institute	43	47	47	46	54	54	31	45	-
R319	Educational institute	42	47	48	47	53	55	32	45	-
R320	Educational institute	36	40	42	41	47	49	24	39	-
R321	Educational institute	37	41	42	41	48	50	24	41	-
R322	Educational institute	43	48	48	47	54	54	30	46	-
R323	Educational institute	39	43	44	43	50	51	27	42	-

Predicted construction noise levels: OOHW Period 1 (Evening)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R001	Residential	44	50	48	47	54	55	30	45	PN, V, SN, RO
R002	Commercial	71	83	64	63	76	79	62	59	-
R003	Commercial	73	82	65	64	77	81	61	60	-
R004	Commercial	76	82	65	64	79	84	60	61	-
R005	Commercial	77	81	67	66	79	86	58	63	-
R006	Commercial	77	81	68	67	78	91	56	71	-
R007	Commercial	73	77	65	64	75	89	47	73	-
R008	Commercial	77	75	67	66	72	86	50	82	-
R009	Residential	**77**	**75**	69	68	**75**	**80**	46	**82**	PN, V, SN, RO, RP, DR
R010	Residential	71	**76**	68	67	**75**	**77**	42	72	PN, V, SN, RO, RP, DR
R011	Residential	71	**77**	66	65	**75**	73	40	67	PN, V, SN, RO, RP, DR
R012	Residential	73	**78**	65	64	**78**	73	39	65	PN, V, SN, RO, RP, DR
R013	Residential	73	**79**	63	62	**81**	70	38	62	PN, V, SN, RO, RP, DR
R014	Residential	74	**79**	62	61	**82**	69	38	59	PN, V, SN, RO, RP, DR
R015	Residential	74	**79**	60	59	**81**	69	38	57	PN, V, SN, RO, RP, DR
R016	Residential	73	**78**	58	57	74	65	40	58	PN, V, SN, RO, RP, DR
R017	Residential	64	72	52	51	66	57	33	47	PN, V, SN, RO, RP, DR
R018	Residential	61	68	54	53	65	61	36	53	PN, V, SN, RO, RP, DR
R019	Residential	56	63	51	50	61	57	33	46	PN, V, SN, RO, RP, DR
R020	Residential	49	54	47	46	56	55	26	48	PN, V, SN, RO
R021	Residential	52	58	48	47	57	56	29	46	PN, V, SN, RO
R022	Residential	45	50	43	42	52	51	23	43	PN, V, SN, RO
R023	Residential	48	52	44	43	54	52	25	42	PN, V, SN, RO
R024	Residential	48	53	47	46	56	54	30	44	PN, V, SN, RO
R025	Residential	47	52	50	49	57	57	31	47	PN, V, SN, RO
R026	Residential	47	51	48	47	57	56	31	46	PN, V, SN, RO
R027	Residential	47	51	49	48	55	57	30	46	PN, V, SN, RO
R028	Residential	46	51	48	47	55	56	30	45	PN, V, SN, RO
R029	Residential	44	48	47	46	54	55	30	46	PN, V, SN, RO
R030	Residential	40	44	44	43	51	51	26	42	PN
R031	Residential	43	47	46	45	53	53	29	44	PN, V, SN, RO
R032	Residential	44	49	46	45	53	54	26	44	PN, V, SN, RO
R033	Residential	46	50	46	45	53	53	25	44	PN, V, SN, RO
R034	Residential	46	50	47	46	54	54	26	44	PN, V, SN, RO
R035	Residential	43	49	45	44	52	53	24	43	PN, V, SN, RO
R036	Residential	42	48	45	44	52	53	24	43	PN, V, SN, RO
R037	Active recreation	41	47	47	46	53	54	28	43	-
R038	Residential	40	45	45	44	51	52	26	42	PN, V, SN, RO
R039	Residential	61	63	57	56	65	72	35	66	PN, V, SN, RO, RP, DR
R040	Residential	53	56	51	50	57	62	32	58	PN, V, SN, RO, RP, DR
R041	Residential	50	57	50	49	60	62	30	55	PN, V, SN, RO, RP, DR
R042	Residential	46	52	45	44	57	52	25	46	PN, V, SN, RO
R043	Residential	43	47	45	44	52	55	26	48	PN, V, SN, RO
R044	Residential	52	57	50	49	60	61	28	53	PN, V, SN, RO
R045	Residential	59	74	55	54	69	67	53	52	PN, V, SN, RO, RP, DR
R046	Residential	53	68	52	51	62	65	48	50	PN, V, SN, RO, RP, DR
R047	Residential	51	62	51	50	60	64	39	52	PN, V, SN, RO, RP, DR
R048	Residential	56	64	50	49	59	71	39	56	PN, V, SN, RO, RP, DR
R049	Residential	55	62	49	48	57	71	36	55	PN, V, SN, RO, RP, DR
R050	Residential	53	61	51	50	57	67	36	59	PN, V, SN, RO, RP, DR
R051	Residential	55	59	52	51	57	68	33	58	PN, V, SN, RO, RP, DR
R052	Residential	51	55	49	48	55	65	32	56	PN, V, SN, RO, RP, DR
R053	Residential	49	53	48	47	54	63	28	54	PN, V, SN, RO, RP, DR
R054	Residential	47	50	46	45	52	62	27	52	PN, V, SN, RO, RP, DR
R055	Residential	46	53	46	45	52	63	29	51	PN, V, SN, RO, RP, DR
R056	Residential	46	49	44	43	50	59	28	51	PN, V, SN, RO
R057	Residential	46	51	45	44	53	60	30	50	PN, V, SN, RO
R058	Residential	40	48	42	41	49	53	26	44	PN, V, SN, RO
R059	Residential	40	46	43	42	49	54	26	45	PN, V, SN, RO
R060	Residential	39	46	41	40	48	53	25	41	PN, V, SN, RO
R061	Residential	39	45	41	40	47	54	25	43	PN, V, SN, RO
R062	Residential	40	48	40	39	48	55	27	43	PN, V, SN, RO
R063	Residential	40	47	40	39	49	54	27	41	PN, V, SN, RO
R064	Residential	40	47	42	41	49	54	29	41	PN, V, SN, RO
R065	Residential	40	46	43	42	49	53	29	41	PN, V, SN, RO

Predicted construction noise levels: OOHW Period 1 (Evening)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R066	Residential	40	48	43	42	49	54	29	43	PN, V, SN, RO
R067	Residential	46	51	46	45	53	59	30	45	PN, V, SN, RO
R068	Residential	47	60	47	46	56	60	44	48	PN, V, SN, RO
R069	Residential	59	70	59	58	67	71	49	51	PN, V, SN, RO, RP, DR
R070	Commercial	57	66	58	57	66	69	48	50	-
R071	Residential	50	62	48	47	60	62	43	46	PN, V, SN, RO, RP, DR
R072	Residential	47	57	48	47	56	61	36	45	PN, V, SN, RO
R073	Residential	47	55	46	45	55	59	34	44	PN, V, SN, RO
R074	Residential	42	54	44	43	52	56	34	42	PN, V, SN, RO
R075	Residential	41	53	43	42	50	55	32	43	PN, V, SN, RO
R076	Residential	40	47	42	41	47	53	27	40	PN, V, SN, RO
R077	Residential	54	62	56	55	63	67	44	51	PN, V, SN, RO, RP, DR
R078	Residential	48	55	50	49	58	60	39	45	PN, V, SN, RO
R079	Residential	51	58	55	54	61	64	42	46	PN, V, SN, RO, RP, DR
R080	Residential	43	48	46	45	53	57	31	44	PN, V, SN, RO
R081	Residential	48	54	52	51	59	61	39	48	PN, V, SN, RO
R082	Residential	47	53	48	47	57	59	36	42	PN, V, SN, RO
R083	Residential	47	55	52	51	57	63	38	48	PN, V, SN, RO, RP, DR
R084	Residential	44	49	49	48	55	57	35	45	PN, V, SN, RO
R085	Residential	43	47	48	47	53	57	34	44	PN, V, SN, RO
R086	Residential	42	47	47	46	53	55	34	41	PN, V, SN, RO
R087	Residential	40	46	39	38	48	53	25	44	PN, V, SN, RO
R088	Residential	40	45	42	41	48	55	25	46	PN, V, SN, RO
R089	Residential	43	48	44	43	49	58	26	47	PN, V, SN, RO
R090	Residential	44	48	45	44	50	57	26	49	PN, V, SN, RO
R091	Residential	44	49	45	44	52	58	26	48	PN, V, SN, RO
R092	Residential	43	46	44	43	50	58	25	47	PN, V, SN, RO
R093	Residential	46	50	45	44	51	56	25	51	PN, V, SN, RO
R094	Residential	45	50	44	43	52	56	27	50	PN, V, SN, RO
R095	Residential	48	52	42	41	52	52	24	44	PN, V, SN, RO
R096	Residential	48	52	43	42	56	54	22	47	PN, V, SN, RO
R097	Residential	48	52	43	42	57	56	22	48	PN, V, SN, RO
R098	Residential	48	52	42	41	55	52	23	43	PN, V, SN, RO
R099	Residential	46	51	43	42	54	51	21	42	PN, V, SN, RO
R100	Residential	45	50	44	43	52	51	21	42	PN, V, SN, RO
R101	Residential	47	55	43	42	52	51	23	42	PN, V, SN, RO
R102	Residential	47	55	40	39	51	49	21	41	PN, V, SN, RO
R103	Residential	48	53	42	41	52	49	20	40	PN, V, SN, RO
R104	Residential	41	46	42	41	48	56	23	44	PN, V, SN, RO
R105	Residential	42	47	42	41	48	57	26	46	PN, V, SN, RO
R106	Residential	41	45	42	41	48	54	23	45	PN, V, SN, RO
R107	Residential	42	47	42	41	48	56	23	46	PN, V, SN, RO
R108	Residential	41	46	41	40	51	56	23	45	PN, V, SN, RO
R109	Residential	41	45	39	38	48	51	20	41	PN
R110	Residential	39	43	39	38	48	50	18	42	PN
R111	Residential	41	45	39	38	48	53	20	43	PN, V, SN, RO
R112	Residential	40	44	38	37	48	53	19	43	PN, V, SN, RO
R113	Residential	40	43	37	36	49	50	17	41	PN
R114	Residential	41	44	38	37	49	53	19	43	PN, V, SN, RO
R115	Residential	40	44	37	36	50	52	19	43	PN, V, SN, RO
R116	Residential	40	43	38	37	50	50	19	44	PN
R117	Residential	37	41	35	34	43	44	15	36	PN
R118	Residential	39	43	39	38	49	52	20	42	PN, V, SN, RO
R119	Residential	40	44	38	37	47	52	20	42	PN, V, SN, RO
R120	Residential	40	43	39	38	47	52	20	43	PN, V, SN, RO
R121	Residential	38	43	38	37	45	50	17	40	PN
R122	Residential	39	44	38	37	47	51	20	40	PN
R123	Residential	38	43	38	37	44	50	20	42	PN
R124	Residential	36	43	38	37	45	51	21	41	PN
R125	Residential	42	46	38	37	49	48	17	40	PN
R126	Residential	53	58	57	56	63	65	34	52	PN, V, SN, RO, RP, DR
R127	Residential	52	57	56	55	63	64	32	51	PN, V, SN, RO, RP, DR
R128	Residential	52	57	55	54	62	64	32	51	PN, V, SN, RO, RP, DR
R129	Residential	52	56	56	55	62	63	31	52	PN, V, SN, RO, RP, DR
R130	Residential	52	56	54	53	63	59	29	51	PN, V, SN, RO, RP, DR

Predicted construction noise levels: OOHW Period 1 (Evening)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R131	Residential	52	56	56	55	63	62	32	52	PN, V, SN, RO, RP, DR
R132	Residential	52	55	56	55	62	62	32	52	PN, V, SN, RO, RP, DR
R133	Residential	54	57	56	55	63	64	36	51	PN, V, SN, RO, RP, DR
R134	Residential	51	55	55	54	61	63	35	51	PN, V, SN, RO, RP, DR
R135	Residential	50	54	54	53	59	62	34	51	PN, V, SN, RO, RP, DR
R136	Residential	51	55	52	51	62	59	31	51	PN, V, SN, RO, RP, DR
R137	Residential	51	55	55	54	62	64	35	51	PN, V, SN, RO, RP, DR
R138	Residential	50	54	55	54	61	63	35	51	PN, V, SN, RO, RP, DR
R139	Residential	51	55	53	52	60	61	36	51	PN, V, SN, RO
R140	Residential	52	57	58	57	63	66	40	52	PN, V, SN, RO, RP, DR
R141	Residential	51	55	56	55	62	64	34	51	PN, V, SN, RO, RP, DR
R142	Residential	53	56	57	56	63	65	34	54	PN, V, SN, RO, RP, DR
R143	Residential	50	54	55	54	61	63	30	51	PN, V, SN, RO, RP, DR
R144	Residential	51	54	54	53	61	62	31	51	PN, V, SN, RO, RP, DR
R145	Residential	51	54	54	53	61	62	32	50	PN, V, SN, RO, RP, DR
R146	Residential	50	53	54	53	59	63	31	50	PN, V, SN, RO, RP, DR
R147	Residential	50	53	54	53	59	62	32	51	PN, V, SN, RO, RP, DR
R148	Residential	50	53	53	52	60	62	31	50	PN, V, SN, RO, RP, DR
R149	Residential	48	52	53	52	59	62	33	49	PN, V, SN, RO, RP, DR
R150	Residential	48	52	50	49	58	60	30	49	PN, V, SN, RO
R151	Residential	47	52	53	52	59	61	32	49	PN, V, SN, RO
R152	Residential	47	52	51	50	57	60	32	46	PN, V, SN, RO
R153	Residential	47	50	49	48	57	59	32	47	PN, V, SN, RO
R154	Residential	45	50	50	49	56	59	31	47	PN, V, SN, RO
R155	Residential	44	49	50	49	56	59	29	46	PN, V, SN, RO
R156	Residential	56	61	61	60	67	71	45	57	PN, V, SN, RO, RP, DR
R157	Residential	52	57	57	56	64	63	41	51	PN, V, SN, RO, RP, DR
R158	Residential	53	58	58	57	63	68	37	53	PN, V, SN, RO, RP, DR
R159	Residential	53	57	56	55	62	66	38	52	PN, V, SN, RO, RP, DR
R160	Residential	53	57	57	56	64	66	34	53	PN, V, SN, RO, RP, DR
R161	Residential	53	58	57	56	62	67	38	53	PN, V, SN, RO, RP, DR
R162	Residential	50	55	55	54	62	62	34	51	PN, V, SN, RO, RP, DR
R163	Residential	50	55	56	55	61	64	39	50	PN, V, SN, RO, RP, DR
R164	Residential	50	54	53	52	60	60	37	50	PN, V, SN, RO
R165	Residential	50	54	55	54	61	63	34	50	PN, V, SN, RO, RP, DR
R166	Residential	49	53	54	53	59	63	34	50	PN, V, SN, RO, RP, DR
R167	Residential	48	53	52	51	59	60	34	49	PN, V, SN, RO
R168	Residential	46	50	53	52	58	59	30	49	PN, V, SN, RO
R169	Residential	49	54	53	52	60	60	33	50	PN, V, SN, RO
R170	Residential	47	51	50	49	56	57	29	46	PN, V, SN, RO
R171	Residential	47	52	53	52	58	61	34	48	PN, V, SN, RO
R172	Residential	51	56	56	55	61	64	39	53	PN, V, SN, RO, RP, DR
R173	Residential	53	57	57	56	63	63	39	51	PN, V, SN, RO, RP, DR
R174	Residential	52	56	57	56	63	64	33	53	PN, V, SN, RO, RP, DR
R175	Residential	51	55	54	53	60	64	36	50	PN, V, SN, RO, RP, DR
R176	Residential	51	55	55	54	61	62	36	51	PN, V, SN, RO, RP, DR
R177	Residential	51	54	56	55	61	65	37	51	PN, V, SN, RO, RP, DR
R178	Residential	50	55	55	54	61	64	37	50	PN, V, SN, RO, RP, DR
R179	Residential	50	54	50	49	60	61	33	49	PN, V, SN, RO
R180	Residential	48	53	50	49	59	60	35	49	PN, V, SN, RO
R181	Residential	49	53	49	48	59	59	32	48	PN, V, SN, RO
R182	Residential	48	52	52	51	58	61	29	48	PN, V, SN, RO
R183	Residential	45	48	51	50	56	58	35	47	PN, V, SN, RO
R184	Residential	48	52	52	51	57	61	36	48	PN, V, SN, RO
R185	Residential	47	51	51	50	57	60	34	47	PN, V, SN, RO
R186	Residential	46	51	51	50	57	57	30	47	PN, V, SN, RO
R187	Residential	47	50	50	49	57	59	33	47	PN, V, SN, RO
R188	Residential	45	50	49	48	56	58	32	46	PN, V, SN, RO
R189	Residential	45	49	49	48	55	57	32	46	PN, V, SN, RO
R190	Residential	44	48	48	47	55	57	29	46	PN, V, SN, RO
R191	Residential	43	47	47	46	53	55	28	45	PN, V, SN, RO
R192	Residential	37	42	42	41	48	49	21	39	PN
R193	Residential	43	47	47	46	54	55	23	44	PN, V, SN, RO
R194	Residential	43	47	48	47	54	55	28	45	PN, V, SN, RO
R195	Residential	38	43	45	44	50	51	25	41	PN

Predicted construction noise levels: OOHW Period 1 (Evening)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R196	Residential	43	47	47	46	53	55	29	44	PN, V, SN, RO
R197	Residential	40	45	45	44	51	52	27	42	PN, V, SN, RO
R198	Residential	40	44	44	43	50	51	25	40	PN
R199	Residential	42	46	45	44	53	52	28	41	PN, V, SN, RO
R200	Residential	43	47	45	44	54	53	27	42	PN, V, SN, RO
R201	Residential	39	45	46	45	51	54	26	40	PN, V, SN, RO
R202	Residential	40	45	46	45	51	52	27	43	PN, V, SN, RO
R203	Residential	41	45	47	46	52	53	29	45	PN, V, SN, RO
R204	Residential	41	45	47	46	53	55	30	43	PN, V, SN, RO
R205	Residential	41	45	47	46	53	53	24	43	PN, V, SN, RO
R206	Residential	45	49	51	50	56	59	33	47	PN, V, SN, RO
R207	Residential	45	49	50	49	56	58	33	47	PN, V, SN, RO
R208	Residential	44	49	50	49	55	58	33	47	PN, V, SN, RO
R209	Residential	43	47	48	47	54	55	29	45	PN, V, SN, RO
R210	Residential	46	50	51	50	56	59	34	48	PN, V, SN, RO
R211	Residential	42	47	45	44	51	52	29	42	PN, V, SN, RO
R212	Residential	45	50	49	48	56	58	33	45	PN, V, SN, RO
R213	Residential	45	50	51	50	56	59	33	47	PN, V, SN, RO
R214	Residential	47	52	53	52	58	60	35	49	PN, V, SN, RO
R215	Residential	46	51	53	52	58	60	34	49	PN, V, SN, RO
R216	Residential	45	49	51	50	56	59	34	48	PN, V, SN, RO
R217	Residential	47	52	52	51	58	60	35	49	PN, V, SN, RO
R218	Residential	40	45	46	45	51	53	31	42	PN, V, SN, RO
R219	Residential	39	43	45	44	51	54	28	41	PN, V, SN, RO
R220	Residential	40	44	46	45	51	52	22	43	PN, V, SN, RO
R221	Residential	42	46	48	47	54	55	31	46	PN, V, SN, RO
R222	Residential	37	41	43	42	48	50	22	40	PN
R223	Residential	35	39	40	39	47	48	20	37	PN
R224	Residential	36	40	43	42	48	49	22	38	PN
R225	Residential	36	40	42	41	48	49	22	39	PN
R226	Residential	35	39	40	39	47	49	20	38	PN
R227	Residential	33	38	38	37	45	46	20	36	PN
R228	Residential	30	35	37	36	42	45	19	35	PN
R229	Residential	33	39	37	36	42	46	22	35	PN
R230	Residential	36	40	40	39	45	50	22	39	PN
R231	Residential	38	42	43	42	48	52	26	42	PN, V, SN, RO
R232	Residential	38	42	43	42	48	52	26	41	PN, V, SN, RO
R233	Commercial	42	47	48	47	53	55	34	46	-
R234	Commercial	42	45	47	46	53	55	33	45	-
R235	Commercial	41	46	47	46	52	55	32	44	-
R236	Commercial	39	43	44	43	50	53	27	42	-
R237	Residential	37	42	40	39	47	50	24	40	PN
R238	Residential	45	49	49	48	55	59	37	48	PN, V, SN, RO
R239	Residential	47	52	50	49	56	60	36	51	PN, V, SN, RO
R240	Residential	52	57	53	52	62	66	41	53	PN, V, SN, RO, RP, DR
R241	Residential	44	49	50	49	56	58	34	47	PN, V, SN, RO
R242	Residential	55	60	59	58	65	68	47	56	PN, V, SN, RO, RP, DR
R243	Commercial	43	48	48	47	53	58	34	47	-
R244	Commercial	46	51	48	47	55	61	34	50	-
R245	Residential	38	43	45	44	50	53	27	43	PN, V, SN, RO
R246	Residential	38	42	42	41	49	51	25	41	PN
R247	Residential	37	41	42	41	48	51	26	41	PN
R248	Residential	37	41	41	40	48	51	24	41	PN
R249	Residential	36	40	39	38	44	49	22	39	PN
R250	Residential	32	38	37	36	42	44	21	34	PN
R251	Residential	37	41	43	42	48	50	24	39	PN
R252	Place of worship	58	62	62	61	68	71	49	57	-
R253	Residential	54	58	60	59	65	67	45	53	PN, V, SN, RO, RP, DR
R254	Residential	53	58	59	58	65	66	39	56	PN, V, SN, RO, RP, DR
R255	Medical facility	53	57	59	58	64	67	41	55	-
R256	Commercial	48	53	53	52	60	61	32	51	-
R257	Residential	47	51	53	52	58	61	34	50	PN, V, SN, RO
R258	Residential	49	53	54	53	60	63	38	53	PN, V, SN, RO, RP, DR
R259	Residential	40	44	45	44	51	52	26	43	PN, V, SN, RO
R260	Residential	48	52	55	54	60	62	38	52	PN, V, SN, RO, RP, DR

Predicted construction noise levels: OOHW Period 1 (Evening)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R261	Residential	46	50	52	51	57	58	36	47	PN, V, SN, RO
R262	Residential	50	55	55	54	60	63	38	51	PN, V, SN, RO, RP, DR
R263	Residential	50	55	56	55	61	64	39	52	PN, V, SN, RO, RP, DR
R264	Residential	47	52	52	51	58	60	37	48	PN, V, SN, RO
R265	Residential	48	53	55	54	60	62	37	50	PN, V, SN, RO, RP, DR
R266	Residential	48	51	52	51	58	59	28	48	PN, V, SN, RO
R267	Residential	47	51	52	51	58	59	27	48	PN, V, SN, RO
R268	Residential	47	51	52	51	58	58	29	49	PN, V, SN, RO
R269	Residential	47	51	49	48	58	57	26	47	PN, V, SN, RO
R270	Residential	48	53	50	49	59	58	32	47	PN, V, SN, RO
R271	Residential	48	53	52	51	59	58	34	49	PN, V, SN, RO
R272	Residential	45	49	51	50	57	58	30	48	PN, V, SN, RO
R273	Residential	46	50	51	50	57	58	32	48	PN, V, SN, RO
R274	Residential	46	50	50	49	57	59	32	47	PN, V, SN, RO
R275	Residential	46	50	50	49	56	58	32	47	PN, V, SN, RO
R276	Residential	45	50	50	49	57	58	32	49	PN, V, SN, RO
R277	Residential	46	50	50	49	55	58	32	49	PN, V, SN, RO
R278	Residential	45	51	50	49	56	58	32	48	PN, V, SN, RO
R279	Residential	48	53	51	50	60	58	34	50	PN, V, SN, RO
R280	Residential	45	49	49	48	55	56	31	47	PN, V, SN, RO
R281	Residential	45	50	51	50	57	59	32	49	PN, V, SN, RO
R282	Residential	44	48	47	46	55	54	29	45	PN, V, SN, RO
R283	Residential	45	49	49	48	56	57	31	47	PN, V, SN, RO
R284	Residential	46	50	49	48	57	58	31	48	PN, V, SN, RO
R285	Residential	47	50	49	48	56	58	31	48	PN, V, SN, RO
R286	Residential	46	50	50	49	57	58	32	48	PN, V, SN, RO
R287	Residential	46	50	51	50	57	58	32	48	PN, V, SN, RO
R288	Residential	45	49	49	48	56	57	31	48	PN, V, SN, RO
R289	Residential	45	50	50	49	57	58	32	48	PN, V, SN, RO
R290	Residential	43	48	48	47	54	54	28	45	PN, V, SN, RO
R291	Residential	45	49	49	48	56	57	30	46	PN, V, SN, RO
R292	Residential	43	47	49	48	54	56	29	46	PN, V, SN, RO
R293	Residential	44	48	49	48	55	58	30	47	PN, V, SN, RO
R294	Residential	40	44	45	44	50	54	25	43	PN, V, SN, RO
R295	Residential	43	47	48	47	54	57	29	45	PN, V, SN, RO
R296	Residential	44	48	48	47	54	57	29	46	PN, V, SN, RO
R297	Residential	40	45	45	44	52	54	25	43	PN, V, SN, RO
R298	Residential	39	43	42	41	50	53	23	42	PN, V, SN, RO
R299	Residential	41	45	47	46	52	55	29	43	PN, V, SN, RO
R300	Residential	44	48	47	46	54	58	30	45	PN, V, SN, RO
R301	Residential	43	48	46	45	54	56	30	44	PN, V, SN, RO
R302	Residential	43	48	47	46	53	57	30	44	PN, V, SN, RO
R303	Residential	42	46	47	46	53	55	29	43	PN, V, SN, RO
R304	Residential	42	47	47	46	53	56	29	45	PN, V, SN, RO
R305	Residential	41	46	47	46	52	55	29	44	PN, V, SN, RO
R306	Residential	43	47	48	47	54	56	30	45	PN, V, SN, RO
R307	Residential	43	47	48	47	54	57	30	45	PN, V, SN, RO
R308	Residential	46	50	50	49	55	58	31	47	PN, V, SN, RO
R309	Residential	45	50	49	48	55	57	30	47	PN, V, SN, RO
R310	Residential	44	49	48	47	55	57	30	46	PN, V, SN, RO
R311	Residential	44	49	49	48	55	58	31	46	PN, V, SN, RO
R312	Residential	44	48	48	47	54	58	32	46	PN, V, SN, RO
R313	Residential	42	46	47	46	52	56	30	43	PN, V, SN, RO
R314	Residential	40	45	45	44	51	52	23	42	PN, V, SN, RO
R315	Residential	44	49	48	47	55	57	30	46	PN, V, SN, RO
R316	Educational institute	44	48	48	47	55	55	30	46	-
R317	Educational institute	48	53	51	50	59	59	34	51	-
R318	Educational institute	43	47	47	46	54	54	31	45	-
R319	Educational institute	42	47	48	47	53	55	32	45	-
R320	Educational institute	36	40	42	41	47	49	24	39	-
R321	Educational institute	37	41	42	41	48	50	24	41	-
R322	Educational institute	43	48	48	47	54	54	30	46	-
R323	Educational institute	39	43	44	43	50	51	27	42	-

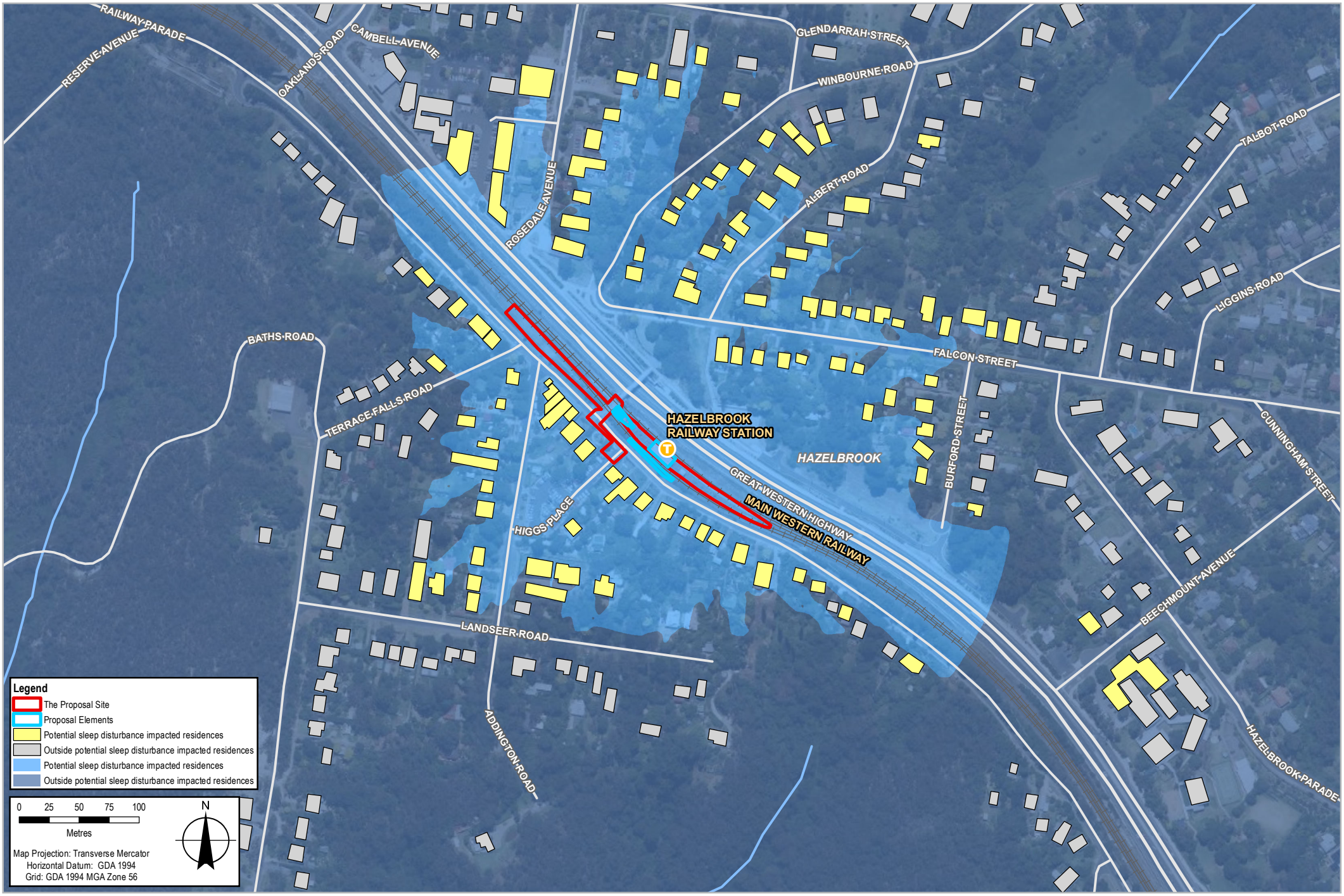
Predicted construction noise levels: OOHW Period 2 (Night)

Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected										
Non-residential: Exceeds noise management level										
R009	Residential	**77**	**75**	69	68	**75**	**80**	46	**82**	PN, V, SN, AA, RP, DR
R010	Residential	71	**76**	68	67	**75**	**77**	42	72	PN, V, SN, AA, RP, DR
R011	Residential	71	**77**	66	65	**75**	73	40	67	PN, V, SN, AA, RP, DR
R012	Residential	73	**78**	65	64	**78**	73	39	65	PN, V, SN, AA, RP, DR
R013	Residential	73	**79**	63	62	**81**	70	38	62	PN, V, SN, AA, RP, DR
R014	Residential	74	**79**	62	61	**82**	69	38	59	PN, V, SN, AA, RP, DR
R015	Residential	74	**79**	60	59	**81**	69	38	57	PN, V, SN, AA, RP, DR
R016	Residential	73	**78**	58	57	74	65	40	58	PN, V, SN, AA, RP, DR
R017	Residential	64	72	52	51	66	57	33	47	PN, V, SN, AA, RP, DR
R018	Residential	61	68	54	53	65	61	36	53	PN, V, SN, AA, RP, DR
R019	Residential	56	63	51	50	61	57	33	46	PN, V, SN, AA, RP, DR
R039	Residential	61	63	57	56	65	72	35	66	PN, V, SN, AA, RP, DR
R040	Residential	53	56	51	50	57	62	32	58	PN, V, SN, AA, RP, DR
R041	Residential	50	57	50	49	60	62	30	55	PN, V, SN, AA, RP, DR
R044	Residential	52	57	50	49	60	61	28	53	PN, V, SN, AA, RP, DR
R045	Residential	59	74	55	54	69	67	53	52	PN, V, SN, AA, RP, DR
R046	Residential	53	68	52	51	62	65	48	50	PN, V, SN, AA, RP, DR
R047	Residential	51	62	51	50	60	64	39	52	PN, V, SN, AA, RP, DR
R048	Residential	56	64	50	49	59	71	39	56	PN, V, SN, AA, RP, DR
R049	Residential	55	62	49	48	57	71	36	55	PN, V, SN, AA, RP, DR
R050	Residential	53	61	51	50	57	67	36	59	PN, V, SN, AA, RP, DR
R051	Residential	55	59	52	51	57	68	33	58	PN, V, SN, AA, RP, DR
R052	Residential	51	55	49	48	55	65	32	56	PN, V, SN, AA, RP, DR
R053	Residential	49	53	48	47	54	63	28	54	PN, V, SN, AA, RP, DR
R054	Residential	47	50	46	45	52	62	27	52	PN, V, SN, AA, RP, DR
R055	Residential	46	53	46	45	52	63	29	51	PN, V, SN, AA, RP, DR
R057	Residential	46	51	45	44	53	60	30	50	PN, V, SN, AA, RP, DR
R068	Residential	47	60	47	46	56	60	44	48	PN, V, SN, AA, RP, DR
R069	Residential	59	70	59	58	67	71	49	51	PN, V, SN, AA, RP, DR
R071	Residential	50	62	48	47	60	62	43	46	PN, V, SN, AA, RP, DR
R072	Residential	47	57	48	47	56	61	36	45	PN, V, SN, AA, RP, DR
R077	Residential	54	62	56	55	63	67	44	51	PN, V, SN, AA, RP, DR
R078	Residential	48	55	50	49	58	60	39	45	PN, V, SN, AA, RP, DR
R079	Residential	51	58	55	54	61	64	42	46	PN, V, SN, AA, RP, DR
R081	Residential	48	54	52	51	59	61	39	48	PN, V, SN, AA, RP, DR
R083	Residential	47	55	52	51	57	63	38	48	PN, V, SN, AA, RP, DR
R126	Residential	53	58	57	56	63	65	34	52	PN, V, SN, AA, RP, DR
R127	Residential	52	57	56	55	63	64	32	51	PN, V, SN, AA, RP, DR
R128	Residential	52	57	55	54	62	64	32	51	PN, V, SN, AA, RP, DR
R129	Residential	52	56	56	55	62	63	31	52	PN, V, SN, AA, RP, DR
R130	Residential	52	56	54	53	63	59	29	51	PN, V, SN, AA, RP, DR
R131	Residential	52	56	56	55	63	62	32	52	PN, V, SN, AA, RP, DR
R132	Residential	52	55	56	55	62	62	32	52	PN, V, SN, AA, RP, DR
R133	Residential	54	57	56	55	63	64	36	51	PN, V, SN, AA, RP, DR
R134	Residential	51	55	55	54	61	63	35	51	PN, V, SN, AA, RP, DR
R135	Residential	50	54	54	53	59	62	34	51	PN, V, SN, AA, RP, DR
R136	Residential	51	55	52	51	62	59	31	51	PN, V, SN, AA, RP, DR
R137	Residential	51	55	55	54	62	64	35	51	PN, V, SN, AA, RP, DR
R138	Residential	50	54	55	54	61	63	35	51	PN, V, SN, AA, RP, DR
R139	Residential	51	55	53	52	60	61	36	51	PN, V, SN, AA, RP, DR
R140	Residential	52	57	58	57	63	66	40	52	PN, V, SN, AA, RP, DR
R141	Residential	51	55	56	55	62	64	34	51	PN, V, SN, AA, RP, DR
R142	Residential	53	56	57	56	63	65	34	54	PN, V, SN, AA, RP, DR
R143	Residential	50	54	55	54	61	63	30	51	PN, V, SN, AA, RP, DR
R144	Residential	51	54	54	53	61	62	31	51	PN, V, SN, AA, RP, DR
R145	Residential	51	54	54	53	61	62	32	50	PN, V, SN, AA, RP, DR
R146	Residential	50	53	54	53	59	63	31	50	PN, V, SN, AA, RP, DR
R147	Residential	50	53	54	53	59	62	32	51	PN, V, SN, AA, RP, DR
R148	Residential	50	53	53	52	60	62	31	50	PN, V, SN, AA, RP, DR
R149	Residential	48	52	53	52	59	62	33	49	PN, V, SN, AA, RP, DR
R150	Residential	48	52	50	49	58	60	30	49	PN, V, SN, AA, RP, DR
R151	Residential	47	52	53	52	59	61	32	49	PN, V, SN, AA, RP, DR
R152	Residential	47	52	51	50	57	60	32	46	PN, V, SN, AA, RP, DR
R156	Residential	56	61	61	60	67	71	45	57	PN, V, SN, AA, RP, DR
R157	Residential	52	57	57	56	64	63	41	51	PN, V, SN, AA, RP, DR
R158	Residential	53	58	58	57	63	68	37	53	PN, V, SN, AA, RP, DR
R159	Residential	53	57	56	55	62	66	38	52	PN, V, SN, AA, RP, DR
R160	Residential	53	57	57	56	64	66	34	53	PN, V, SN, AA, RP, DR
R161	Residential	53	58	57	56	62	67	38	53	PN, V, SN, AA, RP, DR
R162	Residential	50	55	55	54	62	62	34	51	PN, V, SN, AA, RP, DR
R163	Residential	50	55	56	55	61	64	39	50	PN, V, SN, AA, RP, DR
R164	Residential	50	54	53	52	60	60	37	50	PN, V, SN, AA, RP, DR
R165	Residential	50	54	55	54	61	63	34	50	PN, V, SN, AA, RP, DR
R166	Residential	49	53	54	53	59	63	34	50	PN, V, SN, AA, RP, DR
R167	Residential	48	53	52	51	59	60	34	49	PN, V, SN, AA, RP, DR
R169	Residential	49	54	53	52	60	60	33	50	PN, V, SN, AA, RP, DR
R171	Residential	47	52	53	52	58	61	34	48	PN, V, SN, AA, RP, DR
R172	Residential	51	56	56	55	61	64	39	53	PN, V, SN, AA, RP, DR
R173	Residential	53	57	57	56	63	63	39	51	PN, V, SN, AA, RP, DR
R174	Residential	52	56	57	56	63	64	33	53	PN, V, SN, AA, RP, DR
R175	Residential	51	55	54	53	60	64	36	50	PN, V, SN, AA, RP, DR
R176	Residential	51	55	55	54	61	62	36	51	PN, V, SN, AA, RP, DR
R177	Residential	51	54	56	55	61	65	37	51	PN, V, SN, AA, RP, DR
R178	Residential	50	55	55	54	61	64	37	50	PN, V, SN, AA, RP, DR
R179	Residential	50	54	50	49	60	61	33	49	PN, V, SN, AA, RP, DR
R180	Residential	48	53	50	49	59	60	35	49	PN, V, SN, AA, RP, DR
R182	Residential	48	52	52	51	58	61	29	48	PN, V, SN, AA, RP, DR
R184	Residential	48	52	52	51	57	61	36	48	PN, V, SN, AA, RP, DR
R185	Residential	47	51	51	50	57	60	34	47	PN, V, SN, AA, RP, DR
R214	Residential	47	52	53	52	58	60	35	49	PN, V, SN, AA, RP, DR
R215	Residential	46	51	53	52	58	60	34	49	PN, V, SN, AA, RP, DR

Predicted construction noise levels: OOHW Period 2 (Night)

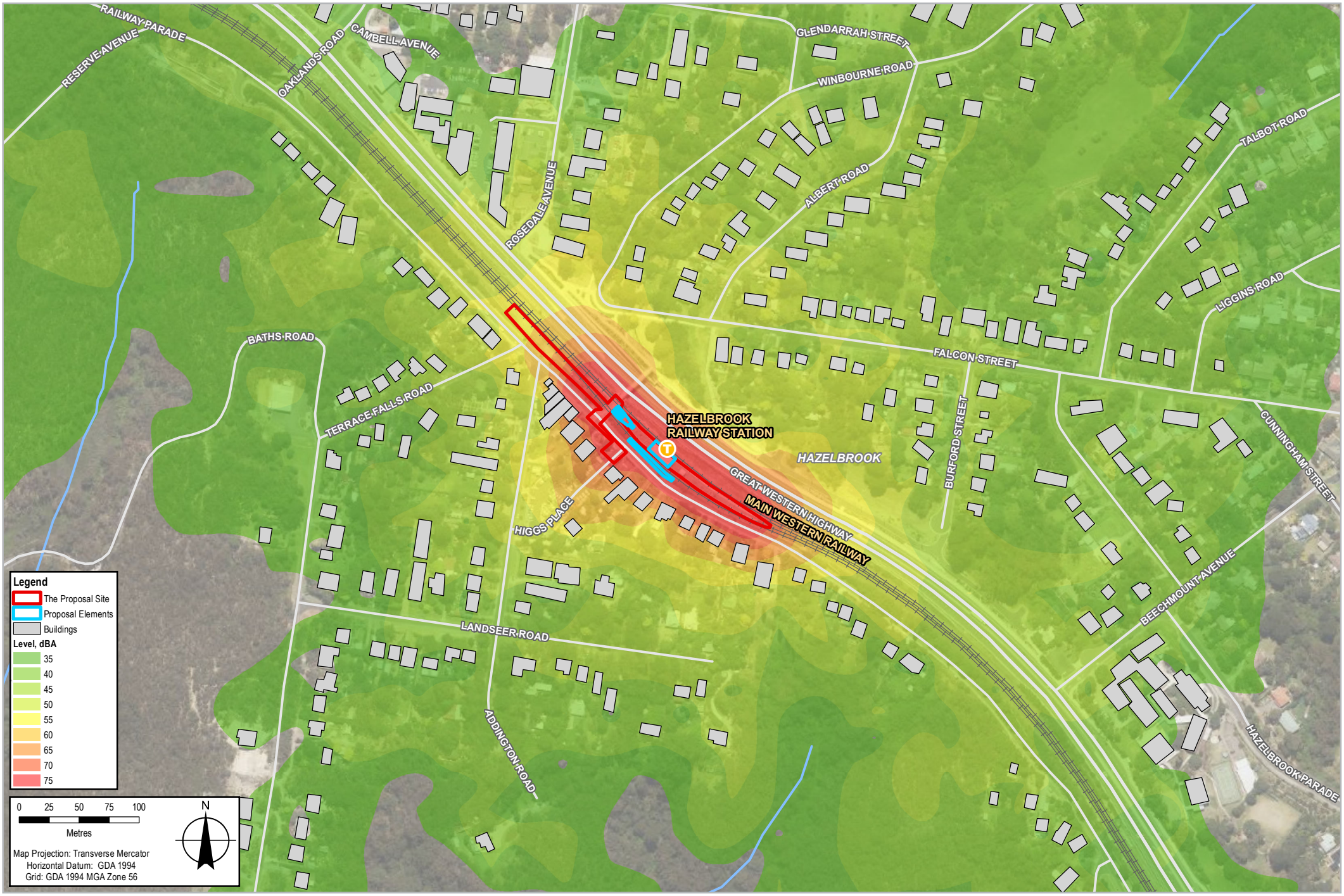
Receiver ID	Receiver Type	CS01	CS02	CS03	CS04	CS05	CS06	CS07	CS08	Additional management measures
Residential: Noticeable Clearly audible Moderately intrusive Highly intrusive **Bold** Highly noise affected Non-residential: Exceeds noise management level										
R217	Residential	47	52	52	51	58	60	35	49	PN, V, SN, AA, RP, DR
R239	Residential	47	52	50	49	56	60	36	51	PN, V, SN, AA, RP, DR
R240	Residential	52	57	53	52	62	66	41	53	PN, V, SN, AA, RP, DR
R242	Residential	55	60	59	58	65	68	47	56	PN, V, SN, AA, RP, DR
R253	Residential	54	58	60	59	65	67	45	53	PN, V, SN, AA, RP, DR
R254	Residential	53	58	59	58	65	66	39	56	PN, V, SN, AA, RP, DR
R257	Residential	47	51	53	52	58	61	34	50	PN, V, SN, AA, RP, DR
R258	Residential	49	53	54	53	60	63	38	53	PN, V, SN, AA, RP, DR
R260	Residential	48	52	55	54	60	62	38	52	PN, V, SN, AA, RP, DR
R262	Residential	50	55	55	54	60	63	38	51	PN, V, SN, AA, RP, DR
R263	Residential	50	55	56	55	61	64	39	52	PN, V, SN, AA, RP, DR
R264	Residential	47	52	52	51	58	60	37	48	PN, V, SN, AA, RP, DR
R265	Residential	48	53	55	54	60	62	37	50	PN, V, SN, AA, RP, DR
R279	Residential	48	53	51	50	60	58	34	50	PN, V, SN, AA, RP, DR

Appendix D – Predicted construction noise contours

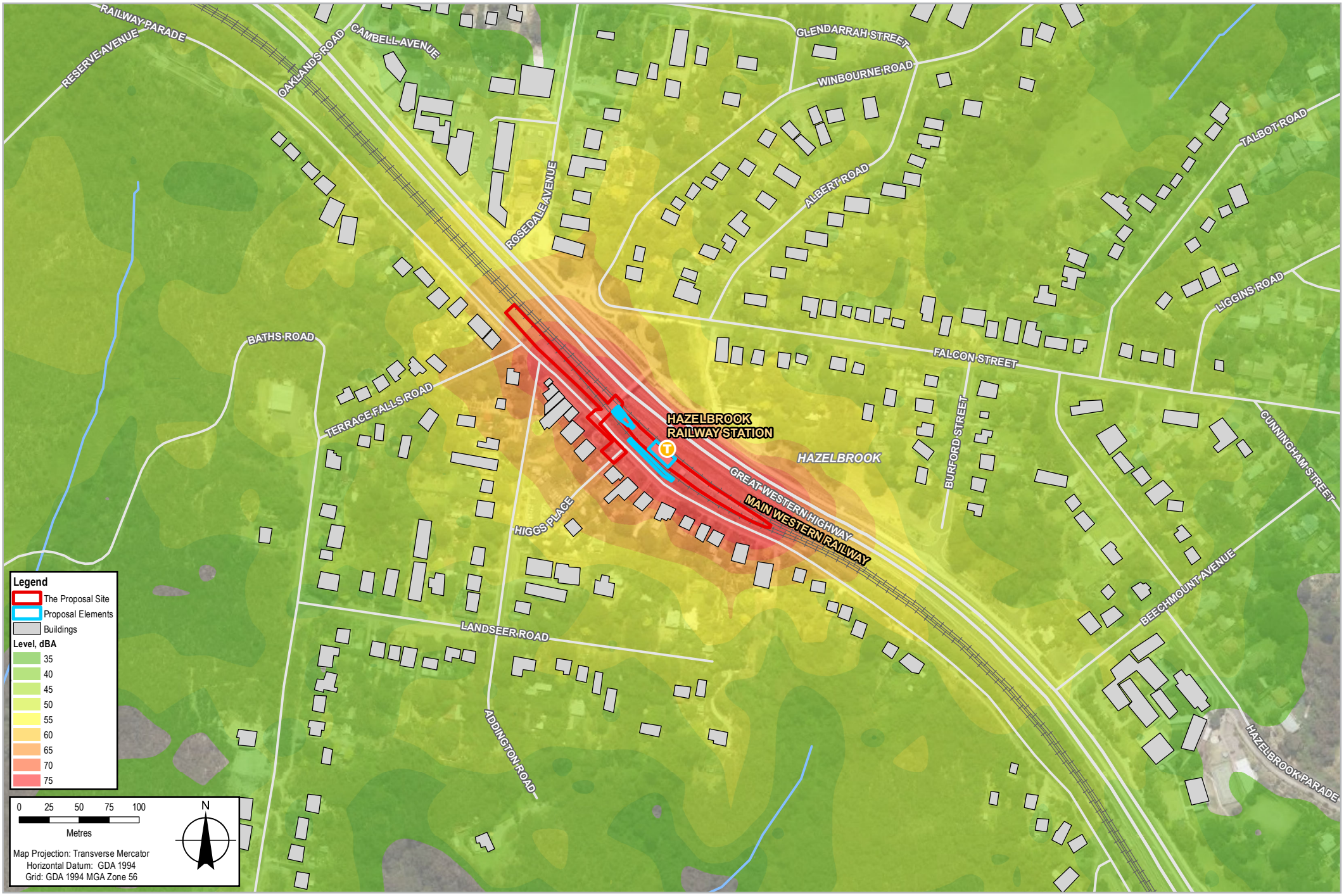


N:\AU\Sydney\Projects\21\27503\GIS\Maps\Deliverables\21_27503_Z003_Noise_SMA.mxd. Created By: mking3

Potential sleep disturbance impacts **Figure D**



Scenario 1 Predicted construction noise levels, dBA **Figure D-1**



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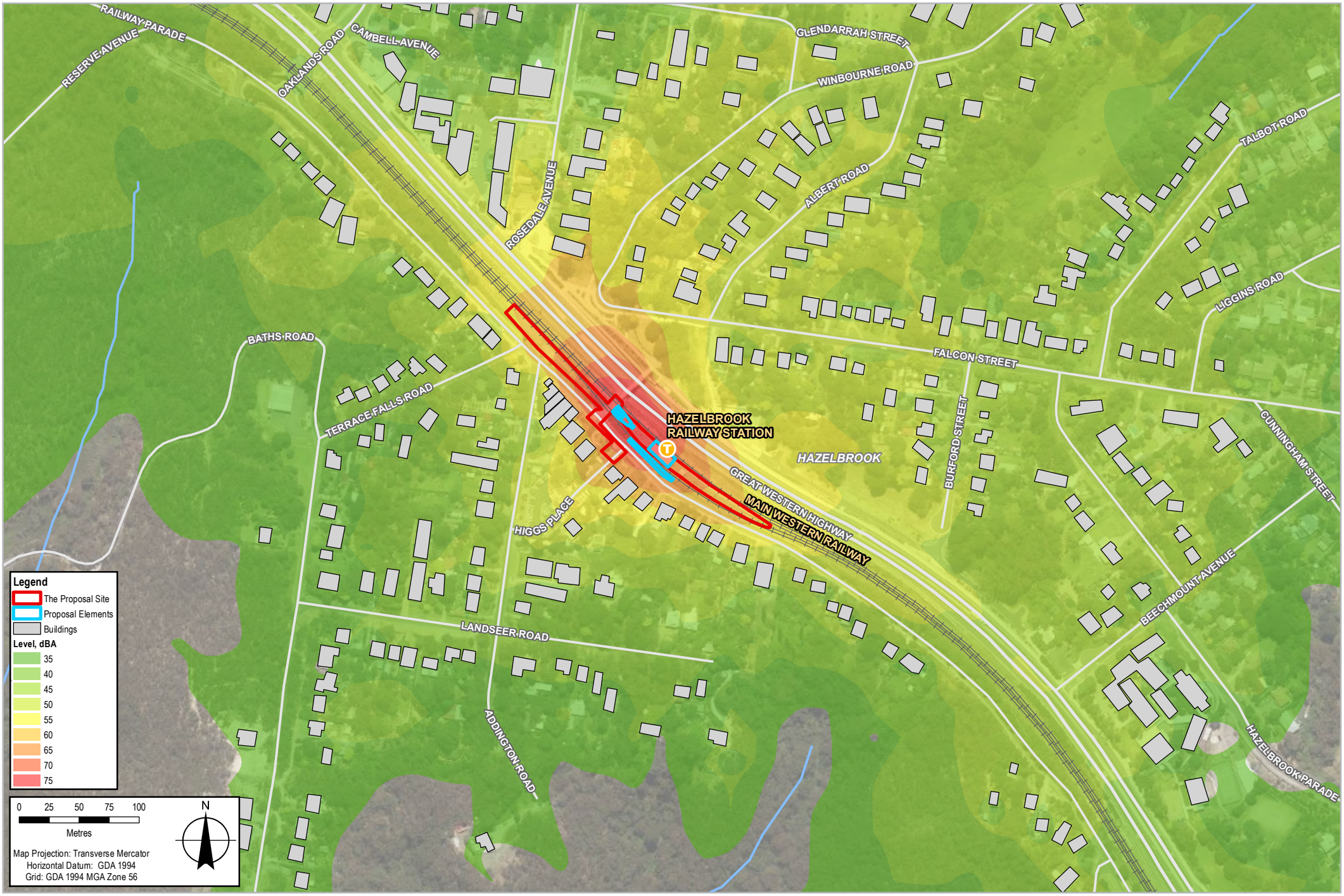
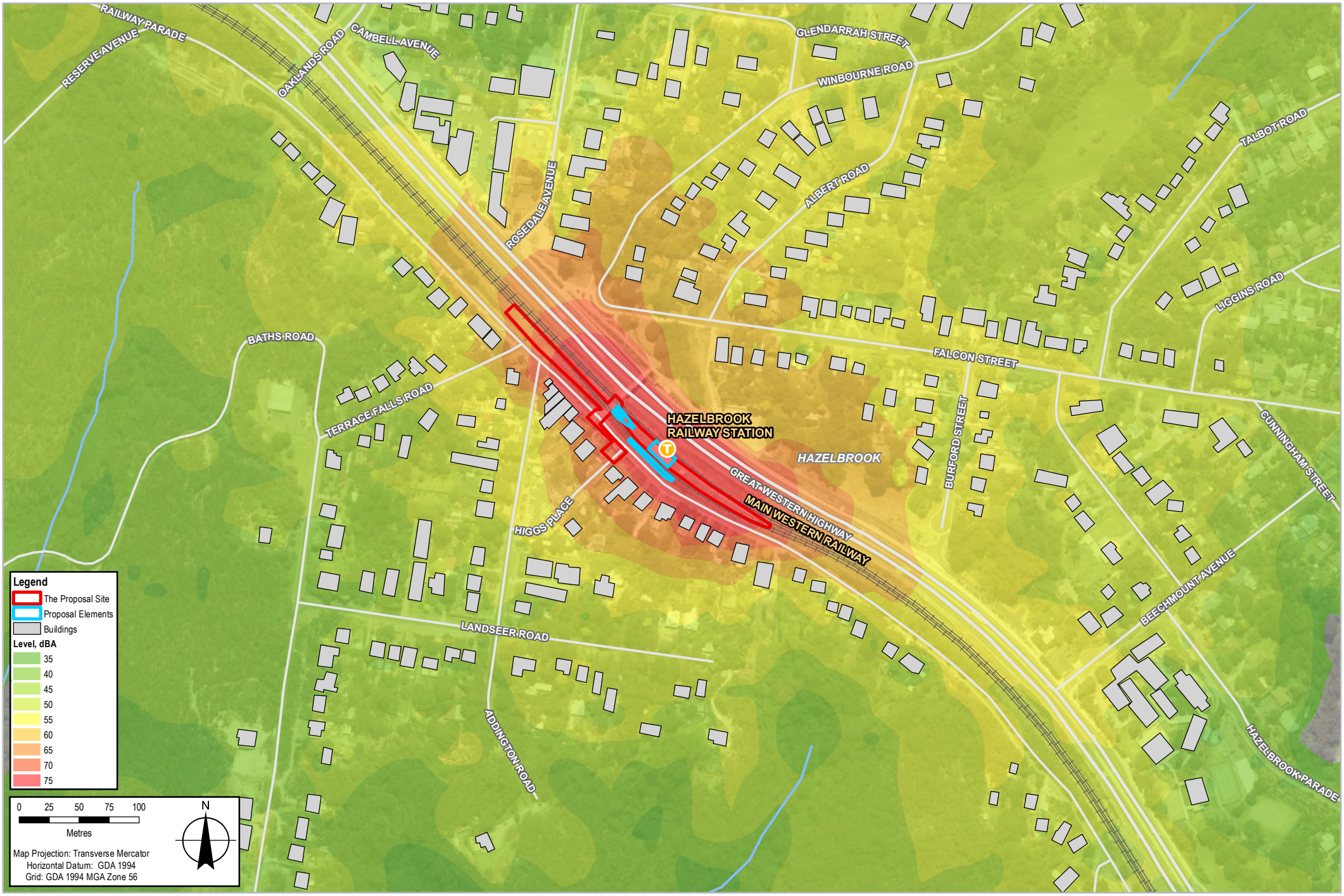
Scenario 2 Predicted construction noise levels, dBA **Figure D-2**



Scenario 3 Predicted construction noise levels, dBA **Figure D-3**

Scenario 4 Predicted construction noise levels, dBA **Figure D-4**



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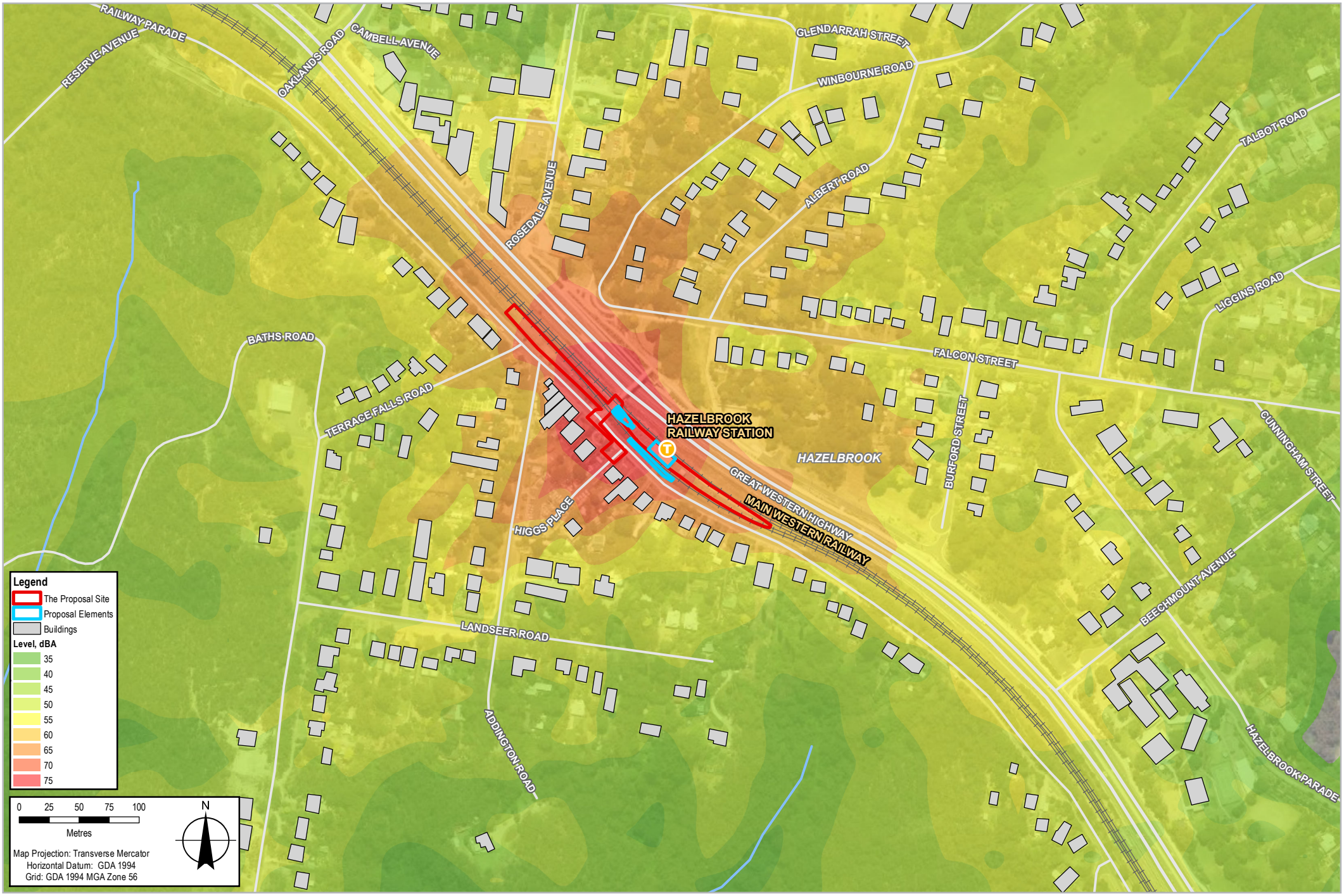
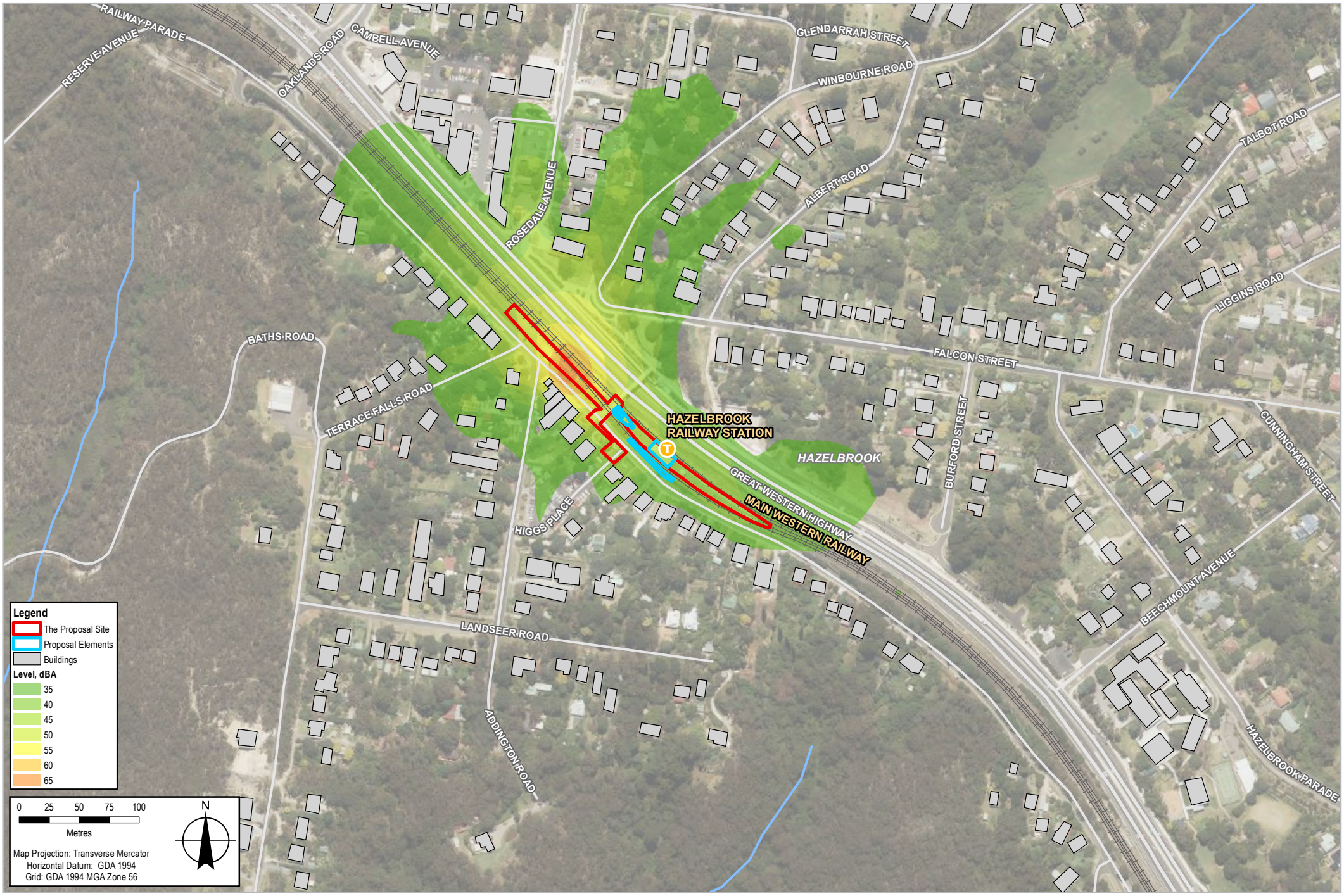
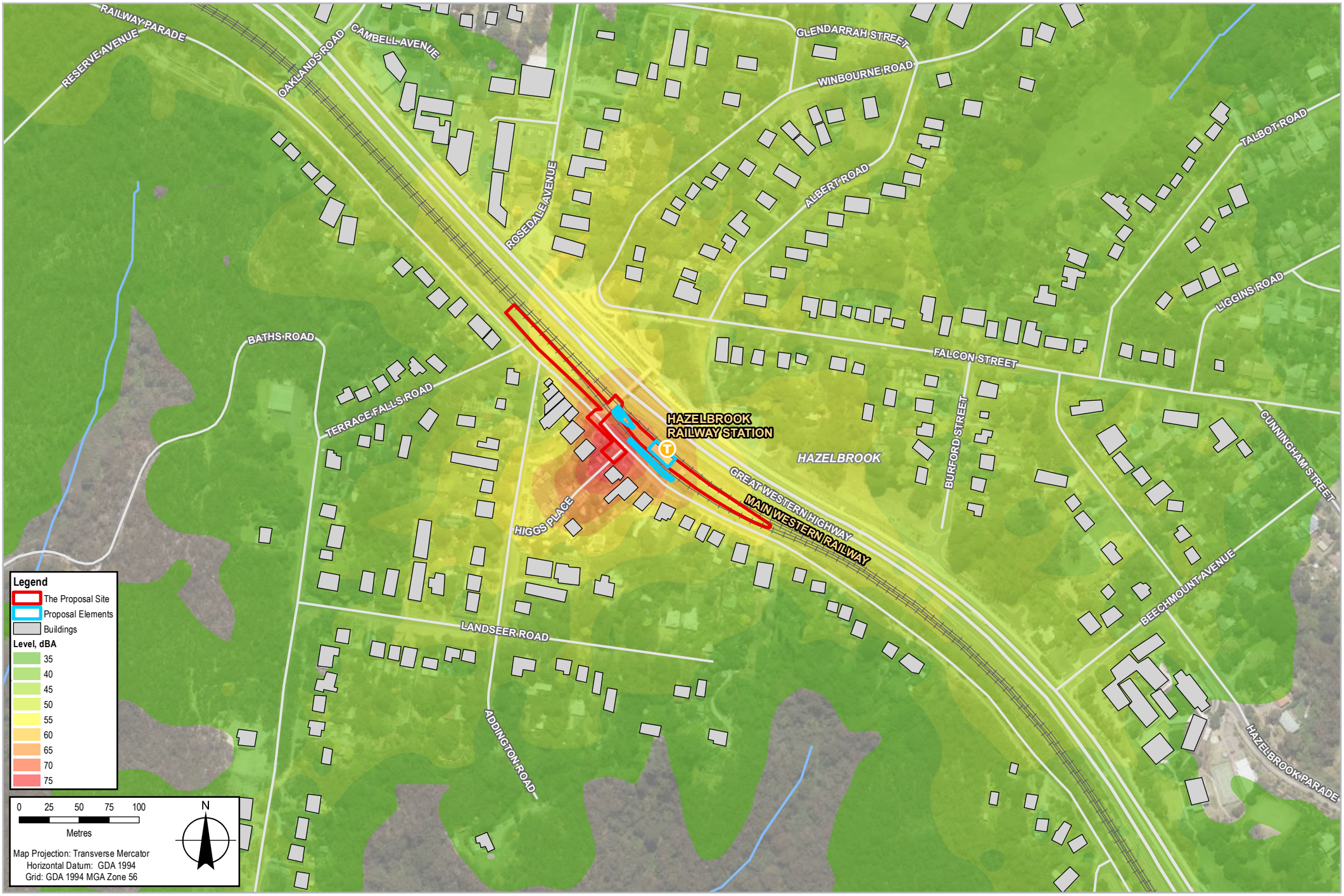
Scenario 5 Predicted construction noise levels, dBA **Figure D-5**



Scenario 6 Predicted construction noise levels, dBA **Figure D-6**



Scenario 7 Predicted construction noise levels, dBA **Figure D-7**



Scenario 8 Predicted construction noise levels, dBA **Figure D-8**

Appendix E – Sleep disturbance results

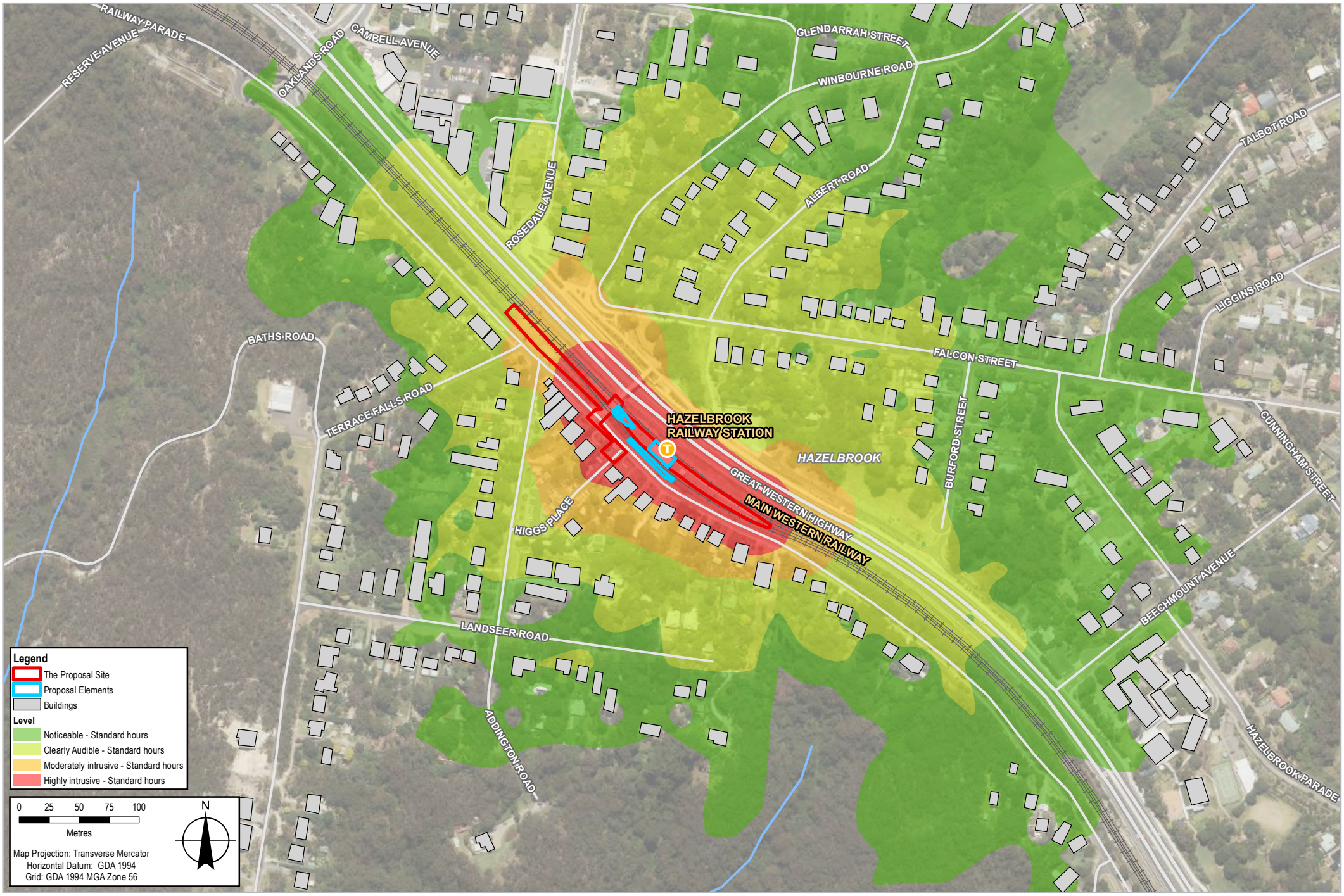
Receiver ID	Criteria	Predicted noise level (external)	Predicted noise level (internal)
R009	50 dBA internal	80	70
R010	50 dBA internal	77	67
R011	50 dBA internal	75	65
R012	50 dBA internal	78	68
R013	50 dBA internal	81	71
R014	50 dBA internal	82	72
R015	50 dBA internal	81	71
R016	50 dBA internal	74	64
R017	50 dBA internal	66	56
R018	50 dBA internal	65	55
R019	50 dBA internal	61	51
R039	50 dBA internal	72	62
R040	50 dBA internal	62	52
R041	50 dBA internal	62	52
R044	50 dBA internal	61	51
R045	50 dBA internal	69	59
R046	50 dBA internal	65	55
R047	50 dBA internal	64	54
R048	50 dBA internal	71	61
R049	50 dBA internal	71	61
R050	50 dBA internal	67	57
R051	50 dBA internal	68	58
R052	50 dBA internal	65	55
R053	50 dBA internal	63	53
R054	50 dBA internal	62	52
R055	50 dBA internal	63	53
R057	50 dBA internal	60	50

Receiver ID	Criteria	Predicted noise level (external)	Predicted noise level (internal)
R068	50 dBA internal	60	50
R069	50 dBA internal	71	61
R071	50 dBA internal	62	52
R072	50 dBA internal	61	51
R077	50 dBA internal	67	57
R078	50 dBA internal	60	50
R079	50 dBA internal	64	54
R081	50 dBA internal	61	51
R083	50 dBA internal	63	53
R126	50 dBA internal	65	55
R127	50 dBA internal	64	54
R128	50 dBA internal	64	54
R129	50 dBA internal	63	53
R130	50 dBA internal	63	53
R131	50 dBA internal	63	53
R132	50 dBA internal	62	52
R133	50 dBA internal	64	54
R134	50 dBA internal	63	53
R135	50 dBA internal	62	52
R136	50 dBA internal	62	52
R137	50 dBA internal	64	54
R138	50 dBA internal	63	53
R139	50 dBA internal	61	51
R140	50 dBA internal	66	56
R141	50 dBA internal	64	54
R142	50 dBA internal	65	55
R143	50 dBA internal	63	53
R144	50 dBA internal	62	52
R145	50 dBA internal	62	52

Receiver ID	Criteria	Predicted noise level (external)	Predicted noise level (internal)
R146	50 dBA internal	63	53
R147	50 dBA internal	62	52
R148	50 dBA internal	62	52
R149	50 dBA internal	62	52
R150	50 dBA internal	60	50
R151	50 dBA internal	61	51
R152	50 dBA internal	60	50
R156	50 dBA internal	71	61
R157	50 dBA internal	64	54
R158	50 dBA internal	68	58
R159	50 dBA internal	66	56
R160	50 dBA internal	66	56
R161	50 dBA internal	67	57
R162	50 dBA internal	62	52
R163	50 dBA internal	64	54
R164	50 dBA internal	60	50
R165	50 dBA internal	63	53
R166	50 dBA internal	63	53
R167	50 dBA internal	60	50
R169	50 dBA internal	60	50
R171	50 dBA internal	61	51
R172	50 dBA internal	64	54
R173	50 dBA internal	63	53
R174	50 dBA internal	64	54
R175	50 dBA internal	64	54
R176	50 dBA internal	62	52
R177	50 dBA internal	65	55
R178	50 dBA internal	64	54
R179	50 dBA internal	61	51

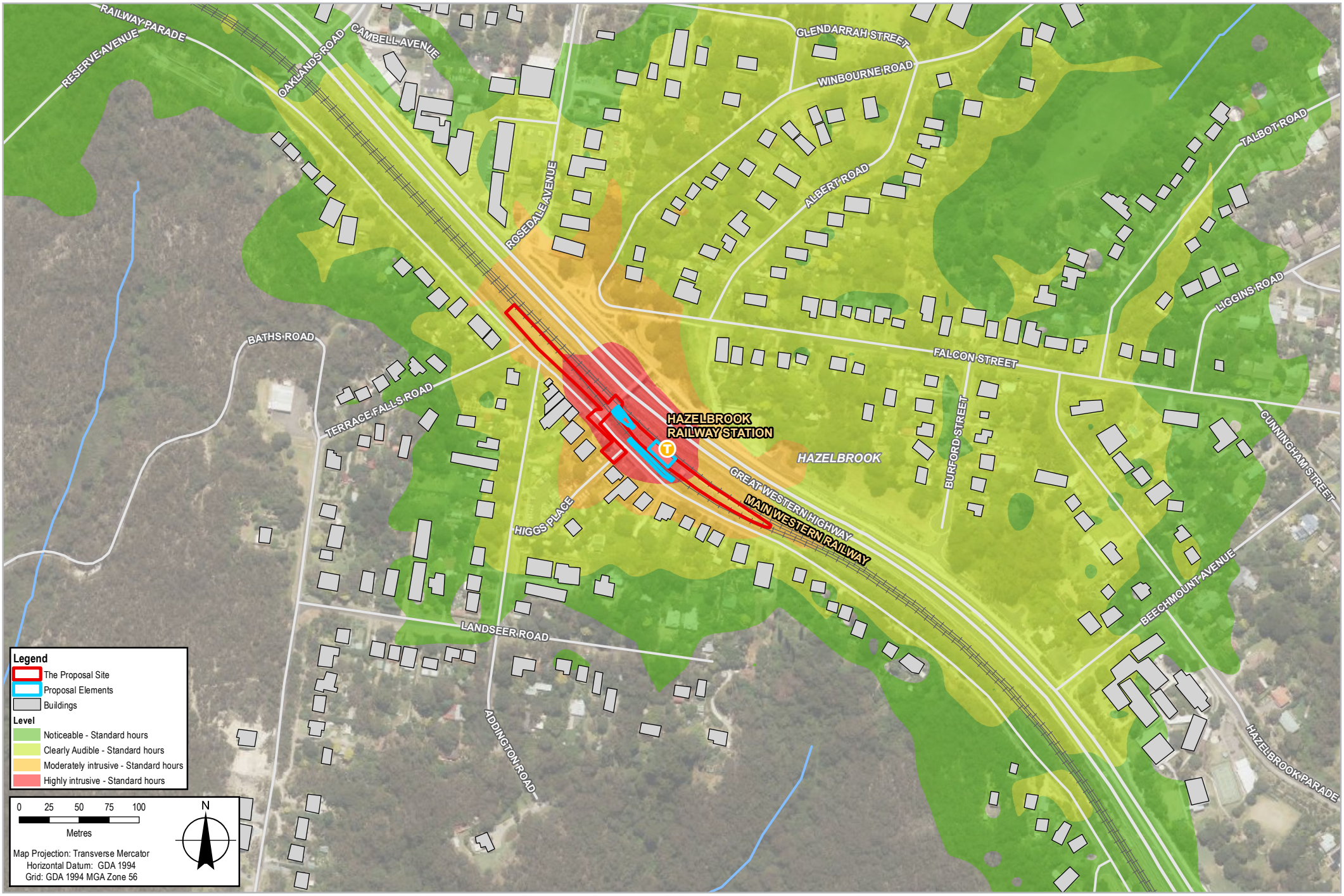
Receiver ID	Criteria	Predicted noise level (external)	Predicted noise level (internal)
R180	50 dBA internal	60	50
R182	50 dBA internal	61	51
R184	50 dBA internal	61	51
R185	50 dBA internal	60	50
R214	50 dBA internal	60	50
R215	50 dBA internal	60	50
R217	50 dBA internal	60	50
R239	50 dBA internal	60	50
R240	50 dBA internal	66	56
R242	50 dBA internal	68	58
R253	50 dBA internal	67	57
R254	50 dBA internal	66	56
R257	50 dBA internal	61	51
R258	50 dBA internal	63	53
R260	50 dBA internal	62	52
R262	50 dBA internal	63	53
R263	50 dBA internal	64	54
R264	50 dBA internal	60	50
R265	50 dBA internal	62	52
R279	50 dBA internal	60	50

Appendix F – Construction noise management zones, standard construction hours

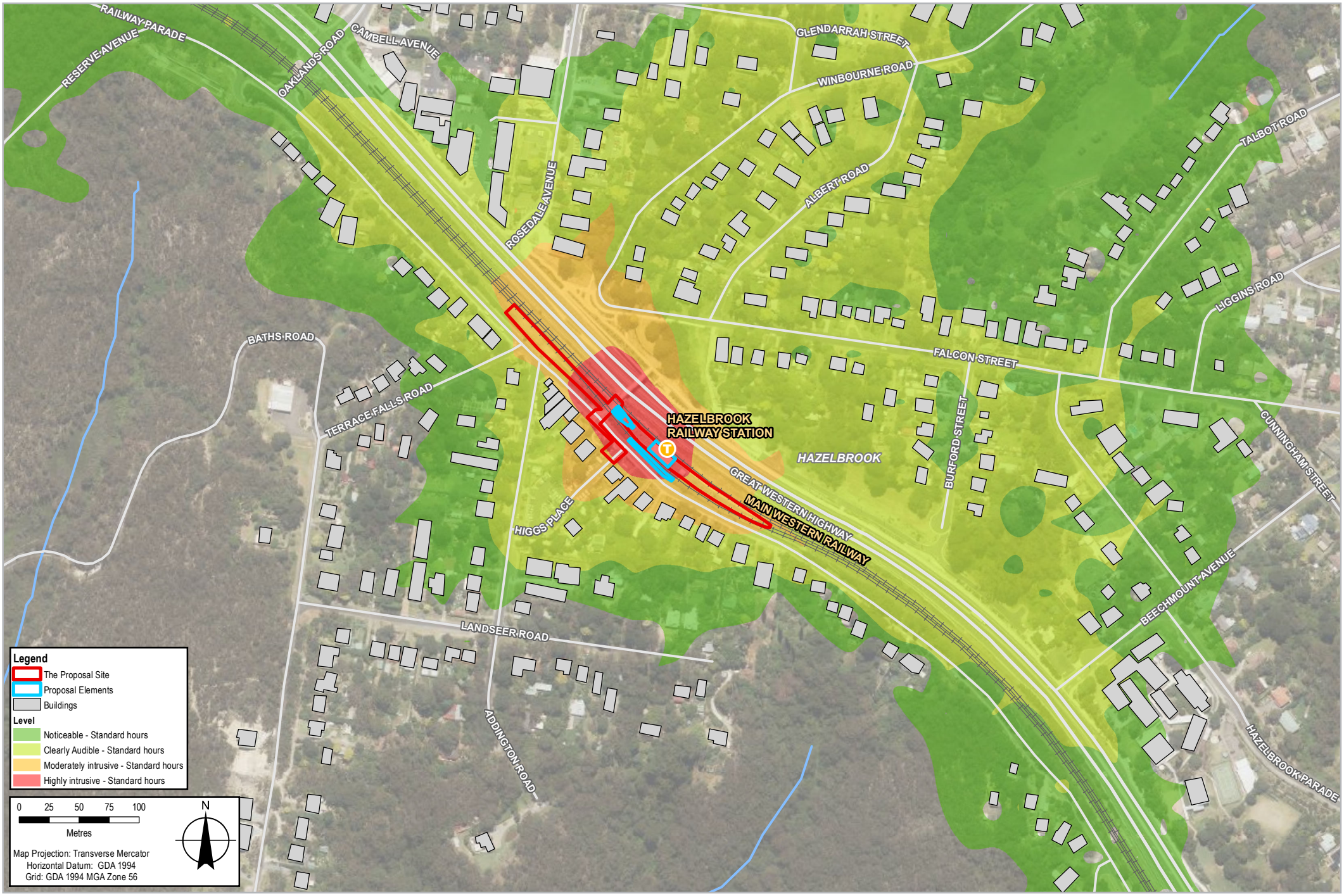


Scenario 1 Construction noise management zones, standard construction hours **Figure F-1**

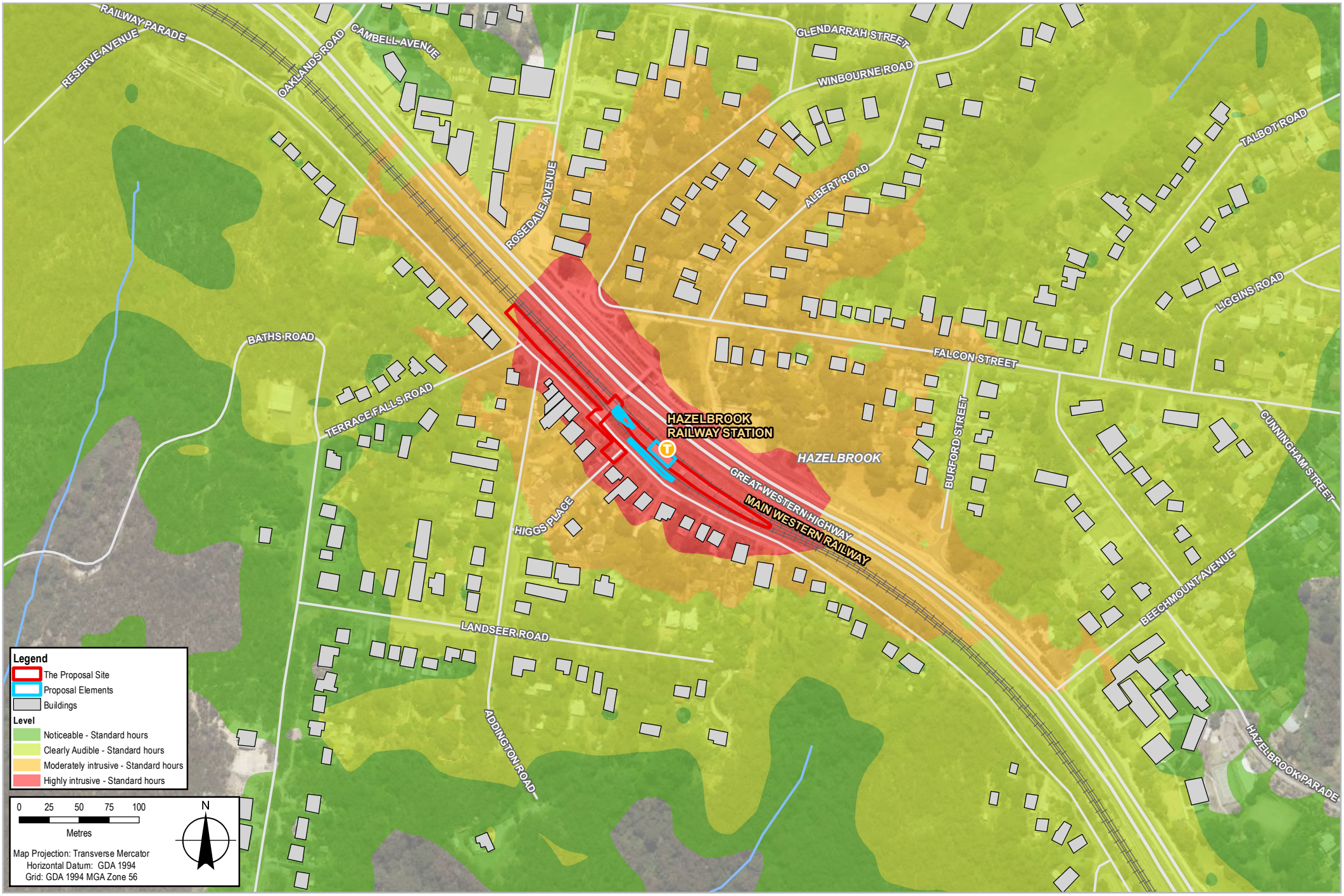
Scenario 2 Construction noise management zones, standard construction hours **Figure F-2**



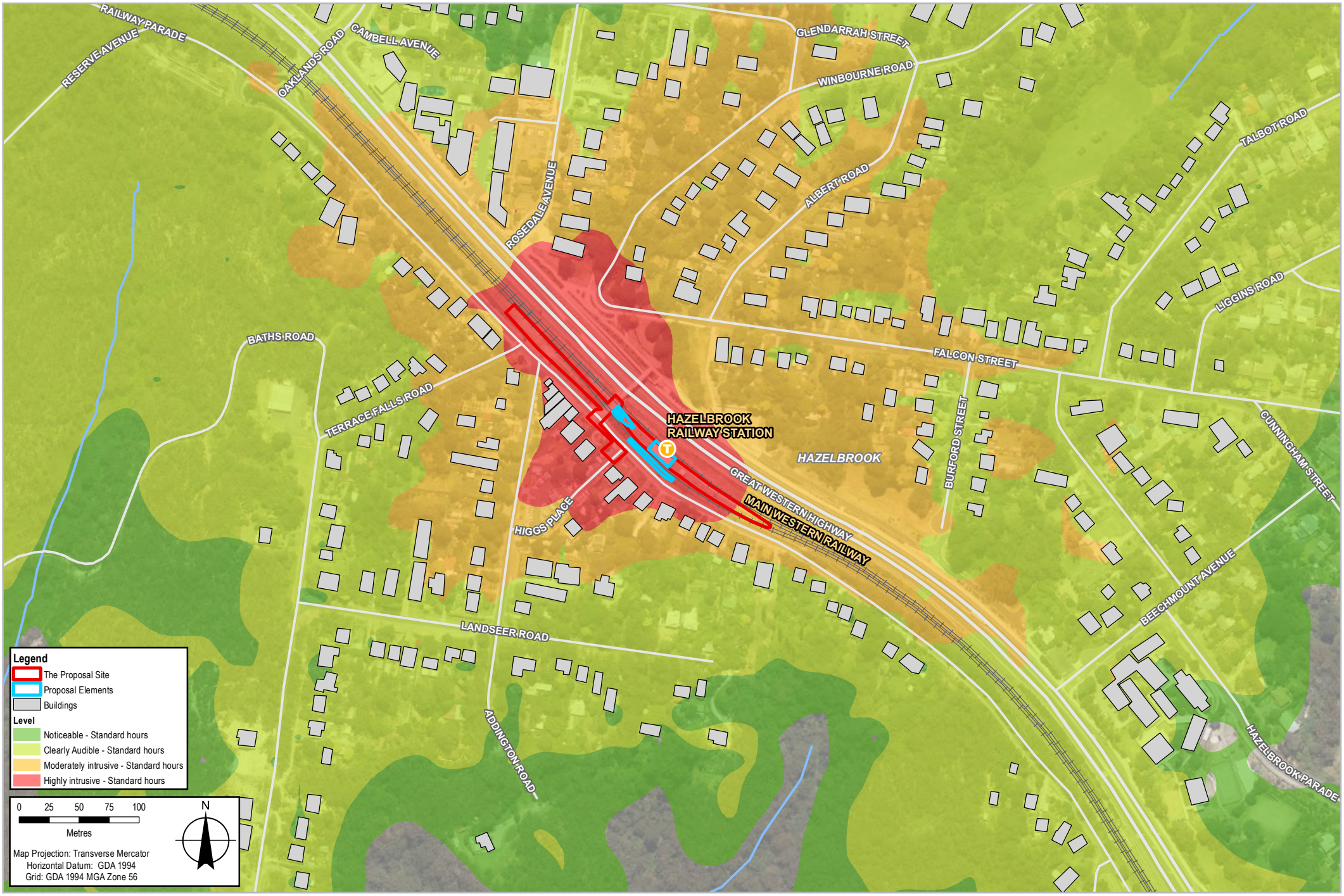
Scenario 3 Construction noise management zones, standard construction hours **Figure F-3**



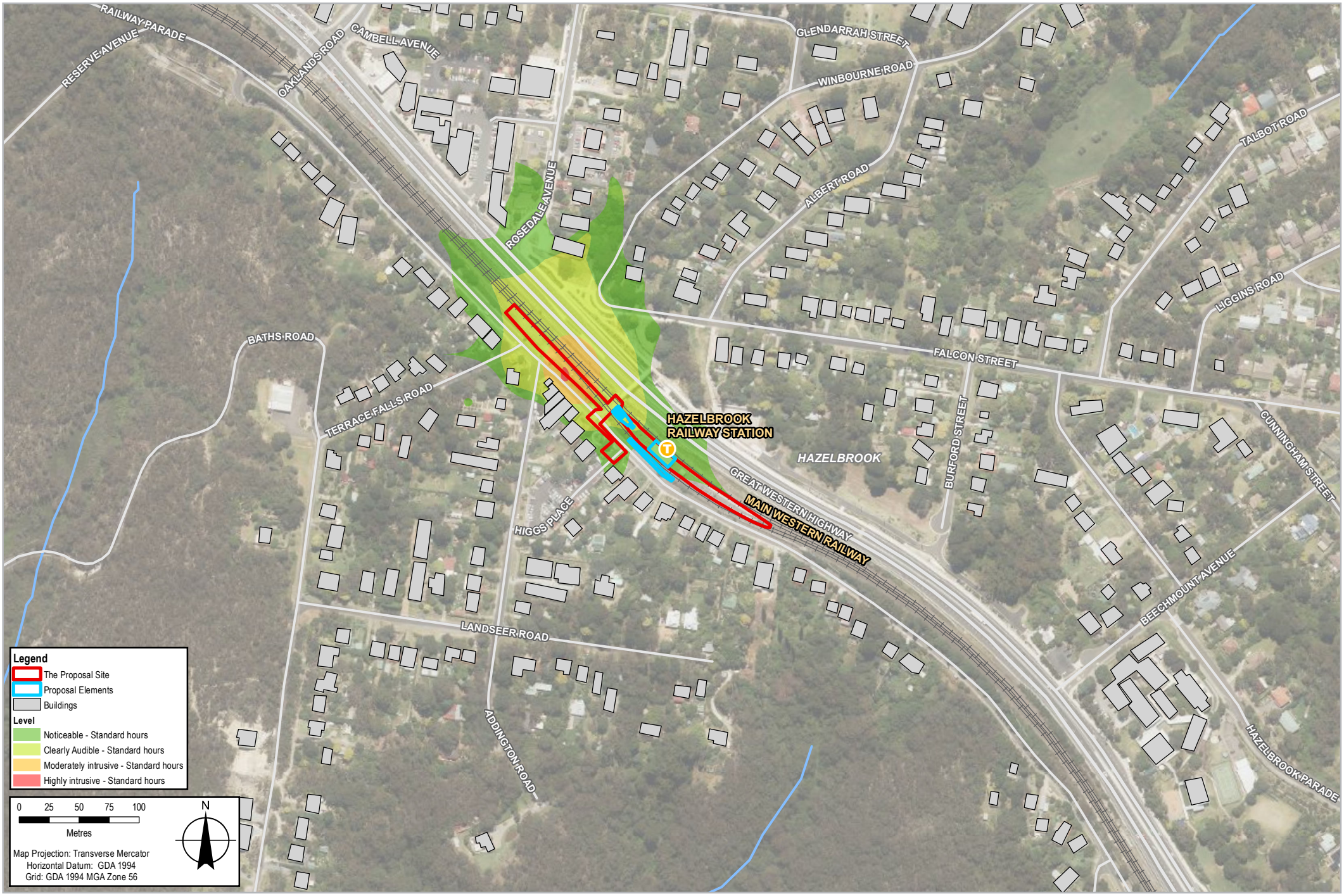
Scenario 4 Construction noise management zones, standard construction hours **Figure F-4**



Scenario 5 Construction noise management zones, standard construction hours **Figure F-5**



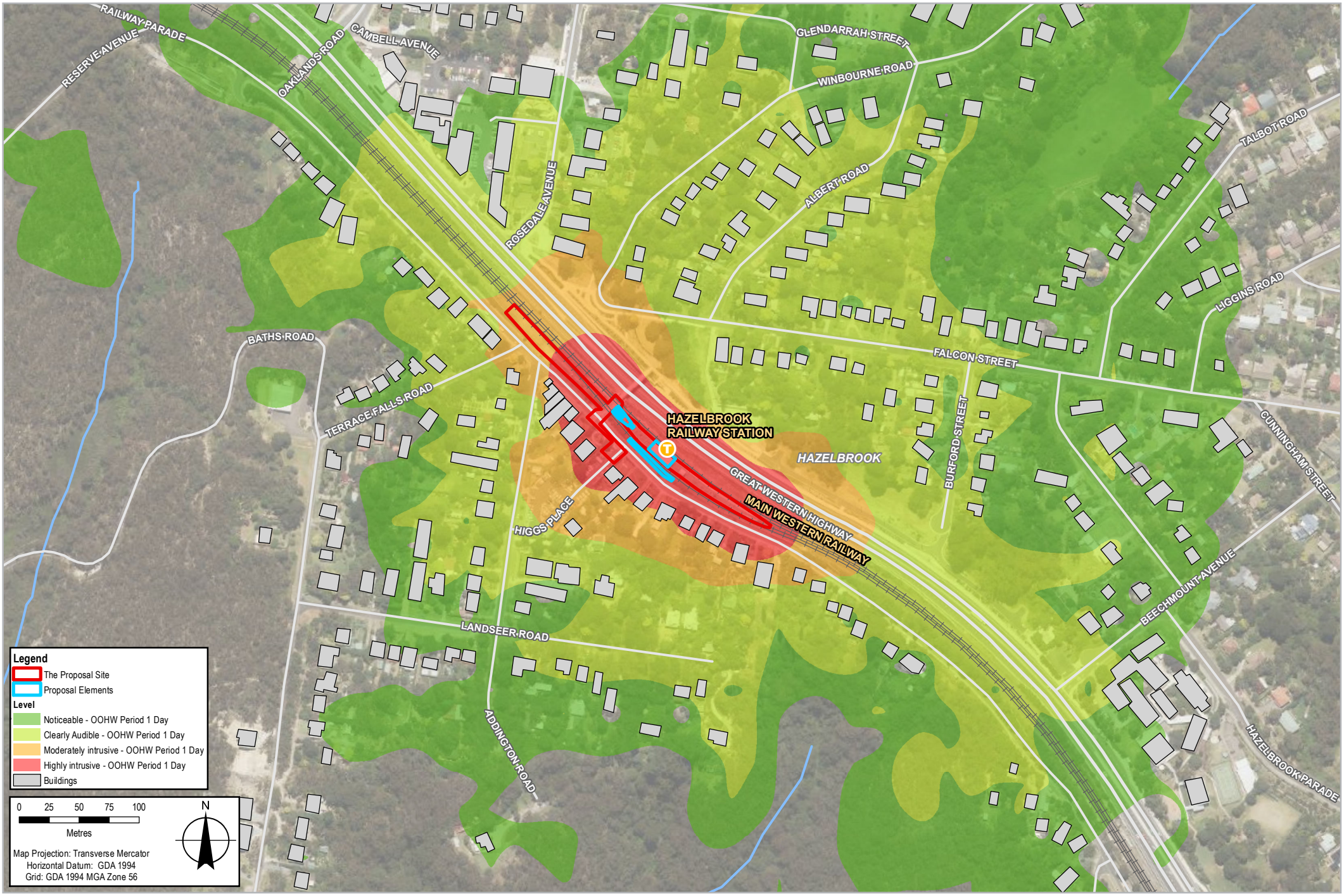
Scenario 6 Construction noise management zones, standard construction hours **Figure F-6**



Scenario 7 Construction noise management zones, standard construction hours **Figure F-7**

Scenario 8 Construction noise management zones, standard construction hours **Figure F-8**

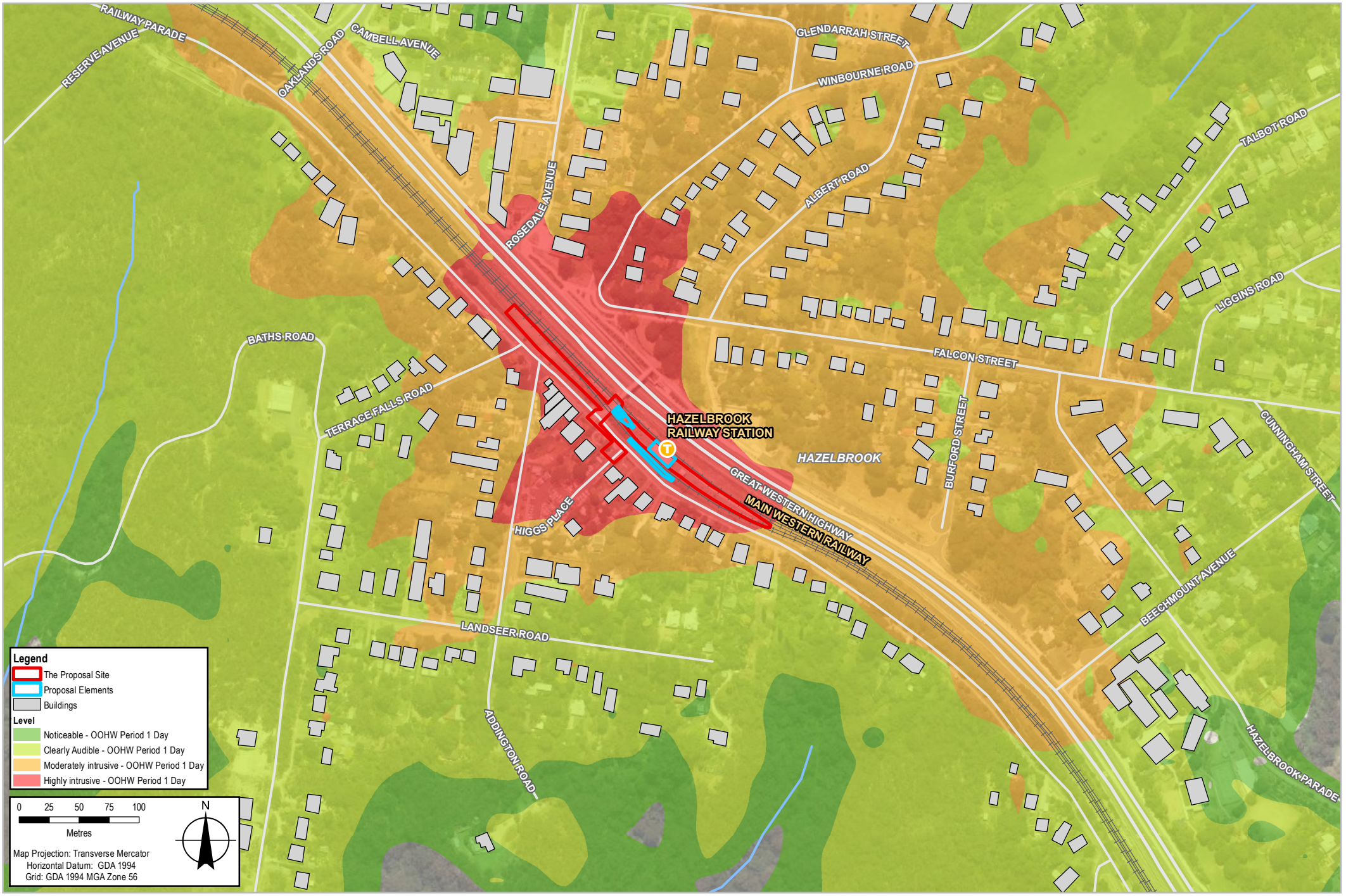
Appendix G – Construction noise management zones, OOHW Period 1 (Day)



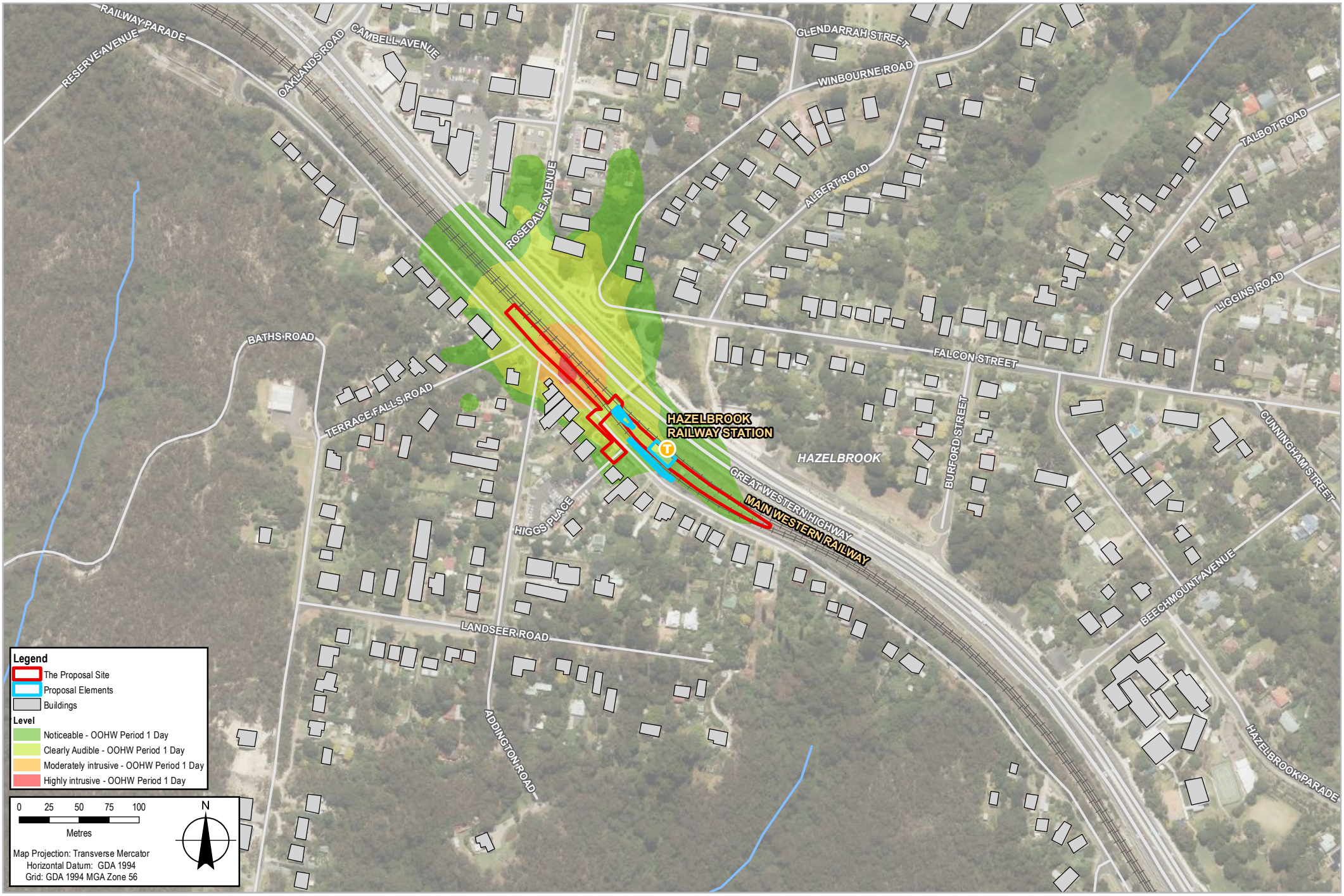
Scenario 1 Construction noise management zones, OOHW Period 1 (Day) **Figure G-1**

Scenario 4 Construction noise management zones, OOHW Period 1 (Day) **Figure G-2**

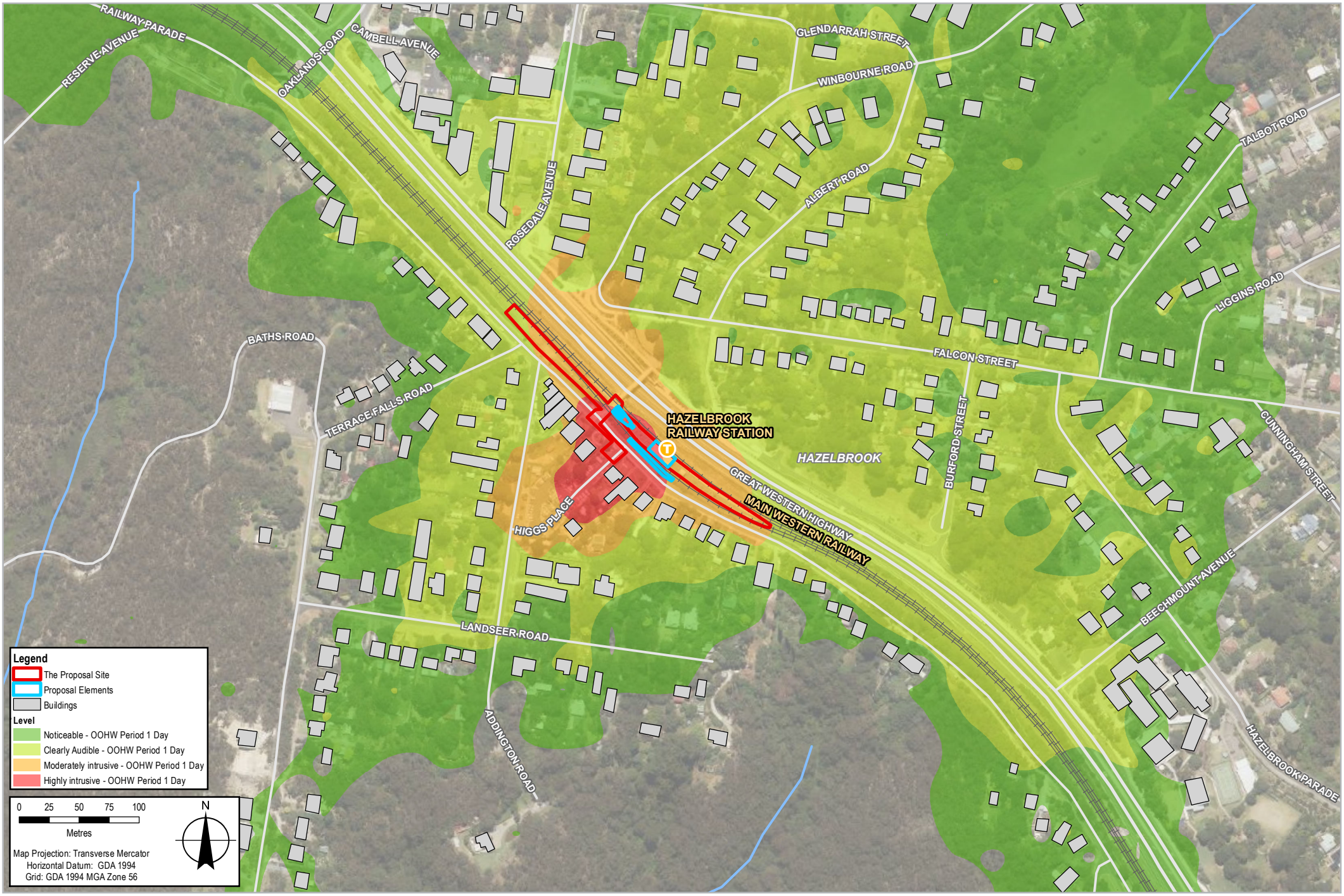
Scenario 5 Construction noise management zones, OOHW Period 1 (Day) **Figure G-3**



Scenario 6 Construction noise management zones, OOHW Period 1 (Day) **Figure G-4**



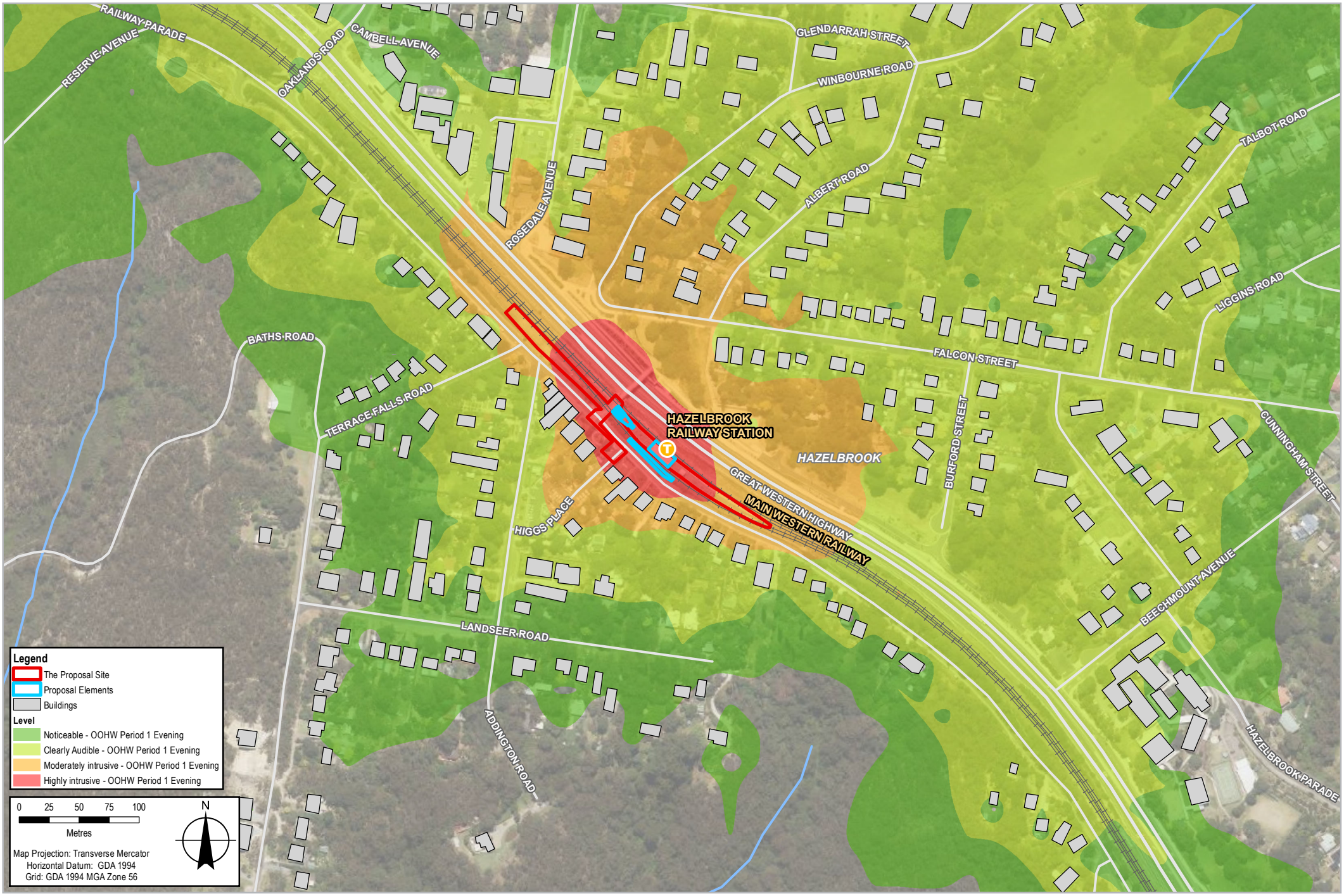
Scenario 7 Construction noise management zones, OOHW Period 1 (Day) **Figure G-5**



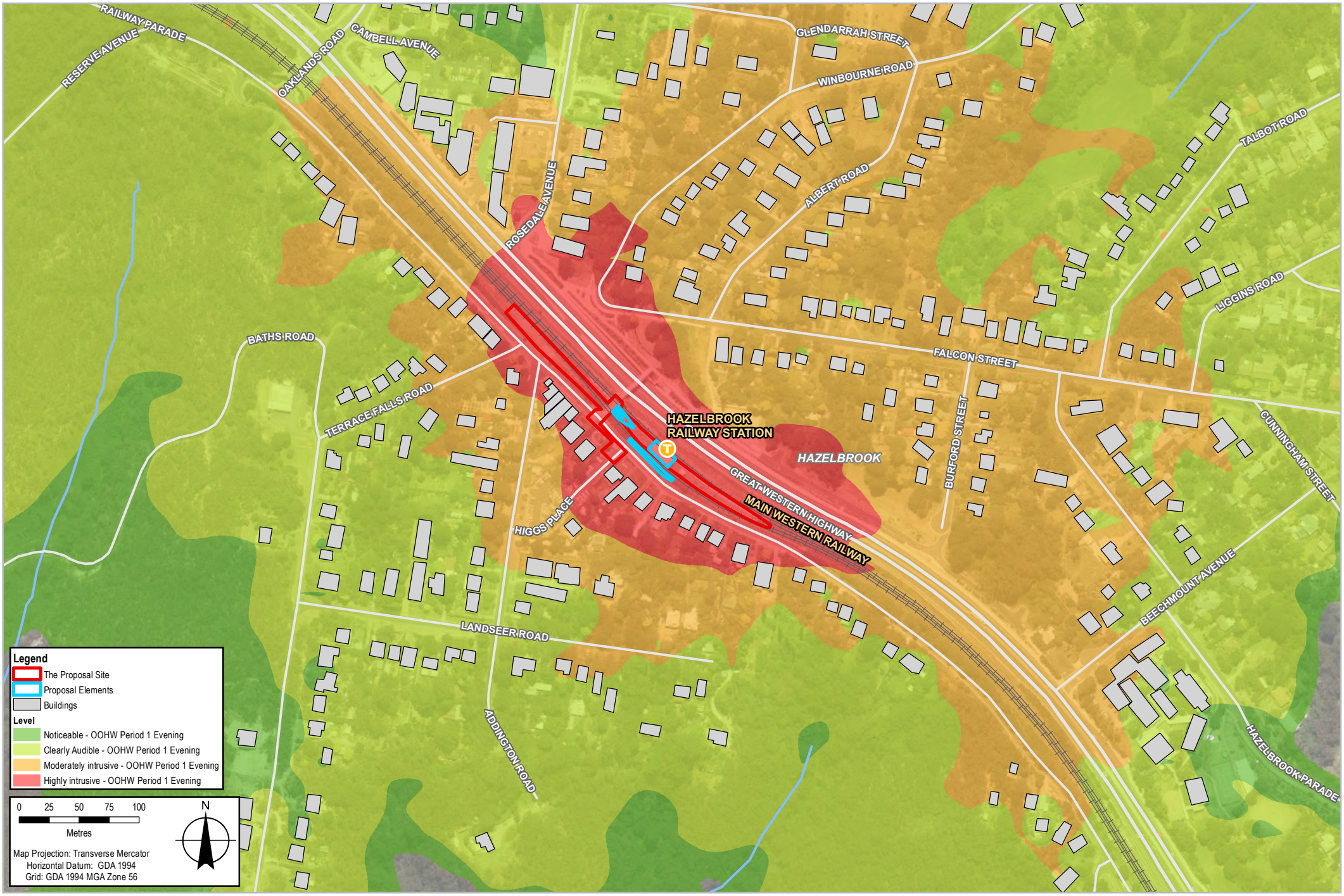
Scenario 8 Construction noise management zones, OOHW Period 1 (Day) **Figure G-6**

Appendix H – Construction noise management zones, OOHW Period 1 (Evening)

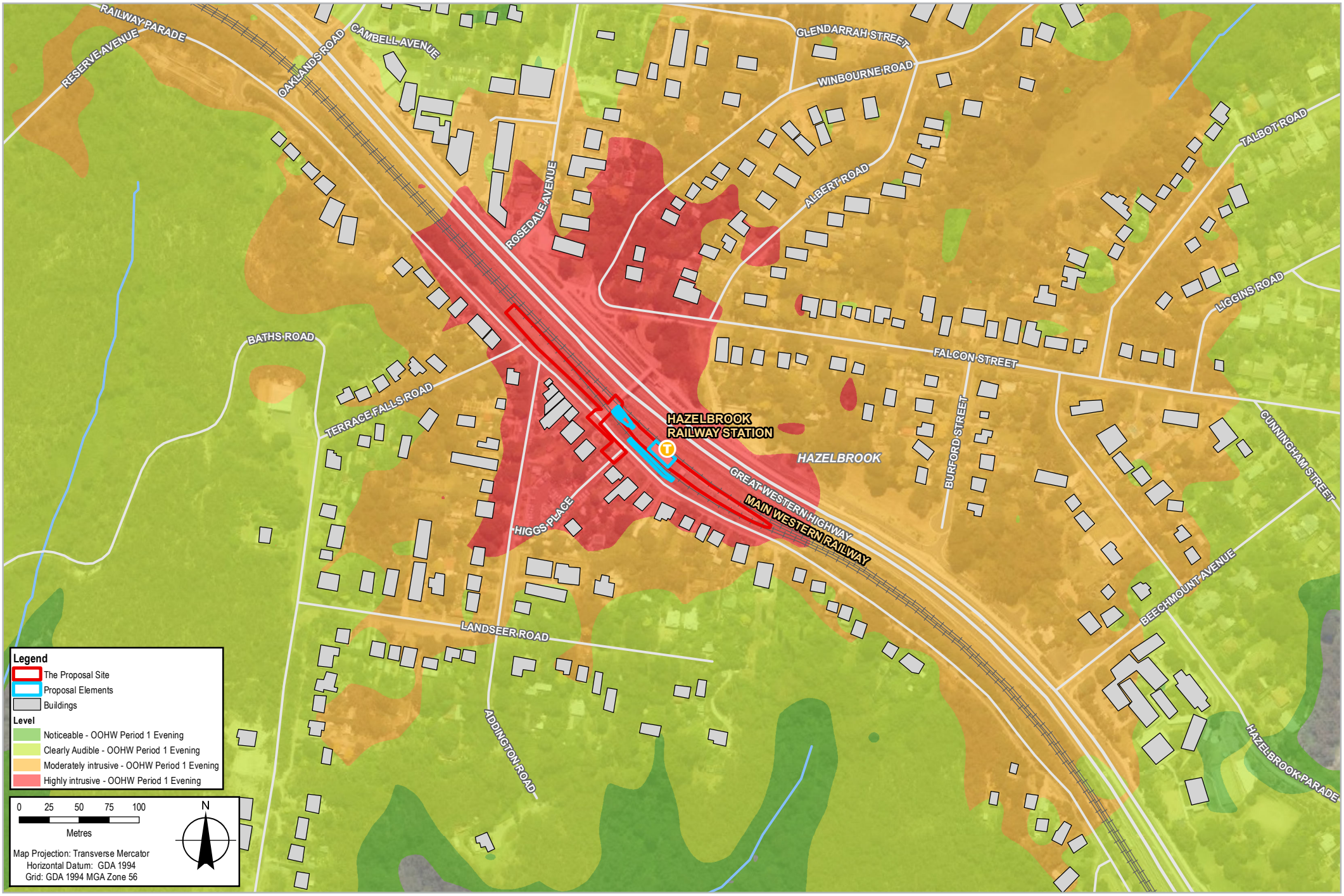
Scenario 1 Construction noise management zones, OOHW Period 1 (Evening) **Figure H-1**



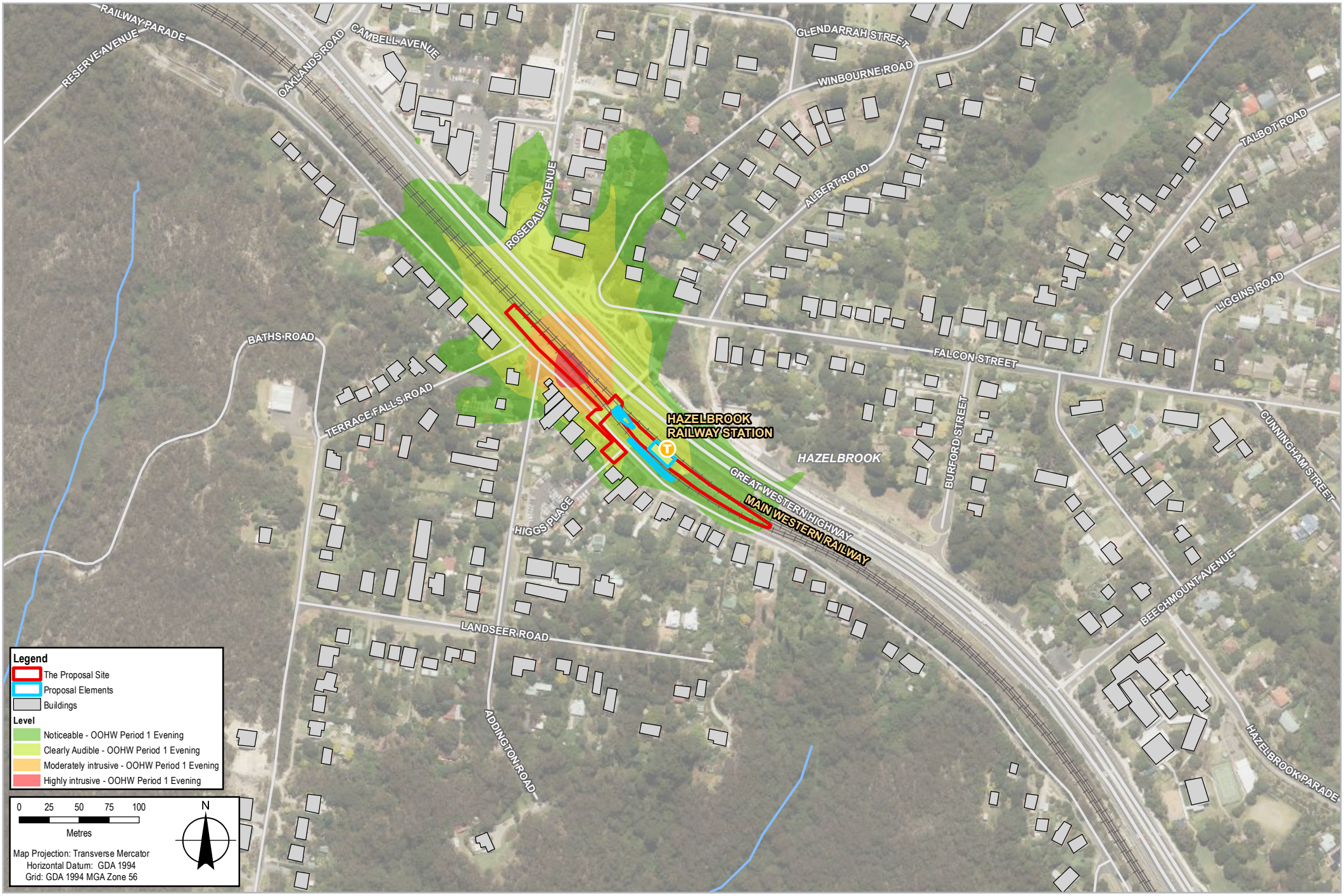
Scenario 4 Construction noise management zones, OOHW Period 1 (Evening) **Figure H-2**



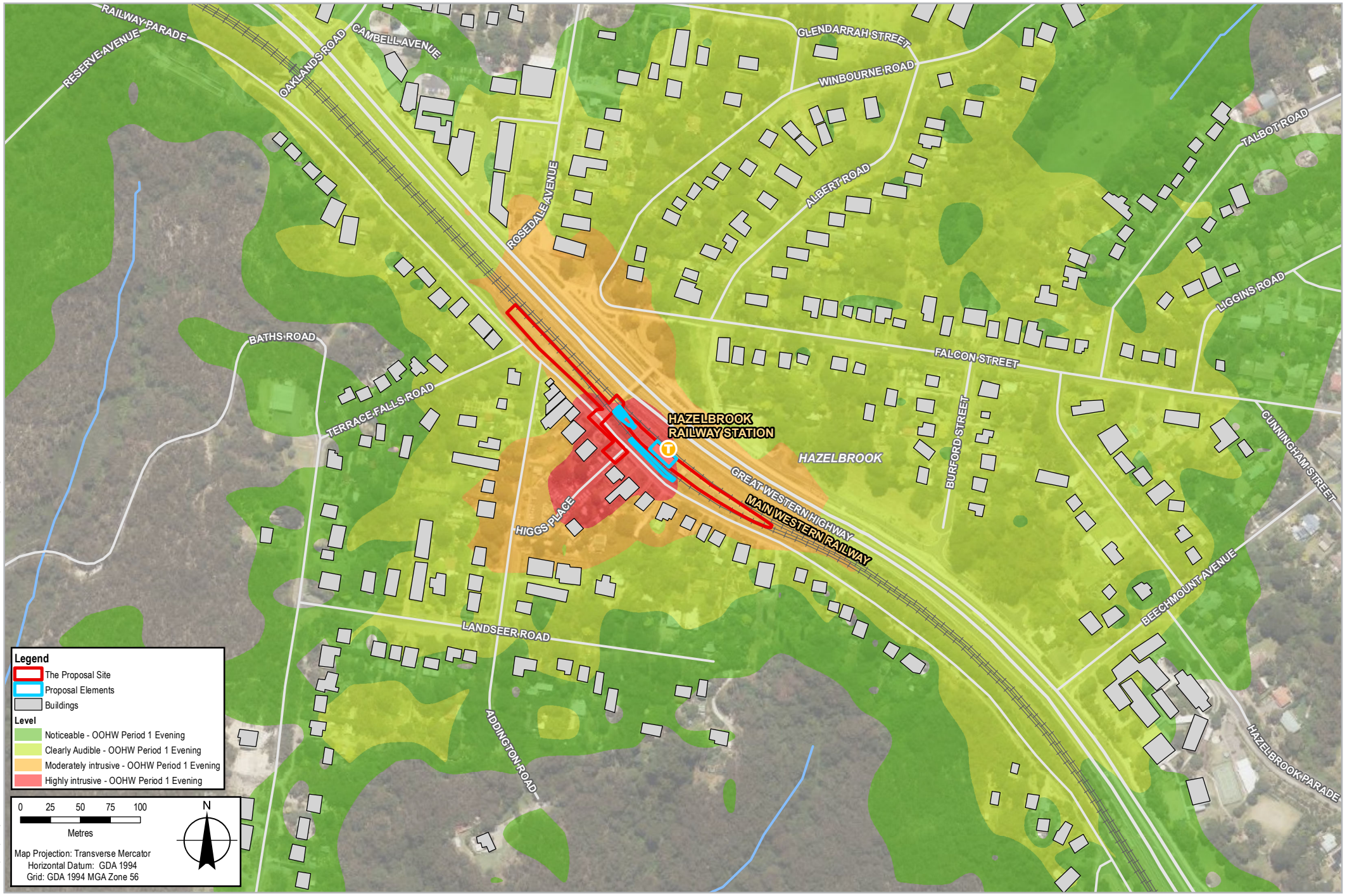
Scenario 5 Construction noise management zones, OOHW Period 1 (Evening) **Figure H-3**



Scenario 6 Construction noise management zones, OOHW Period 1 (Evening) **Figure H-4**



Scenario 7 Construction noise management zones, OOHW Period 1 (Evening) **Figure H-5**

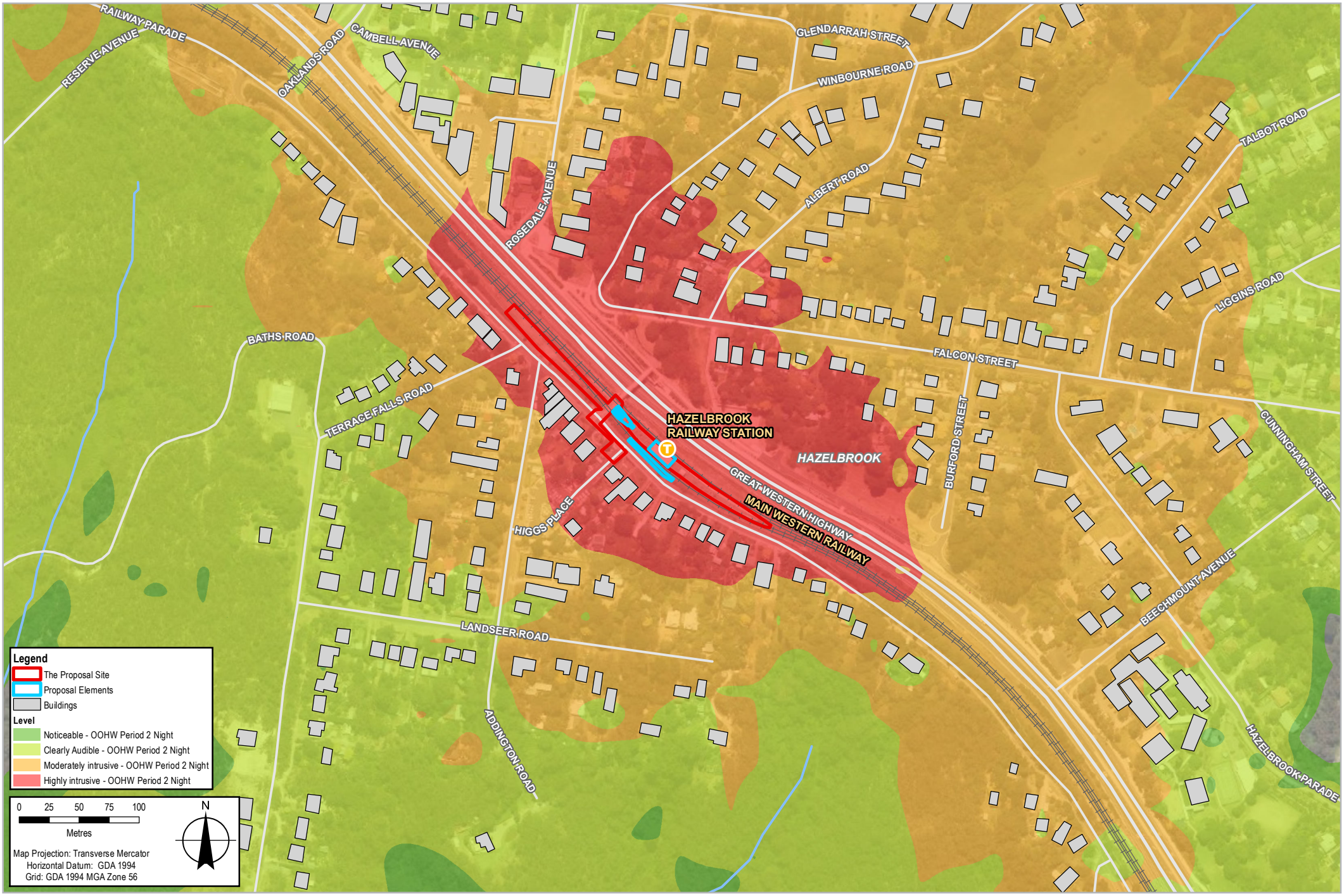


Scenario 8 Construction noise management zones, OOHW Period 1 (Evening) **Figure H-6**

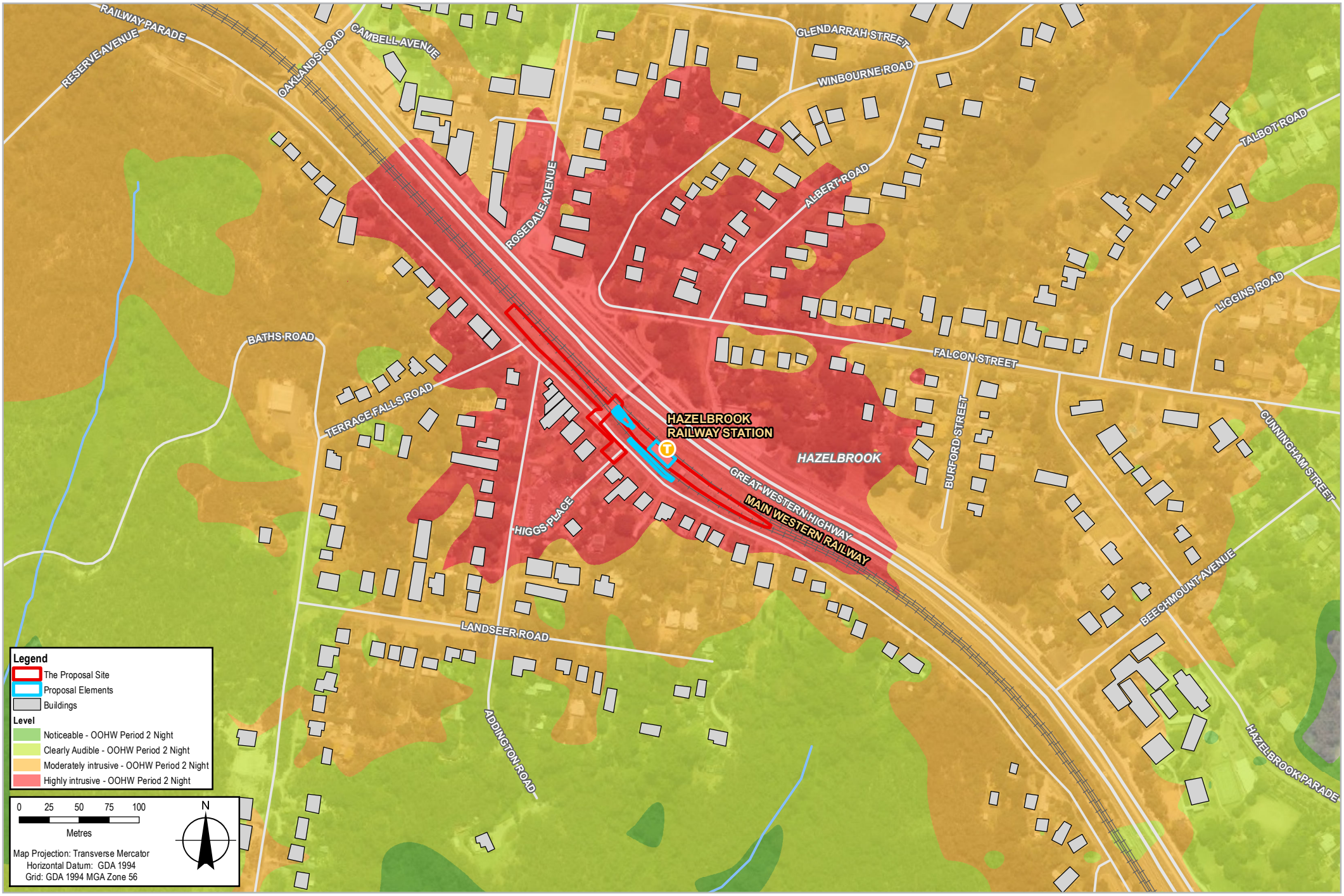
Appendix I – Construction noise management zones, OOHW Period 2 (Night)

Scenario 1 Construction noise management zones, OOHW Period 2 (Night) **Figure I-1**

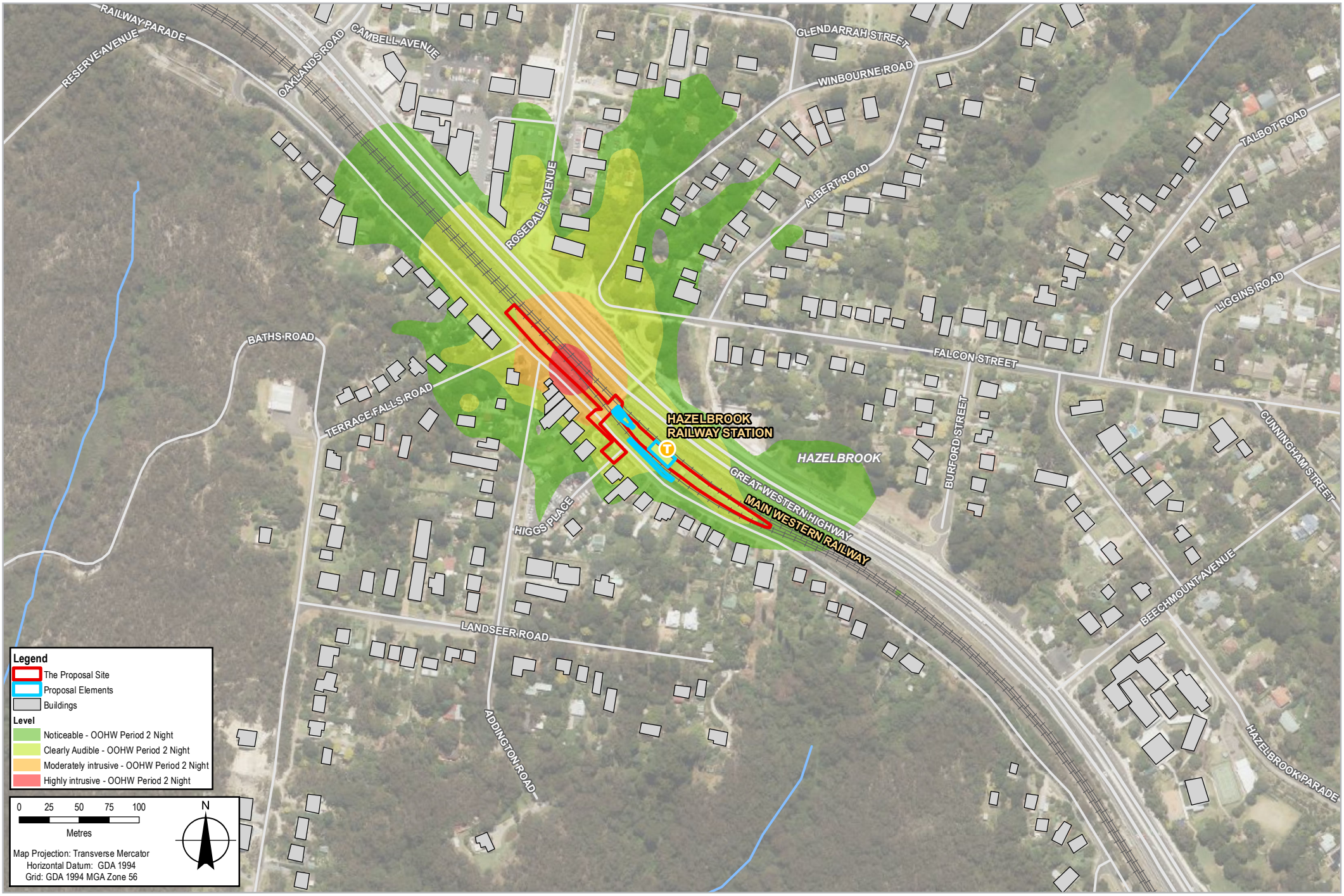
Scenario 4 Construction noise management zones, OOHW Period 2 (Night) **Figure I-2**



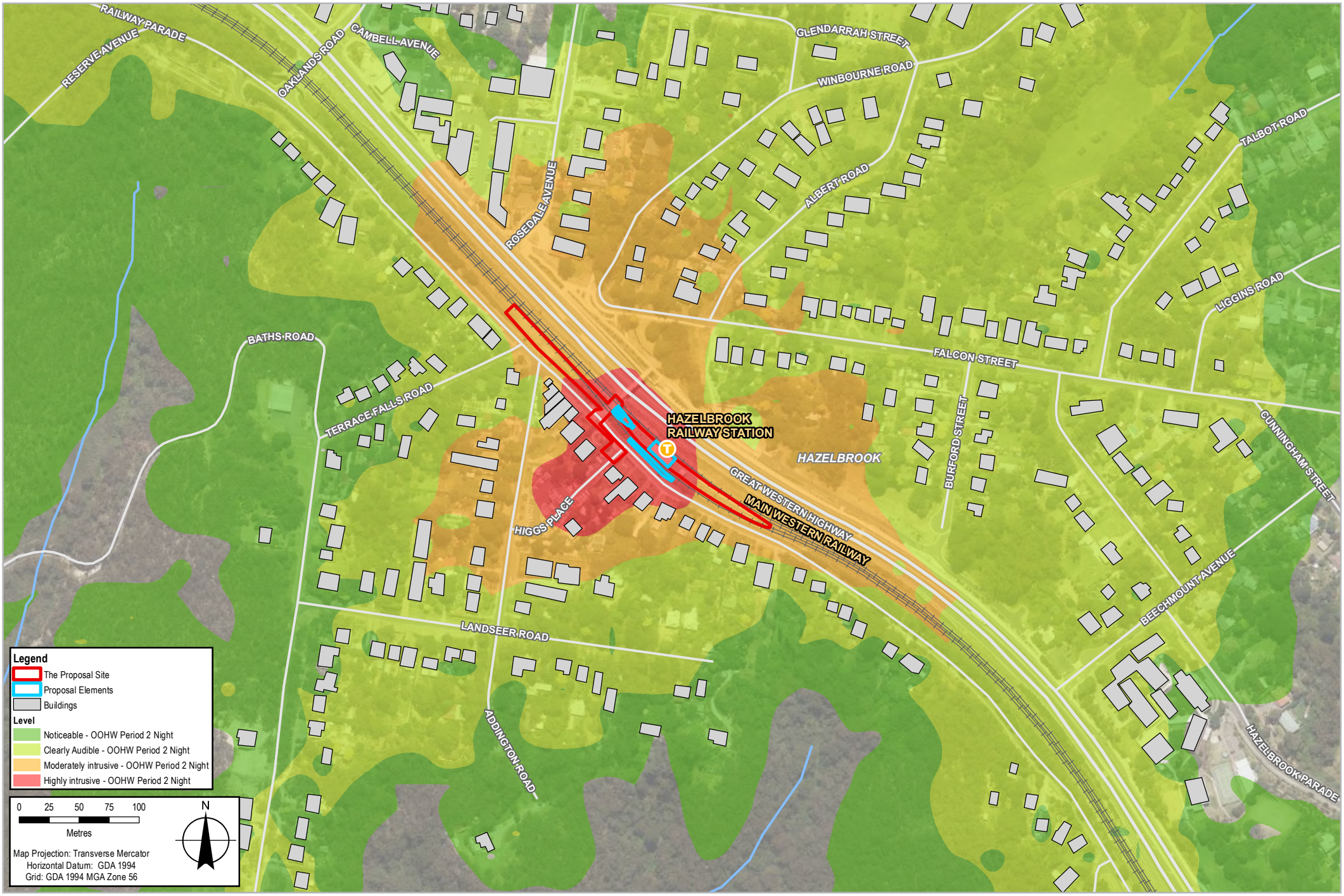
Scenario 5 Construction noise management zones, OOHW Period 2 (Night) **Figure I-3**



Scenario 6 Construction noise management zones, OOHW Period 2 (Night) **Figure I-4**



Scenario 7 Construction noise management zones, OOHW Period 2 (Night) **Figure I-5**



Scenario 8 Construction noise management zones, OOHW Period 2 (Night) **Figure I-6**

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