ACOUSTICS AND AIR

M1 PACIFIC MOTORWAY

NOISE ASSESSMENT

REPORT NO. 13042
VERSION F

PREPARED FOR

SMEC AUSTRALIA PTY LTD
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TABLE OF CONTENTS

GLOSSARY OF ACOUSTIC TERMS

Most environments are affected by environmental noise which continuously varies, sometimes as a result of road traffic. To describe the overall noise environment, a number of noise descriptors have been developed and these involve statistical and other analysis of the varying noise over sampling periods, typically taken as 15 minutes. These descriptors, which are demonstrated in the graph below, are here defined.

Maximum Noise Level (L_{Amax}) – The maximum noise level over a sample period is the maximum level, measured on fast response, during the sample period.

L_{A1} – The L_{A1} level is the noise level which is exceeded for 1% of the sample period. During the sample period, the noise level is below the L_{A1} level for 99% of the time.

L_{A10} – The L_{A10} level is the noise level which is exceeded for 10% of the sample period. During the sample period, the noise level is below the L_{A10} level for 90% of the time. The L_{A10} is a common noise descriptor for environmental noise and road traffic noise.

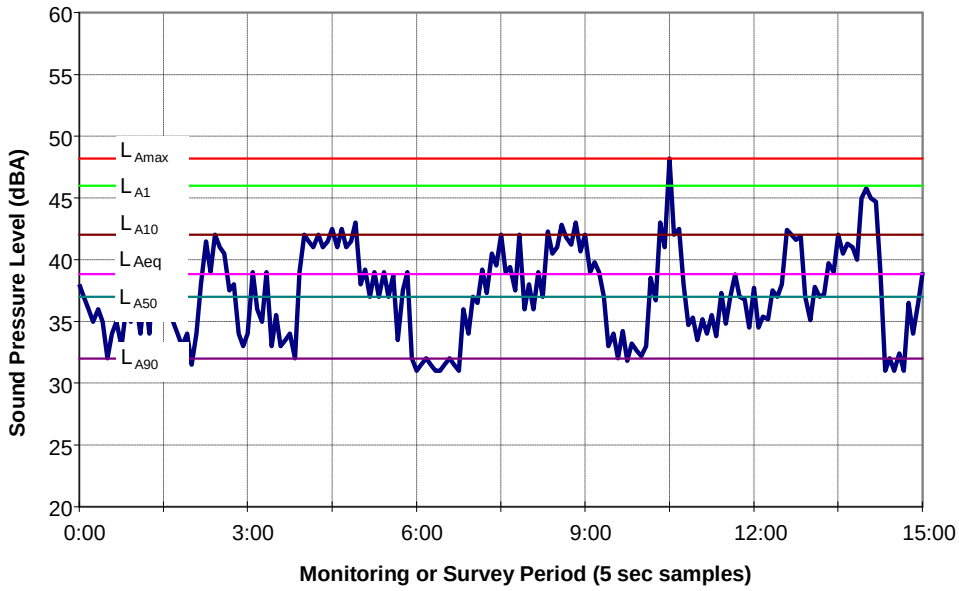
L_{A90} – The L_{A90} level is the noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below the L_{A90} level for 10% of the time. This measure is commonly referred to as the background noise level.

L_{Aeq} – The equivalent continuous sound level (L_{Aeq}) is the energy average of the varying noise over the sample period and is equivalent to the level of a constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.

ABL – The Assessment Background Level is the single figure background level representing each assessment period (daytime, evening and night time) for each day. It is determined by calculating the 10^{th} percentile (lowest 10^{th} percent) background level (L_{A90}) for each period.

RBL – The Rating Background Level for each period is the median value of the ABL values for the period over all of the days measured. There is therefore an RBL value for each period – daytime, evening and night time.

Typical Graph of Sound Pressure Level vs Time



1 INTRODUCTION

It is proposed to widen the M1 Pacific Motorway between Tuggerah and Doyalson in the section from Wyong Road to Doyalson Interchange. The proposal comprises approximately 12.1 kilometres of road and replacement of existing asset. The widening will take place in both directions by construction of a third lane in both directions within the existing median.

The proposal will be built under live traffic conditions. Any out-of-hours work required to minimise disruption to the motorway would be done in accordance with Roads and Maritime *Environmental Noise Management Manual (ENMM)* and the EPA's *Interim Construction Noise Guideline (ICNG)*.

This report is a noise assessment of the proposal for the Review of Environmental Factors (REF). The report considers operational and construction noise.

2 DESCRIPTION OF THE PROPOSAL & STUDY AREA

2.1 Overview of Proposal

Roads and Maritime Services NSW (Roads and Maritime) proposes to widen around 12.1 kilometres of the M1 Pacific Motorway (formerly known as the F3 Freeway) to six lanes between Wyong Road, Tuggerah, and the Doyalson Link Road, Kiar.

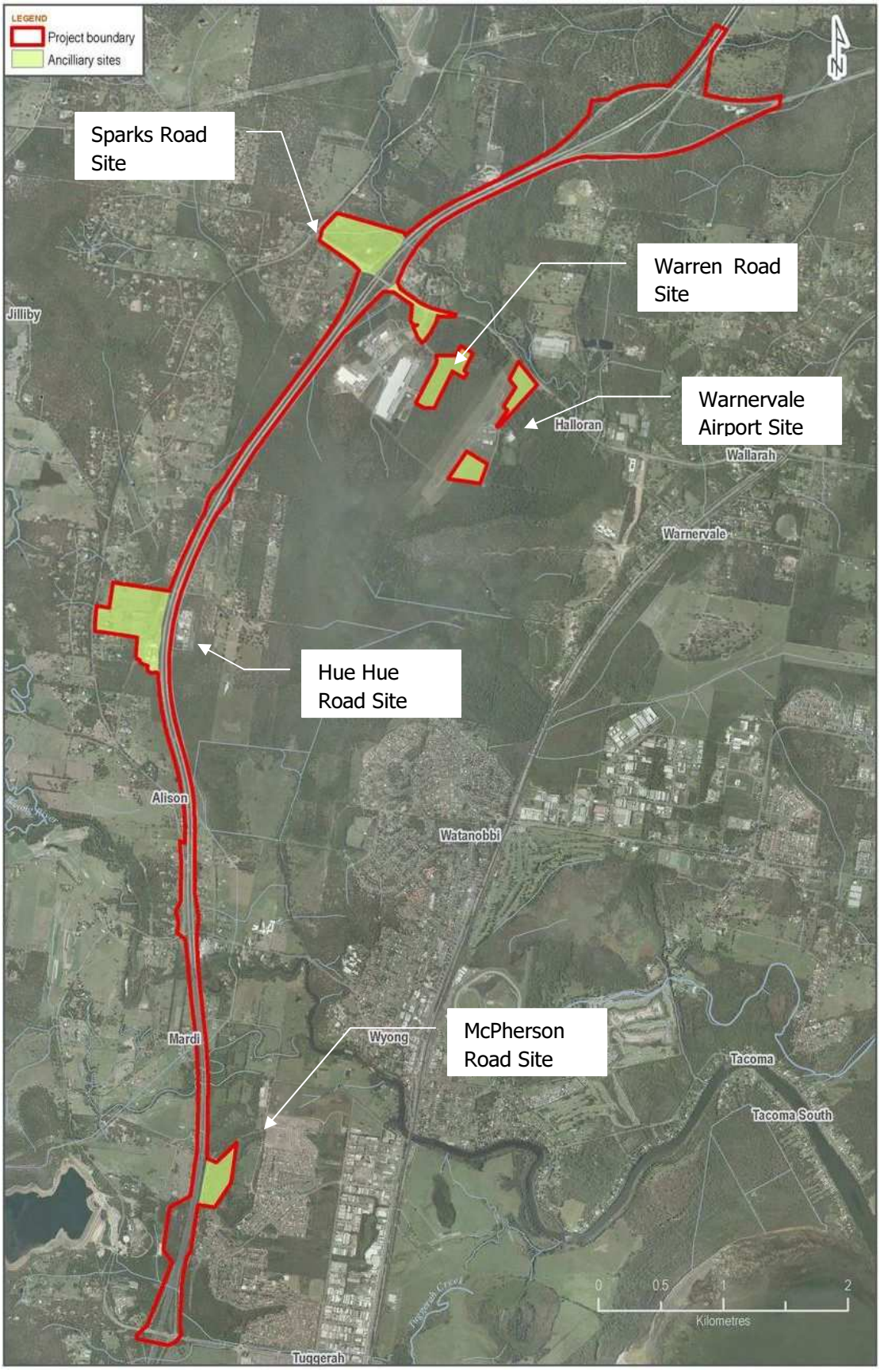
The main elements of the proposal include:

- Providing two additional lanes (one each northbound and southbound) to provide three northbound and three southbound lanes, each with 3.5 metre lane widths. Widening to three lanes would be undertaken predominantly within the median, with line re-marking and some minor widening on the outside of the carriageway in some locations.
- Replacement of the existing asset through full reconstruction or rehabilitation of the existing pavement comprising 2.1 kilometres of flexible pavement and 9.2 kilometres of rigid (concrete) pavement consistent with the existing pavement materials for respective sections of the motorway.
- Upgrades to the existing Warnervale Interchange (Sparks Road) including a new northbound G-type entry ramp, reconfiguration of intersections and approaches, widening the southbound off ramp and constructing a new pedestrian overbridge to the north of the existing bridge.
- A new Doyalson Link Road Interchange northbound ramp arrangement would extend between the motorway and the existing Doyalson Link Road providing access to Doyalson Link Road from the motorway with a total length of around 650 metres.
- Provision of two additional lanes (one each northbound and southbound) on each of six twin bridges by new line-marking (no physical widening of the bridge structures is proposed with additional lanes accommodated wholly within the existing road pavement with reduced shoulder widths where required).
- Ancillary facilities to support construction activities including stockpiling, storage, concrete batching and crushing (proposed ancillary sites shown in Figure 2-1.)
- The formation for a future southbound exit ramp at the Doyalson Road interchange, (although the final design of the ramp has yet to be finalised and construction of the ramp is not proposed as part of this proposal).
- Replacement of three 3-cell box culverts, adjustments to the surface inlet level at all existing drainage pits and construction of new drainage pits and connections to the existing network at pits at a number of locations along the motorway with a new drainage network constructed for new ramps.
- A number of new variable message signs (VMS) with emergency telephones co-located and including a parking area, with power and telemetry provided in the median running longitudinally with transverse connections at each VMS location.

A more detailed description of the proposal is provided in Chapter 3 of the REF that this technical paper supports.

Figure 2-1 provides an overview of the proposal.

Figure 2-1 Proposal Overview with Ancillary Sites



Drainage

2.2 Ancillary Facilities

A number of ancillary facility locations are also proposed to support construction activities for the proposal. Five locations are proposed in total; however, not all would necessarily be required. The sites would provide construction compounds, material laydown areas, stockpile sites and potential concrete batching plants.

The proposed ancillary sites are shown on Figure 2-1.

2.3 Study Area & Noise Catchment Areas

While noise is assessed at individual houses, Noise Catchment Areas were identified in order to facilitate labelling of those houses. The NCA's were determined by changes in pavement type or interchange.

Figure 2-2 shows the locations Noise Catchment Areas used for the assessment.

Noise Catchment Area (NCA) 1 is on the eastern side of the motorway and extends from the southern end at Wyong Road, Mardi, to the Wyong River bridge crossing. This catchment encompasses the section of the motorway that is paved with flexible pavement (open graded asphaltic concrete). In the southern part of this NCA is the suburb of Mardi where houses are as close as 130 metres from the Motorway, but generally more than 300m. In the northern part of the NCA there are generally isolated receivers.

NCA 2 is on the western side of the motorway from the southern extent at Wyong Road, Mardi, to the Wyong River bridge crossing. There are no conurbations of houses in this NCA which comprises isolated receivers, some in small groups.

NCA 3 is on the eastern side of the motorway from the Wyong River to Sparks Road. This NCA comprises isolated receivers, some in small groups.

NCA 4 extends from the western side of the motorway from the Wyong River to Sparks Road. This NCA comprises mostly isolated receivers; however, there are some small groups of houses, for example at Hue Hue Road in Alison and, at the north, near the northbound off-ramp to Sparks Road in Jilliby.

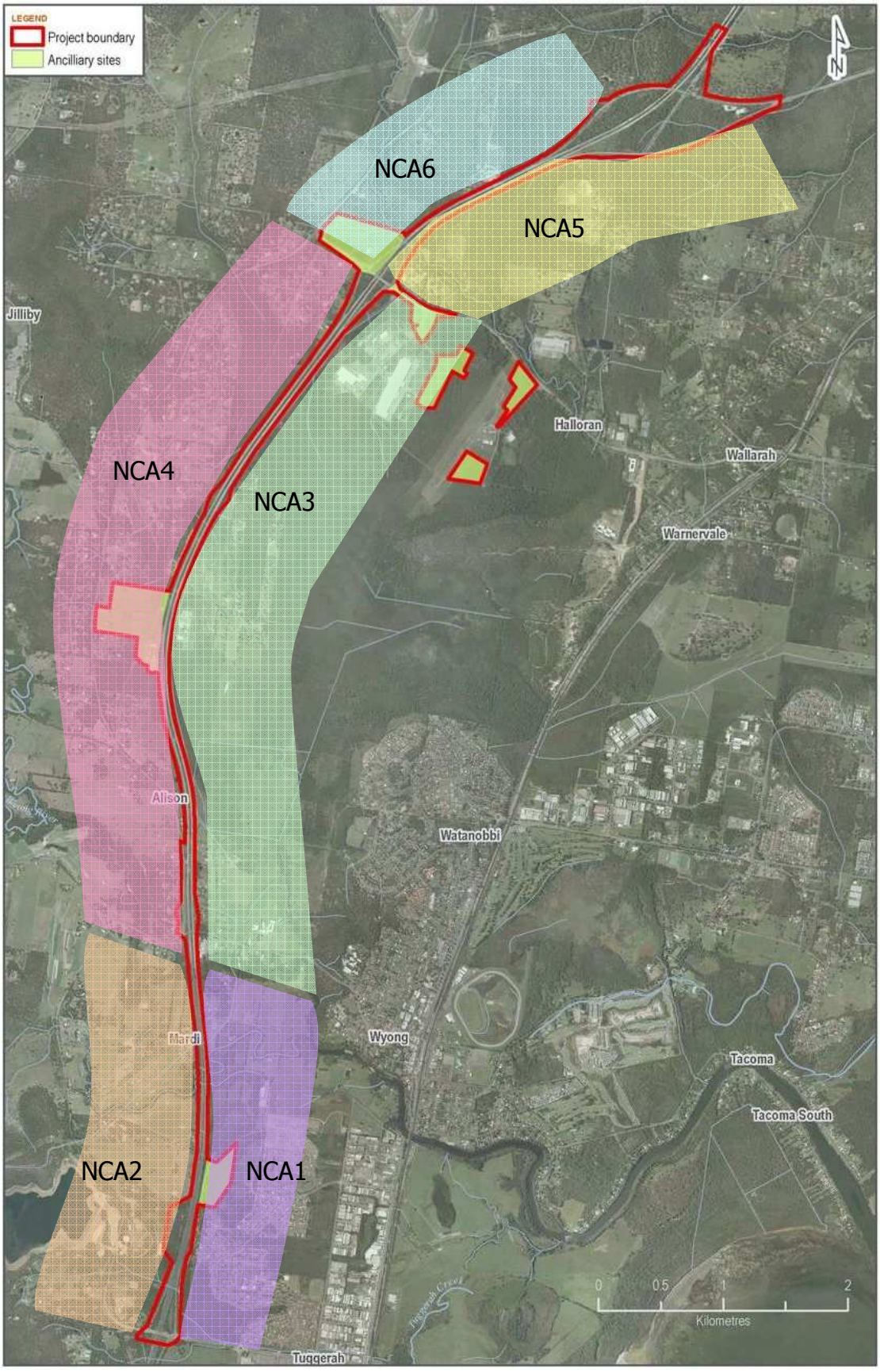
NCA 5 is on the eastern side of the motorway, north of Sparks Road, continuing to the northern extent of the proposal. Seven isolated receivers were identified.

NCA 6 is on the western side of the motorway, north of Sparks Road, continuing to the northern extent of the proposal. Two receivers were identified on Hue Hue Road.

All NCAs include some receivers that would generally be considered to be "isolated". Neither the *RNP* nor the *ENMM* give specific guidance on what constitutes an isolated receiver. In Practice Note iv of the *ENMM* states in reference to mitigation: "If residences are closely grouped in numbers of three or less, architectural treatments are preferred over roadside barriers, as it is likely that the cost per receiver for barriers will be at least twice that for architectural treatments."

"Isolated" receivers are considered to be receivers where the density of housing is so low that provision of noise barriers would be significantly more expensive than provision of architectural treatment to the individual receivers.

Figure 2-2 Noise Catchment Areas



3 NOISE MONITORING

3.1 Purpose

Noise is monitored prior to construction for two reasons:

- To measure existing traffic noise to allow validation of the noise model used for the operational traffic assessment.
- To measure the existing Rating Background Levels (RBLs) in order to set appropriate construction noise criteria along the alignment.

3.2 Method & Results

Monitoring was undertaken simultaneously with traffic counts at three locations between 4 April and 16 April 2013. Although the logging period included a school holiday period, sufficient data was collected prior to commencement of the school holidays, and only that data was used for the analysis of traffic noise. The addresses of the properties where loggers were located are shown in Table 3-1. A map showing the locations of the loggers is provided at Figure 3-1. Close-up location maps are given on the cover pages of result charts in Appendix A.

The noise monitoring equipment used for these measurements consisted of environmental noise loggers set to A-weighted, fast response, continuously monitoring over 15-minute sampling periods. This equipment is capable of remotely monitoring and storing noise level descriptors for later detailed analysis. The equipment calibration was checked before and after the survey and no significant drift was noted.

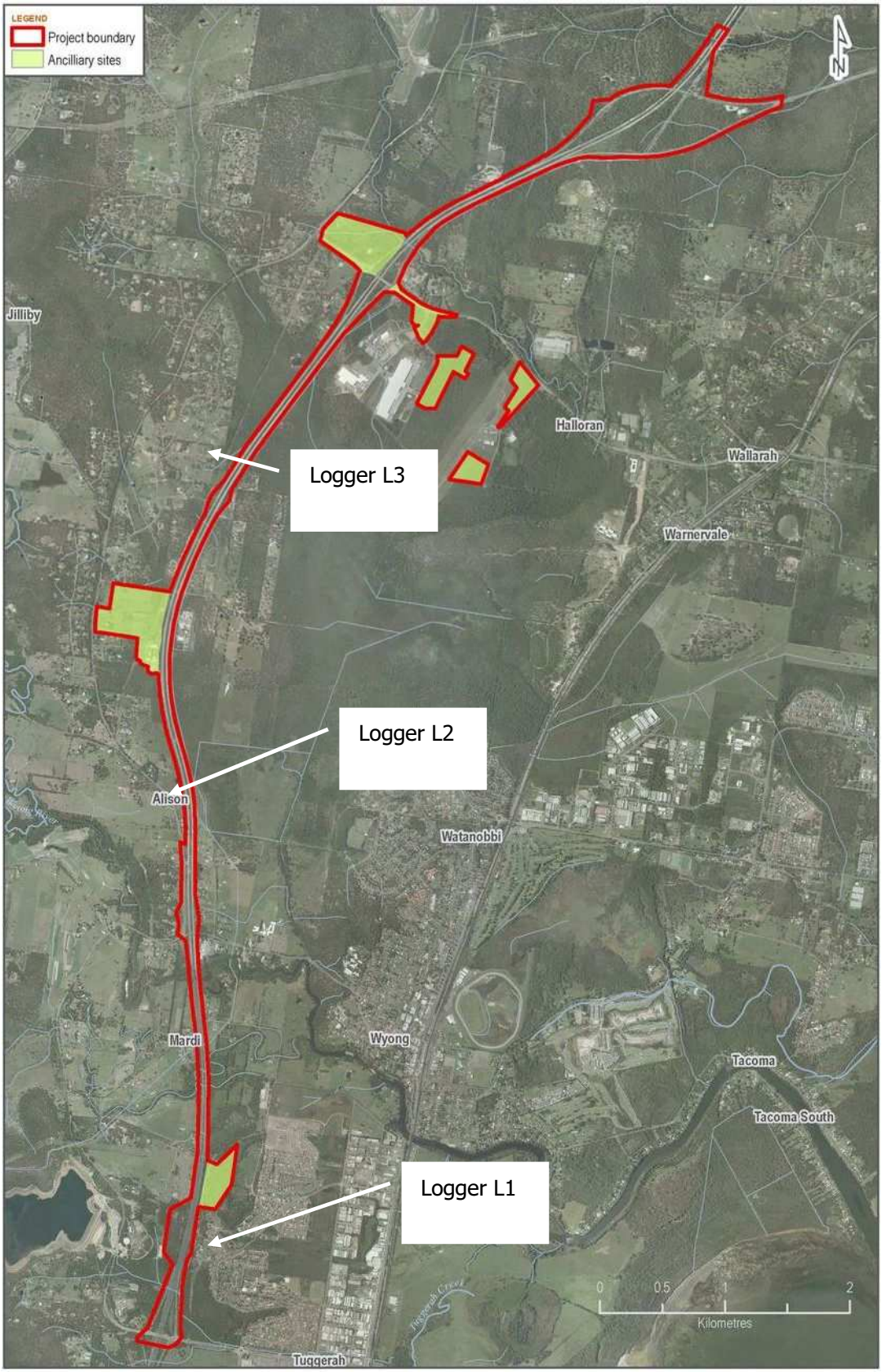
The logger determines L_{A1}, L_{A10}, L_{A90} and L_{Aeq} levels of the ambient noise. L_{A1}, L_{A10} and L_{A90} are the levels exceeded for 1%, 10% and 90% of the sample time respectively (see Glossary of Acoustic Terms for definitions). The L_{A1} is indicative of maximum noise levels due to individual noise events such as the occasional pass-by of a heavy vehicle. This is used for the assessment of sleep disturbance. The L_{A90} level is normally taken as the background noise level during the relevant period.

The logging results have been edited to exclude periods of rain or excessive wind, as determined using data from the Bureau of Meteorology for Mangrove Mountain, the most representative location available. Locations L1, L2 and L3 have noisy environments primarily due to traffic noise, and the results have been edited to ignore times when the noise at the logger was not due to traffic noise from the motorway. These exclusions are based on engineering judgement and are marked on the logger charts in Appendix A.

Table 3-1 Logger Locations

Logger No.	Address	Distance to M1
L1	10 Woolmers Crescent, Mardi	96m
L2	93 Hue Hue Road, Alison	25m
L3	34 Holloway Drive, Jilliby	169m

Figure 3-1 Logger Locations



The traffic noise results ($L_{Aeq,period}$) are given in Table 3-2.

The measured Rating Background Levels (RBL) is given in Table 3-3. The results are used for setting construction noise criteria.

Table 3-2 Noise Levels, L_{Aeq}, dBA

Logger No.	Address	$L_{Aeq,15hr}$	$L_{Aeq,9hr}$	
L1	10 Woolmers Crescent, Mardi	55.6	48.1	Free field
L2	93 Hue Hue Road, Alison	73.8	69.4	Façade measurement
L3	34 Holloway Drive, Jilliby	60.2	53.5	Free field

Table 3-3 Rating Background Levels, dBA

Logger No.	Address	Day	Evening	Night
L1	10 Woolmers Crescent, Mardi	46	46	38
L2	93 Hue Hue Road, Alison	68	64	46
L3	34 Holloway Drive, Jilliby	50	49	42

4 ROAD TRAFFIC NOISE GOALS

4.1 *Road Noise Policy*

The EPA's *Road Noise Policy (RNP)* sets out criteria for assessment of noise from vehicles on public roads.

The *RNP* sets out noise criteria for 'freeways', 'arterial', 'sub-arterial' and 'local roads'. The motorway and all associated ramps are considered to be in the freeway category.

As the alignment of the "build" option is wholly within the alignment of the "no build" option, the redevelopment criteria apply. The "build" option will be no closer to any receiver than the "no build" option.

4.2 Noise Criteria for Residential Land Use

For residential receivers, the noise criteria for redevelopment of freeways are given in Table 4-1.

Table 4-1 *RNP* Criteria for Redevelopment of Freeways

Road Category	Assessment Criteria – dB(A)	
	Day (7am-10pm)	**Night (10pm-7am)**
Noise Assessment Criteria	$L_{Aeq,15hr}$, 60 (external)	$L_{Aeq,9hr}$ 55 (external)
Relative Increase Criteria	Existing traffic $L_{Aeq,15hr}$ + 12 dB (external)	Existing traffic $L_{Aeq,9hr}$ + 12 dB (external)

Where predicted noise levels exceed the project-specific noise criteria, an assessment of all feasible and reasonable mitigation options should be considered. The *RNP* states that *an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person*.

The Relative Increase Criteria will not determine mitigation in this proposal as noise levels are predicted to increase by 3dBA or less due to the "build" option.

4.3 Assessment Timeframe

For road redevelopment projects, the *RNP* requires assessment in two timeframes:

- Timeframe 1 – within one year of changed traffic conditions. This is generally referred to as the Opening Year.
- Timeframe 2 – for design year (typically 10 years) after changed traffic conditions. This is generally referred to as the Assessment Year.

For each timeframe the *RNP* requires comparison between:

- The road traffic noise levels if the project proceeds (termed the "build option").
- The corresponding road traffic noise levels, due to general traffic growth, that would have occurred if the project had not proceeded (termed the "no build option").

For assessment purposes, it was assumed that the proposal would be opened in 2019, hence for this report Timeframe 1 will refer to 2019 and Timeframe 2 will refer to 2029.

4.4 Acute Noise Levels

Roads and Maritime's Environmental Direction Number 24 "Noise assessment for acute levels of noise – redevelopment of existing roads" indicates the following:

"Application of all feasible and reasonable noise mitigation to aim to achieve the RNP noise criteria where, following a road redevelopment:

There is predicted to be a noticeable increase in road traffic noise, or

Road traffic noise levels are predicted to be acute."

Noise levels are acute if they are equal to or more than $L_{Aeq,15hr}$ 65dBA or $L_{Aeq,9hr}$ 60dBA

4.5 Non-Residential Noise Sensitive Receivers

Two non-residential noise sensitive receivers were identified within the study area.

The Woodbury Park Community Centre is in NCA 1 on Woolmers Crescent, Mardi. The centre has interview rooms and activity rooms (Receiver N1-28 shown on Figure 4-1). The school classroom criterion is considered suitable for these uses.

Figure 4-1 Location of Woodbury Park Community Centre

A childcare facility operates at 23 Buttonderry Drive, Jilliby (Receiver N4-86 as shown on Figure 4-2).

Figure 4-2 Location of Childcare Facility

Table 4-2 sets out the assessment criteria for non residential receivers.

Table 4-2 Assessment Criteria for Operational Traffic Noise – Non-Residential Receivers

Existing Sensitive Land Use	Assessment Criteria – dB(A)	
	Day (7am-10pm)	Night (10pm-7am)
1. School classrooms	$L_{Aeq,1hr}$ 40 (internal) when in use	
4. Open space (active use)	$L_{Aeq,15hr}$ 60 (external) when in use	
5. Open space (passive use)	$L_{Aeq,15hr}$ 55 (external) when in use	
8. Childcare facilities	Sleeping rooms $L_{Aeq,1hr}$ 35 (internal) Indoor play areas $L_{Aeq,1hr}$ 40 (internal) Outdoor play areas $L_{Aeq,1hr}$ 55 (external)	

Commercial receivers are not considered noise sensitive receivers and therefore are not assessed for operational noise impacts.

To predict internal noise levels in school classrooms and childcare facilities, it is assumed that internal noise is 10dBA less than external noise. This is based on a façade facing the motorway with windows open for ventilation.

5 NOISE MODELLING

5.1 Purpose of Noise Modelling

The purpose of noise modelling is to predict traffic noise levels at sensitive receivers.

A noise model takes inputs such as road alignment, topography, traffic flow and receiver location, and predicts noise levels.

An assessment of a new road or road redevelopment requires prediction of existing and future noise. Hence at all residences and other sensitive receivers the model should predict noise levels for both the "build" and "no-build" options.

5.2 Modelling Procedure & Assumptions

Noise levels from the existing road alignment were calculated using procedures based on the *Calculation of Road Traffic Noise (CoRTN)* prediction algorithms using CadnaA noise modelling software. Predictions were also verified using SoundPLAN software. The standard *CoRTN* prediction procedures were modified in the following ways.

- L_{Aeq} values were calculated from the L_{A10} values predicted by the *CoRTN* algorithms using the well-validated approximation $L_{Aeq,1hr} = L_{A10,1hr} - 3$.

- Noise source heights were set at 0.5 metres for cars, 1.5 metres for heavy vehicle engines and 3.6 metres for heavy vehicle exhausts, representing typical values for Australian vehicles. Noise from a heavy vehicle exhaust was assessed as 8dBA lower than the noise from the engine. The combined noise from heavy vehicle exhaust and engine gives the sound level as defined in *CoRTN*. The acoustical energy for the various sources is then derived from speed, road surface and traffic volume.

- Small negative corrections for "Australian conditions", derived from documented validation of the *CoRTN* algorithms, have been included, both for calculations with and without façade correction.

- Where there are no barriers present, ground was taken to be 75% soft. With barriers, hard ground is assumed as required under the *CoRTN* procedures.

5.3 Model Inputs

5.3.1 Road Alignment & Topography

Details of the surrounding topography, as two metre contours, and road alignments were provided digitally by Roads and Maritime. The terrain is generally between 0 metres and 30 metres above sea level with rolling hills. There are no deep cuttings in this section of the motorway.

The proposed alignment is within the existing alignment, with new lanes, and alignment variations, being built within the existing median.

5.3.2 Traffic Speed

Light vehicles were modelled at 110km/h, and heavy vehicles at 100km/h.

Modelled speed on ramps was 80km/h.

5.3.3 Road Surface Correction

Surface corrections for various surfaces are given in Table 5-1. All corrections are for traffic with 10 per cent heavy vehicles.

Table 5-1 Road Surface Corrections

Road Surface Type	Vehicle Speed km/h		
	60	80	100/110
Dense Graded Asphaltic Concrete (DGAC) (on ramps)	0	0	0
Open Graded Asphaltic Concrete (OGAC)	3.5	3.5	4
Concrete	1.5	2	2.5

5.3.4 Receiver Heights

Receiver heights used were:

- For traffic noise validation at logger microphone heights – 1.5 metres.
- For residential single storey receivers – 2 metres.

5.3.5 Facade Reflections

For prediction of operational noise to residences, a 2.5dBA correction was added to the noise results.

5.3.6 Australian Conditions

The Australian correction of -1.7dBA was applied to facade predictions (April 1983 Australian Road Research Board report – Research Report ARR No.122).

6 MODEL VALIDATION

6.1 Traffic Counts

During the noise monitoring week, simultaneous traffic counts were carried out by Skyhigh Data Australia. Skyhigh counted traffic on the motorway itself at three locations during the week, and also did 7-hour daytime counts at the intersections. The counts at the Sparks Road Interchange were used in the noise model to provide traffic flow data for the motorway ramps and Sparks Road.

The weekly counts at the midway point along the M1 Pacific Motorway, near the service centres on both northbound and southbound, are shown in Table 6-1. These are the flow values used in the noise validation model which was used to compare with the measured noise levels. The count includes a full week of data, including both Saturday and Sunday.

Table 6-1 Traffic Count near Service Centre

Direction	Period	Daily Average			
		Light	Heavy	Total Vehicles	Percent Heavy
Southbound	Nigh time 9hr	2222.9	651.2	2874.1	22.7
	Daytime 15hr	20676.0	1893.1	22569.1	8.4
Northbound	Night time 9hr	3258.5	634.4	3892.9	16.3
	Daytime 15hr	21601.7	1726.1	23327.9	7.4

6.2 Results

The results of the validation at the three noise logger locations are shown in Table 6-2.

The agreement at locations L1 and L2 is within 2dB. This is the margin considered satisfactory for a noise model. At location L3, the daytime validation was within 1dB; however, the night time level difference was 3dB.

Receiver L3 is separated from the motorway by reasonably dense vegetation and it is possible that the model under-estimated the effect of ground attenuation at this location. Because the model over-predicts the noise when compared to the measured noise, the model results are considered conservative.

The model is therefore considered valid.

Table 6-2 Noise Validation Results

Rec.	Address	Calculated		Measured		Difference – > 0 indicates Over-Prediction	
		Day	Night	Day	Night	Day	Night
L1	10 Woolmers Crescent, Mardi	55.5	49.4	55.6	48.1	0.1	1.3
L2	93 Hue Hue Road, Alison	71.9	67.1	71.3	66.9	0.6	0.2
L3	34 Holloway Drive, Jilliby	60.8	56.3	60.2	53.5	0.6	2.8

7 OPERATIONAL NOISE ASSESSMENT

7.1 Traffic Flow

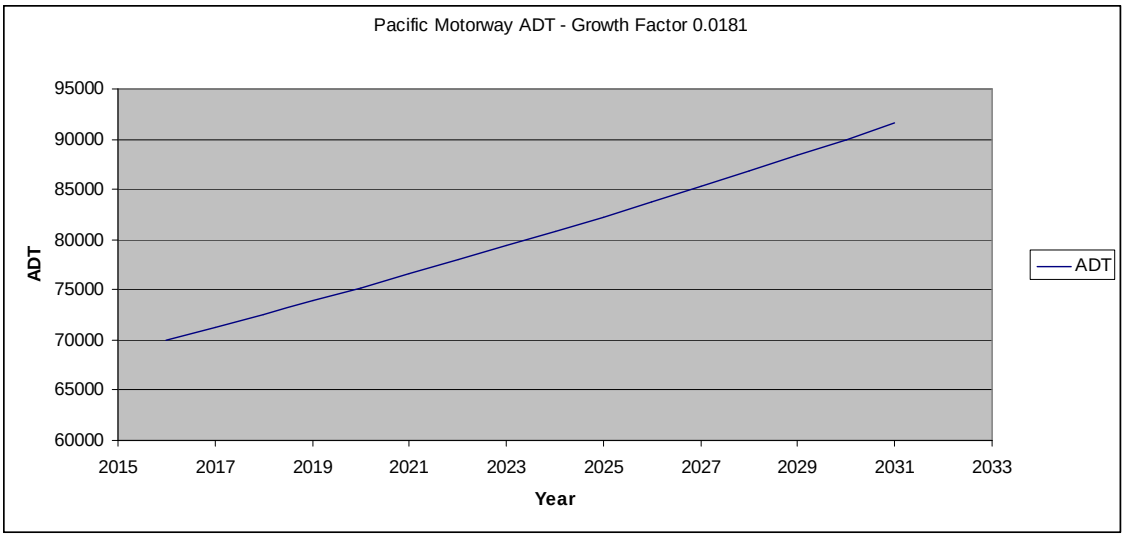
Detailed traffic flow volume predictions are not available, but will be incorporated into the noise and vibration assessment at detailed design stage. Estimates provided by Roads and Maritime are shown in Table 7-1. Roads and Maritime projected that the traffic flow in the year 2031 will reach 90,000 vehicles per day with or without the project. The predicted increase in traffic volume is due to natural growth, not the project. To estimate traffic volumes for the noise model, the volumes in Table 7-1 were used with an interpolation to the years 2019 and 2029, based on a growth factor of 0.0181 per year from 2016 to 2031, as shown in Figure 7-1. To distribute the volumes in Table 7-1 over the northbound and southbound carriageways, and the interchange ramps, the volumes from Table 7-1 were divided according to ratios determined from the detailed classified count used in the validation process (see Section 6.1).

Counting was done from 5 April to 11 April 2013. The results from counts at the Service Centre were used for traffic volumes south of Sparks Road. The results from counts at Doyalson Link Road were used for traffic volumes north of Sparks Road.

Table 7-1 Traffic Flow used for Assessment

Source	Year	ADT
Roads and Maritime Modelling	2010	65,000
	2016	70,000
	2031	90,000
Interpolated Opening Year (AADT)	2019	73,900
Interpolated Assessment Year (AADT)	2029	88,400

Figure 7-1 Traffic Growth



7.2 Results

The model has been used to predict noise levels at 619 receivers, representing all identified noise sensitive receives within 600m of the M1 Pacific Motorway along the study route. Predictions were performed for the years 2019 and 2029 using both the "build" option and "no-build" option. Some receivers where noise is predicted to comply with the *RNP* criteria are not included in the reported results.

Table 7-2 identifies the number of receivers in each catchment area which exceed either the base *RNP* noise criteria, or the acute noise criteria, for the "build" Option.

Table 7-3 identifies the number of receivers in each catchment area where predicted noise levels exceed either the base *RNP* noise criteria, or exceed the acute noise criteria, for the "no-build" Option. Comparisons of the noise levels for the "no-build" option against the *RNP* criteria are provided to demonstrate the effects the project has on noise levels in relation to the criteria.

Table 7-2 Number of Receivers where Predicted Noise Levels Exceed Noise Criteria – Build Option

NCA	Receivers in Catchment	Year	Build Option Exceeds *RNP* Criterion		Exceeds Acute Criterion	
			Day	Night	Day	Night
NCA 1	375	2019	10	14	2	3
		2029	14	14	3	3
NCA 2	31	2019	10	10	5	6
		2029	11	12	6	6
NCA 3	44	2019	31	32	13	15
		2029	33	34	17	18
NCA 4	162	2019	87	100	30	33
		2029	108	119	35	39
NCA 5	7	2019	4	4	3	3
		2029	6	7	3	3
NCA 6	2	2019	0	0	0	0
		2029	0	0	0	0
Total	**621**	**2019**	142	160	53	60
		2029	172	186	64	69

Table 7-3 Number of Receivers where Predicted Noise Levels exceed Noise Criteria – No Build Option

NCA	Receivers in Catchment	Year	No Build Option Exceeds *RNP* Criterion		Exceeds Acute Criterion	
			Day	Night	Day	Night
NCA 1	375	2019	12	12	4	4
		2029	15	16	4	4
NCA 2	31	2019	13	13	7	7
		2029	17	17	7	7
NCA 3	44	2019	28	29	8	9
		2029	30	31	10	10
NCA 4	162	2019	78	82	24	29
		2029	94	96	30	32
NCA 5	7	2019	6	6	3	3
		2029	7	7	3	3
NCA 6	2	2019	0	0	0	0
		2029	0	0	0	0
Total	**621**	**2019**	138	143	46	52
		2029	164	168	54	56

7.3 Discussion

Traffic flow will increase over the 10 years between the opening year (2019) and assessment year (2029). The increase in traffic noise levels due to natural growth is 0.8dBA at all receivers. Because this increase is the same for the "build" and "no build" scenarios, differences between outcomes for the two scenarios will be due to the road design. As the horizontal alignment varies insignificantly between the "build" and "no-build", the remaining minor differences in noise levels between "build" and "no-build" are likely to result from changes in the vertical alignment. This changes the degree to which the receivers are shielded from the road.

Figure 7-2 shows an overview of the noise impacts for the "build" option for 2029.

For the assessment year 2029, acute noise levels are predicted at 69 receivers under the "build" option. These are generally spread along the section of concrete pavement. The noise is also predicted to increase more than 2dBA over the "no-build" option at receivers generally in the area where Hue Hue Road approaches the M1 Pacific Motorway, as shown on Figure 7-2. The highest predicted increase is 2.9dBA at receiver N4-31. These receivers are in NCA3 and NCA 4, (see star shaped markers on Figure 7-2).

At other receivers where noise is predicted to exceed the *RNP* criteria but not to be acute, noise is also predicted to increase by more than 2dBA at two receivers in NCA 3 (see triangle markers on Figure 7-2).

The predicted noise levels at receivers are listed in Appendix B, and represented graphically in Appendices C and D for 2029. Receiver numbers are also shown in the Appendices.

Of the 621 receivers considered:

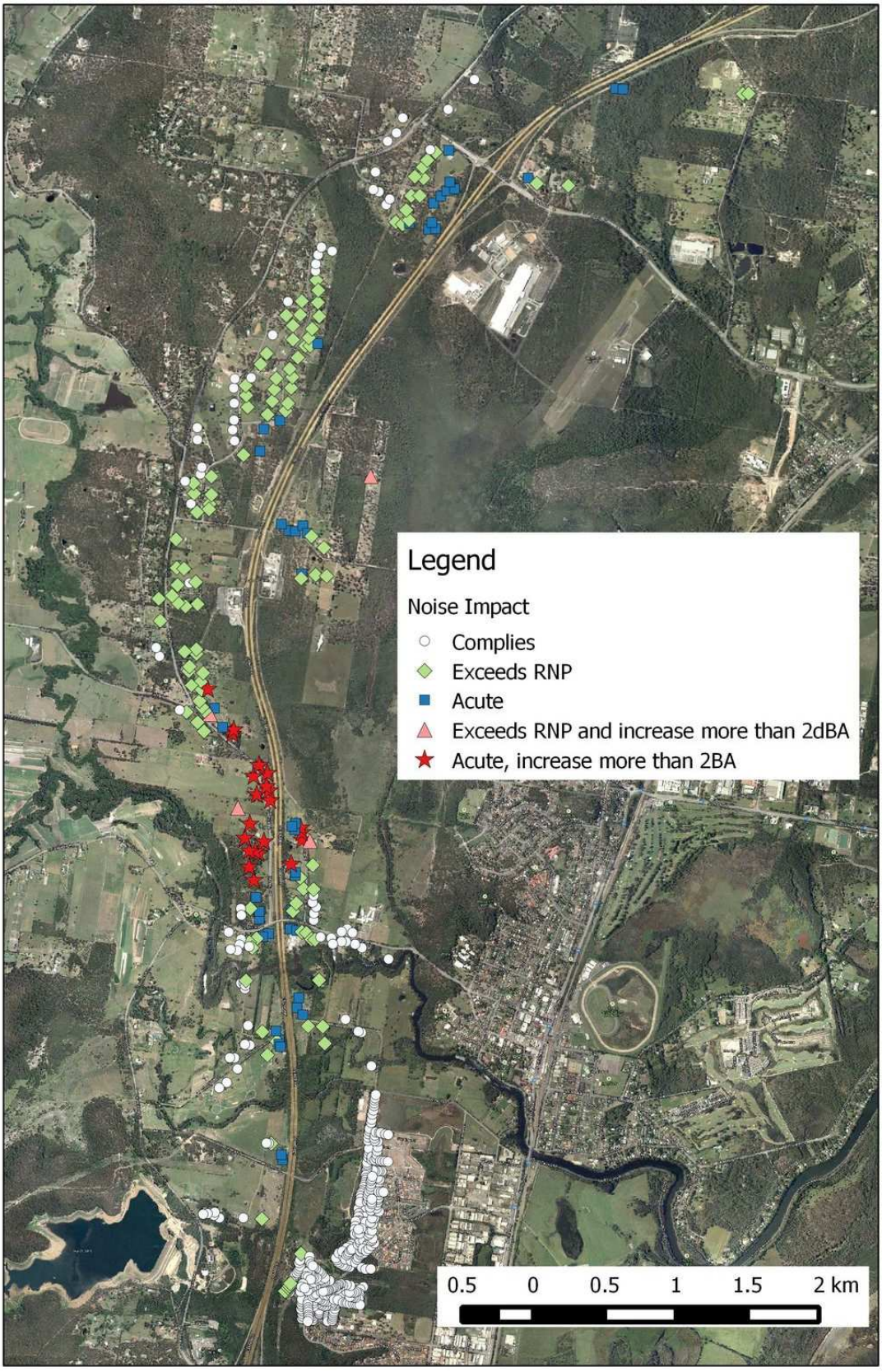
- Noise is predicted to exceed *RNP* criteria and to be acute, but to have increased by 2dBA or less due to the project, at 47 receivers;
- Noise is predicted to exceed *RNP* criteria and to be acute, and to have increased by more than 2dBA due to the project, at 22 receivers;
- Noise is predicted to be above the *RNP* criteria (but not acute) and to have increased by 2dBA or less at 182 receivers.
- Noise is predicted to be above the *RNP* criteria (but not acute) and to have increased by more than 2dBA at 4 receivers.

The *RNP* states that *an increase of up to 2 dB represents a minor impact that is considered barely perceptible to the average person*. Therefore, the increase in noise level due to the proposal represents at most a minor change in noise impact 595 of the 621 receivers considered.

At approximately 50 of the 621 receivers the noise is predicted to decrease as a result of the proposal. Again, the decrease will generally be less than 2dBA and is considered barely perceptible, and at some of those receivers the noise is still predicted to be acute.

The locations of receivers where noise is predicted to exceed the *RNP* criteria, and to be acute, are shown in Appendix E. An overview of the proposal showing the noise impacts under the "build" option in 2029 is shown on Figure 7-2. Detailed views and receiver numbers are shown in Appendix E.

Figure 7-2 Overview of Traffic Noise Impacts, Build Option 2029



8 MAXIMUM NOISE LEVEL ASSESSMENT

Although there are no specific criteria relating to sleep disturbance in the *RNP*, the document recommends that an assessment of maximum noise levels be undertaken where impacts may occur during the night. The only guidance offered in terms of acceptable maximum noise levels is:

- *Maximum internal noise levels below 50-55dBA are unlikely to cause awakening reactions.*
- *One or two noise events per night with maximum internal noise levels of 65-70dBA are not likely to significantly affect health and wellbeing.*

It is largely recognised that the maximum noise level of an event, the number of occurrences, the duration of the event, and the emergence above background or ambient noise levels are key factors affecting sleep disturbance. Not all people are affected to the same degree or by the same noise exposure. Findings from studies of sleep disturbance measured by an awakening, change in sleep state or other effects reflect the considerable variation in the population's response to noise.

The *ENMM* puts forward a protocol for assessing maximum traffic noise levels. In Practice Note (iii) the document states: *At locations where road traffic is continuous rather than intermittent, the $L_{Aeq,9hr}$ target noise levels should sufficiently account for sleep disturbance impacts*. The traffic flow on the Pacific Motorway is considered continuous; however, the *ENMM* also suggests that the assessment of sleep disturbance should include an examination of "maximum noise events": A "maximum noise event" is defined as any single event where the L_{Amax} noise level exceeds 65dBA and the L_{Amax} noise level exceeds the $L_{Aeq,1hr}$ noise level by more than 15dBA.

8.1 Maximum Noise Level Assessment

Table 8-1 and Table 8-2 show estimated maximum levels from the existing M1 Pacific Motorway in 2019 and 2029 respectively. As the "build" and "no-build" options have almost the same alignment, predicted traffic flows, speeds and pavement surfaces, there is very little difference between the options. As with the L_{Aeq} noise levels, minor changes in vertical alignment will lead to changes in maximum noise level within 2dBA at most receivers.

The tables also show that the levels exceed the 65dBA threshold for both "build" and "no build" options. Considering receivers which have an unimpeded view of the M1 Pacific Motorway, at 200 metres from the M1 Pacific Motorway there is a predicted minor exceedance of 2dBA. This exceedance would fall to 0dBA at approximately 250 metres from the carriageway.

At receivers shielded from the M1 Pacific Motorway, for example in Woolmers Crescent, Alison, the predicted level also exceeds the 65dBA threshold by 2dBA. However, the emergence above the L_{Aeq} level is higher as the L_{Aeq} is attenuated more by any shielding than is the $L_{Amax.}$ This may indicate a greater chance of sleep disturbance.

The tables show that in 2029 the emergence of the maximum over the L_{Aeq} is less than in 2019. This is because the L_{Aeq} increases over the 10 year period, yet the maximum levels do not. This applies to both "build" and "no build".

Table 8-1 Maximum Noise Level Events – Build & No Build Scenarios – 2019

Location	$L_{Aeq,1hour}$ Noise Level (dBA)	L_{Amax} Noise Level (dBA)	By how much is L_{Amax} above the 65dBA Noise Threshold (dBA)	By how much is L_{Amax} above the $L_{Aeq,1hour}$ Noise Level (dBA)	Typical No. of Heavy Vehicle Movements per hour - 2019 (Build or No Build)	Average Number of Events per Night (Build or No Build)
Typical Worst Case: 40 100m from M1 Pacific Motorway unshielded (eg 93 Hue Hue Road)	72 77	85 90	20 25	8 18	155	1395
Typical >200m from M1 Pacific Motorway unshielded (eg Holloway Drive, Jilliby)	54 56	63 67	2	7 13	155	1395
Typical > 100 from M1 Pacific Motorway shielded (eg Woolmers Cr, Alison)	48 52	62 67	2	10 19	155	1395

Table 8-2 Maximum Noise Level Events – Build & No Build Scenarios – 2029

Location	$L_{Aeq,1hour}$ Noise Level (dBA)	L_{Amax} Noise Level (dBA)	By how much is L_{Amax} above the 65dBA Noise Threshold (dBA)	By how much is L_{Amax} above the $L_{Aeq,1hour}$ Noise Level (dBA)	Typical No. of Heavy Vehicle Movements per hour - 2029 (Build or No Build)	Average Number of Events per Night (Build or No Build)
Typical Worst Case: 40 100m from M1 Pacific Motorway unshielded (eg 93 Hue Hue Road)	73 78	85 90	18 23	7 17	190	1710
Typical >200m from M1 Pacific Motorway unshielded (eg Holloway Drive, Jilliby)	55 57	63 67	2	6 12	190	1710
Typical > 100 from M1 Pacific Motorway shielded (eg Woolmers Cr, Alison)	49 53	62 67	2	9 18	190	1710

9 OPERATIONAL NOISE MITIGATION

The above results show that noise levels at receivers along the M1 Pacific Motorway will increase due to the natural increase in traffic volumes and that at many receivers a small increase will be due to the changed alignment of the road. In 2029, 186 receivers are predicted to exceed the night time *RNP* criterion, and 69 of those are predicted to experience noise levels described as "acute". Feasible and reasonable noise mitigation measures should therefore be considered for the alignment consistent with the NSW *Road Noise Policy (RNP)*.

9.1 Low Noise Pavement

The proposal length is 12.1 kilometres including tie-in works at the proposal extents.

The southern 2.1 kilometres of the proposal currently has low noise pavement (OGAC). The northern 9.2 kilometres of the proposal currently has concrete pavement. (The remaining length of the proposal represents tie-in works and is remote from noise-sensitive receivers.)

It is proposed to replace each section with the same paving material as at present. Where the existing road has low noise pavement, all lanes of the widened road will have open grade asphalt pavement. Where the existing road has concrete pavement, all lanes of the widened road will have concrete pavement.

9.2 Noise Barriers

Because many exceedances of the *RNP* criteria are at isolated receivers, or small groups of receivers (three or less receivers, as described in the *ENMM*), it is not generally considered reasonable to provide at-road noise mitigation, such as noise barriers or low noise pavement. Such measures are not generally considered cost-effective when only a few receivers benefit. In such cases, it may be considered reasonable to provide at property mitigation. Such treatment is usually in the form of acoustic architectural treatment to the residential building.

Noise barriers have been considered in areas where there are groups of receivers with predicted exceedances in NCA 1, NCA 2, NCA 3 and NCA4. The analysis has been performed in accordance with the recommendations of the *Environmental Noise Management Manual (ENMM).* This involves the calculation of Marginal Benefit Value (MBV) and Total Noise Benefit per Unit Area (TNBA) for a number of barrier designs and selection of an appropriate design using procedures detailed in Practice Note IV of the *ENMM*. Peaks in the curve of MBV vs barrier height correspond to barrier options with the greatest marginal cost-effectiveness. Peaks in the curve of TNBA vs barrier height correspond to barrier options with the greatest overall cost-effectiveness, compared with the other barrier height options being considered.

In the following discussion, receiver numbers on the figures can be used to look up noise levels at receivers in the appendices.

9.3 NCA 1 Mitigation

NCA 1 includes houses in the southern 2.1 kilometre section of the project where there is currently low noise pavement. Under the proposal only this section will have low noise pavement.

The proposal is predicted to increase noise by no more than 1dBA at any receiver in this NCA.

Three isolated receivers in NCA1 with acute noise levels may be considered for architectural treatment.

A group of four receivers in NCA 1 exceed the *RNP* criteria by up to 3dBA under the "build" option (Receivers N1-3, N1-4, N1-5 and N1-6). However, the *ENMM* indicates that where predicted noise levels from a redeveloped road are within 2dBA of the levels under existing conditions and are not acute, it is generally not considered reasonable to consider further mitigation. Hence, the provision of mitigation for these residences is not considered in the assessment.

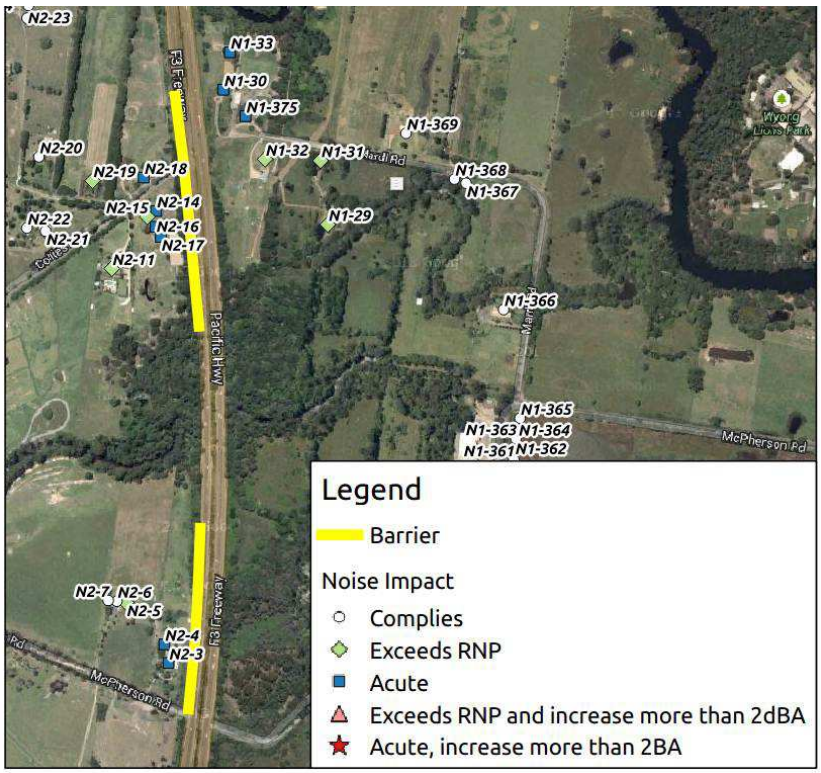
9.4 NCA 2 Mitigation

NCA 2 includes houses in the southern 2.1 kilometre section of the project where there is currently low noise pavement. Under the proposal only this section will have low noise pavement.

The proposal is predicted to increase noise by no more than 1dBA at any receiver in this NCA.

Noise is predicted to be acute at six receivers in NCA2, located within the two groups of receivers shown with possible barriers in Figure 9-1.

Figure 9-1 Possible Barriers in NCA2



In the northern group there are four receivers with acute noise levels, and two with noise levels that are not acute but exceed the *RNP* criteria. A 430 metre barrier was analysed as potential noise mitigation of this group. Barrier heights from three metres to eight metres were analysed as shown in Figure 9-2. The figure plots Marginal Benefit Value (MBV) and Total Noise Benefit per Unit Area (TNBA) against the height of barriers.

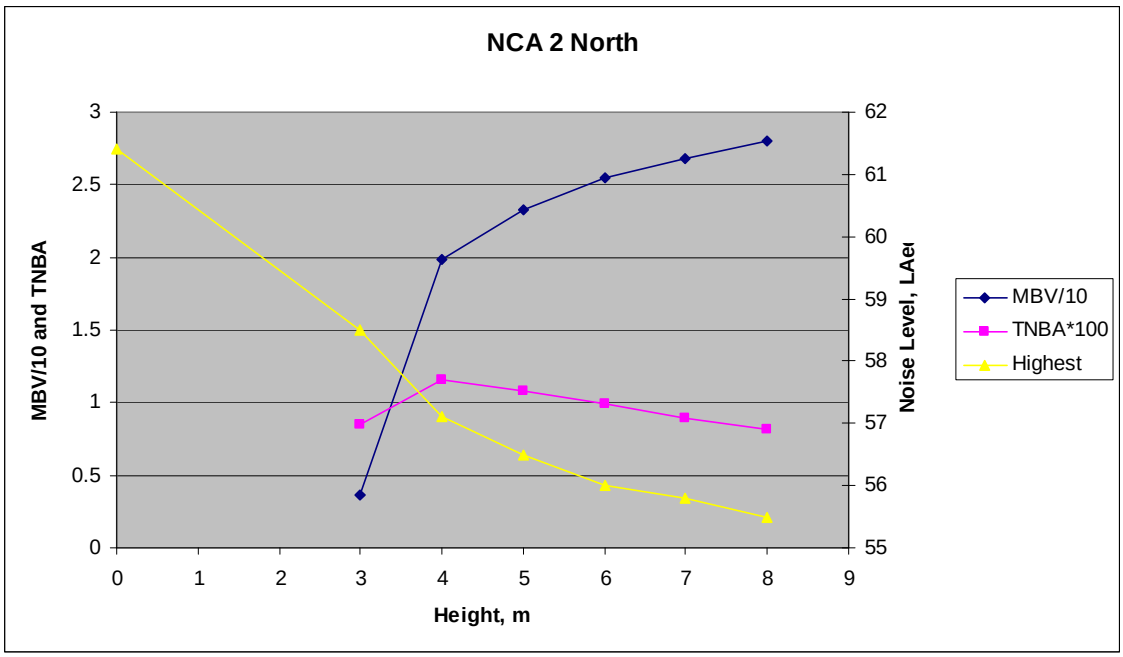
The attenuations achieved at the most affected receiver (N2-17) range from 3.1dBA to 6.4dBA as shown in Table 9-1. Although the noise is not reduced to the *RNP* criterion by even an eight metre barrier, note that with a three metre barrier, no receivers are predicted to have acute noise levels. With a four metre noise barrier the predicted noise levels at receivers N2-3, N2-4.

Figure 9-2 shows a peak in the TNBA curve at a barrier height of four metres, indicating the height with greatest cost effectiveness.

Table 9-1 NCA 2 North – Barrier Attenuation at Most Affected Residence

Height	Attenuation at N2-17
3	3.1
4	4.6
5	5.3
6	5.8
7	6.1
8	6.4

Figure 9-2 *ENMM* analysis of Barrier at North of NCA 2



The southern group in Figure 9-1 has two receivers with acute noise levels, and two with noise levels exceeding the *RNP* criteria. A 340 metre barrier was analysed as potential noise mitigation of this group. Barrier heights from three metres to eight metres were analysed, and the results are shown in Figure 9-3. Attenuations at the most affected receiver ranged from 4.5dBA to 9.8dBA as shown in Table 9-2.

Although the *RNP* noise criterion is not achieved at the most affected receiver, it is achieved at other receivers with a noise barrier of four metres. At a height of four metres, no receiver is predicted to have acute noise levels. Figure 9-3 shows a peak in the TNBA curve at a barrier height of four metres, indicating the height with greatest cost effectiveness.

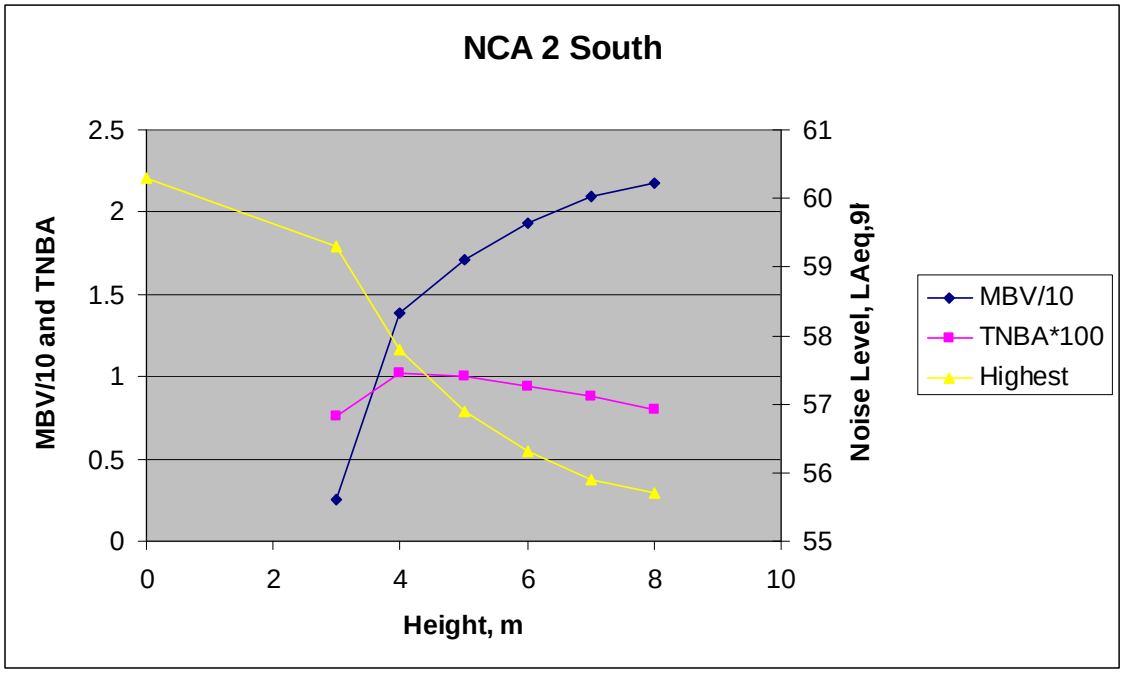
Concerning receivers where noise levels were predicted to be acute without mitigation:

- With four metre noise barriers, the predicted noise levels at receivers N2-3, N2-4, N2-14, N2-16, N2-17 and N2-18 are not acute.
- With four metre noise barriers, no receivers are predicted to be acute.

Table 9-2 NCA 2 South – Barrier Attenuation at Most Affected Residence

Height	Attenuation at N2-4
3	4.5
4	6.5
5	7.8
6	8.8
7	9.5
8	9.8

Figure 9-3 *ENMM* analysis of Barrier at South of NCA 2



9.5 NCA 3 Mitigation

The receivers considered are east of the M1 Pacific Motorway and near Alison Road. Most of them are north of Alison Road; however, the barrier analysed also extends to include a section 80m south of Alison Road, as shown on Figure 9-4. The barrier south of Alison Road picks up two receivers with acute noise levels, and three others with noise levels exceeding the *RNP* criteria, on the southern side of Alison Road. The figure also shows acute receivers west of the M1 Pacific Motorway: those receivers are in NCA 4 and mitigation to them is discussed in Section 9.6.

A range of barrier heights from three metres to eight metres was analysed according to the method of Practice Note IV of the *ENMM*, and the result is shown on Figure 9-4.

The Highest Noise Level, compared to the right hand y axis scale, shows the noise level at the most impacted receiver as the barrier height increases.

Peaks in the TNBA curve correspond to barrier options with the greatest overall cost-effectiveness, compared with the other barrier height options being considered. In this case there are no pronounced peaks.

At three metres the barrier provided 4dBA mitigation at the most affected residence, and at five metres the barrier provided 7dBA mitigation.

Concerning receivers near this barrier where noise levels were predicted to be acute without mitigation:

- With a four metre noise barriers the predicted noise levels at receivers N3-1, N3-2, N3-12, N3-20, N3-21, N3-22, N3-24, N3-26 are not acute.
- Noise levels at receivers N3-27, N3-28, N3-29 and N3-30 remain acute.

Table 9-3 NCA 3 – Barrier Attenuation at Most Affected

Height	Attenuation at N3-22
3	1.5
4	2.7
5	3.6
6	4.3
7	4.9
8	5

Figure 9-4 Possible Barrier for NCA 3

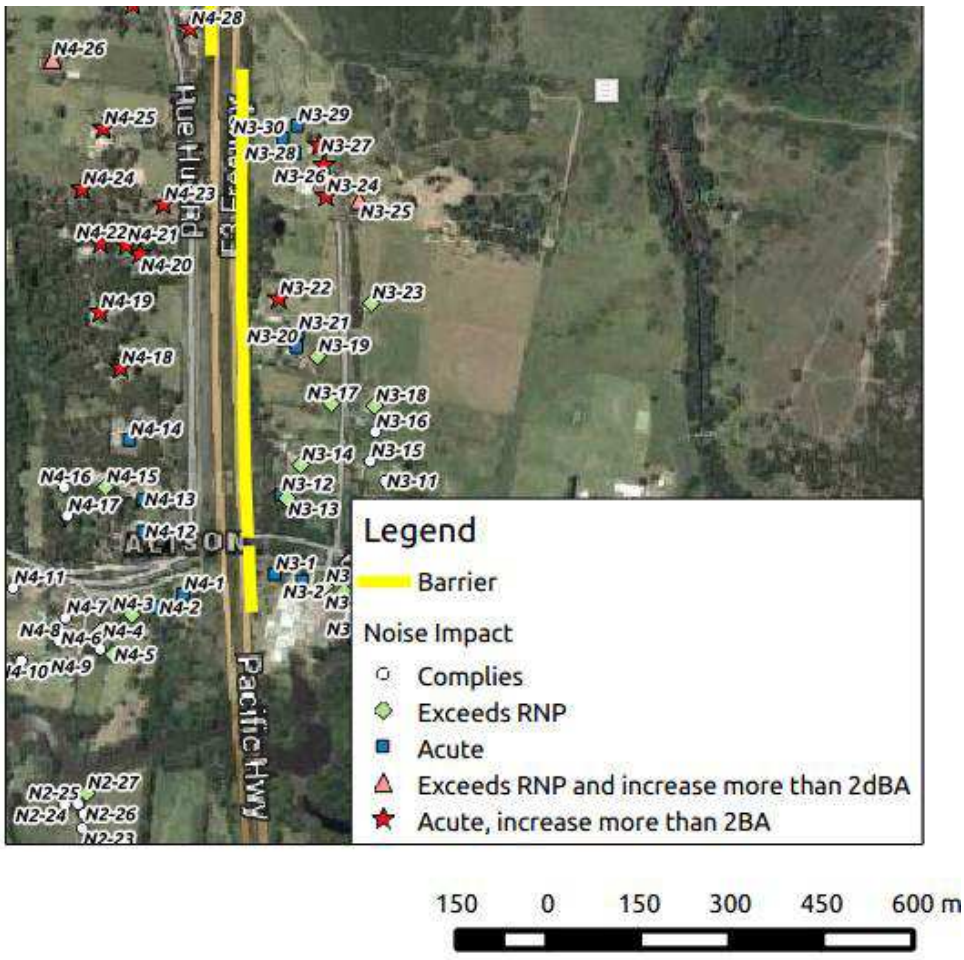
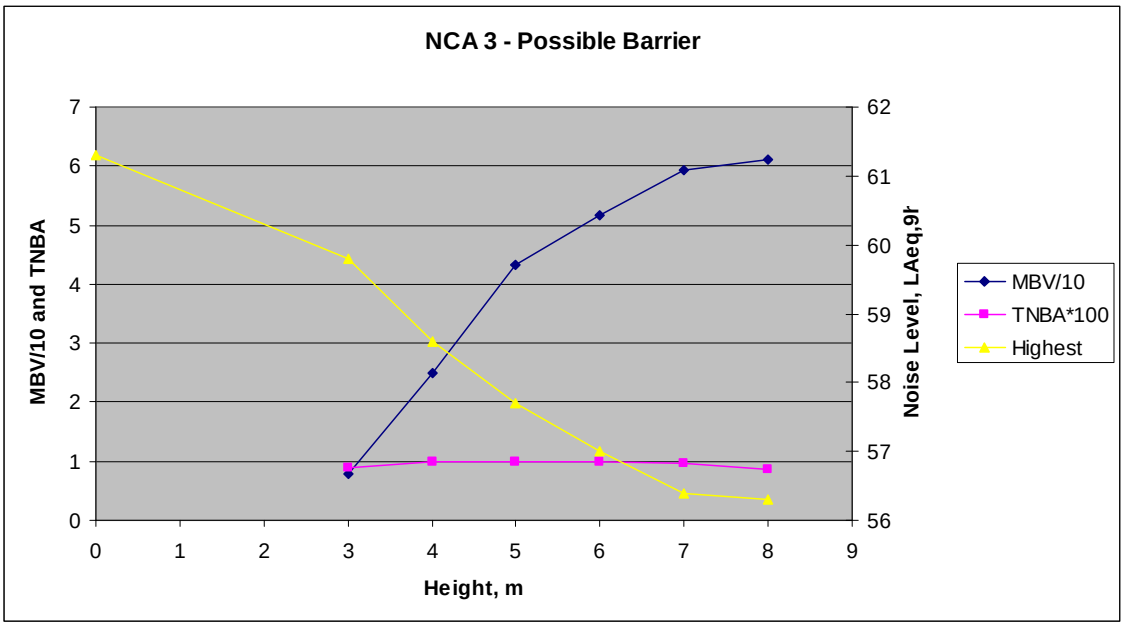


Figure 9-5 *ENMM* analysis of Barrier North East of Alison Road (Long Option)

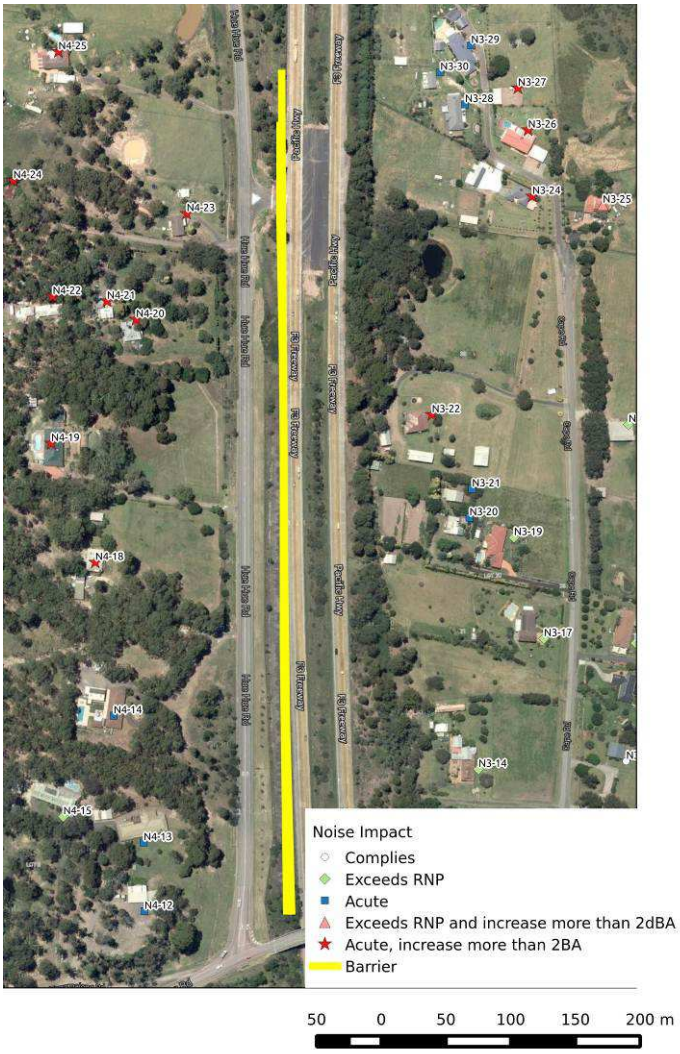


9.6 Possible Barrier in NCA 4 – North & West of Alison Road

North and west of Alison Road in NCA 4 there is a group of receivers with acute noise levels, as shown on Figure 9-6. These receivers are elevated and distant from the road, leading to mitigation of less than 1dBA using barriers up to seven metres. Therefore, a barrier is not recommended at this location.

No further noise barrier investigation was performed at this location.

Figure 9-6 Possible Barrier North of Alison Road



9.7 Possible Barrier in NCA 4 – Hue Hue Road

There is a low density group of six receivers with acute noise levels as shown on Figure 9-7.

For this group, a barrier 450 metres long was assessed on the west of the north bound carriageway.

A range of barrier heights from three metres to eight metres was analysed according to the method of Practice Note IV of the *ENMM*, and the result is shown on Figure 9-8.

The insertion loss at other heights is shown in Table 9-4. Although an insertion loss of 9dBA was found using an eight metre barrier, five of the six receivers still have acute noise levels.

Table 9-4 Barrier Attenuation at Hue Hue Road

Height	Insertion Loss, dBA at Most Affected (N4-29)
3	3
4	5
4.5	6
5	7
5.5	8
6	8
6.5	8
7	9
7.5	9
8	9

Figure 9-7 Possible Barrier at Hue Hue Road

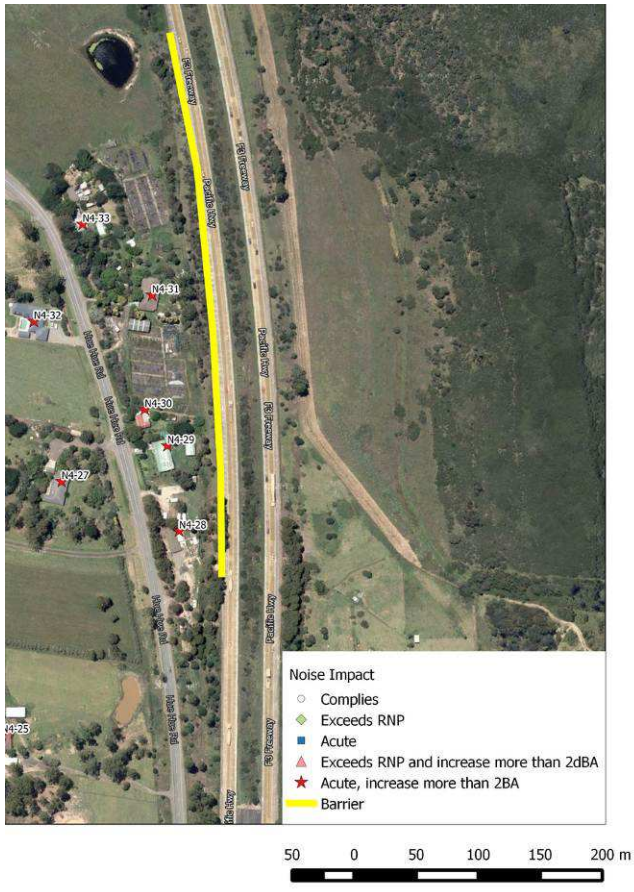
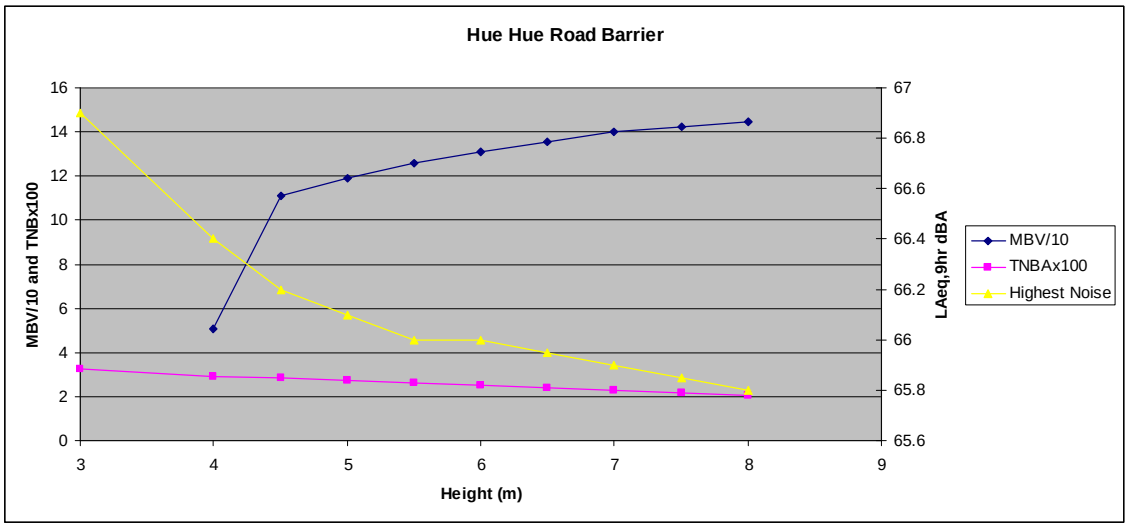


Figure 9-8 *ENMM* analysis of Barrier North East of Alison Road



9.8 Sparks Road Northbound Off-Ramp

A group of 8 acute receivers are shown on Figure 9-9. Although the houses are not closely grouped, their relation to the off ramp presents an opportunity to investigate the effectiveness of a barrier for the group. One of the receivers (N4-86) includes a childcare facility as discussed in Section 10.

A range of barrier heights from five metres to eight metres was analysed according to the method of Practice Note iv of the *ENMM*, and the result is shown on Figure 9-10.

The Highest Noise Level, compared to the right hand y axis scale, shows the noise level at the most impacted receiver as the barrier height increases. The MBV and TNBA curves do not show peaks.

The insertion loss at the most affected receiver, N4-74, is shown in Table 9-5 for the analysed barrier heights.

Concerning receivers near the barrier where noise levels were predicted to be acute without mitigation:

- With a 5.5 metre noise barrier the predicted noise levels at receivers N4-76, N4-82, N4-83, N4-84 and N4-85 are not acute.
- With a 5.5 metre noise barrier noise levels at receivers N4-74 and N4-75 remain acute.

Figure 9-9 Possible Barrier at Sparks Road Northbound Off-Ramp

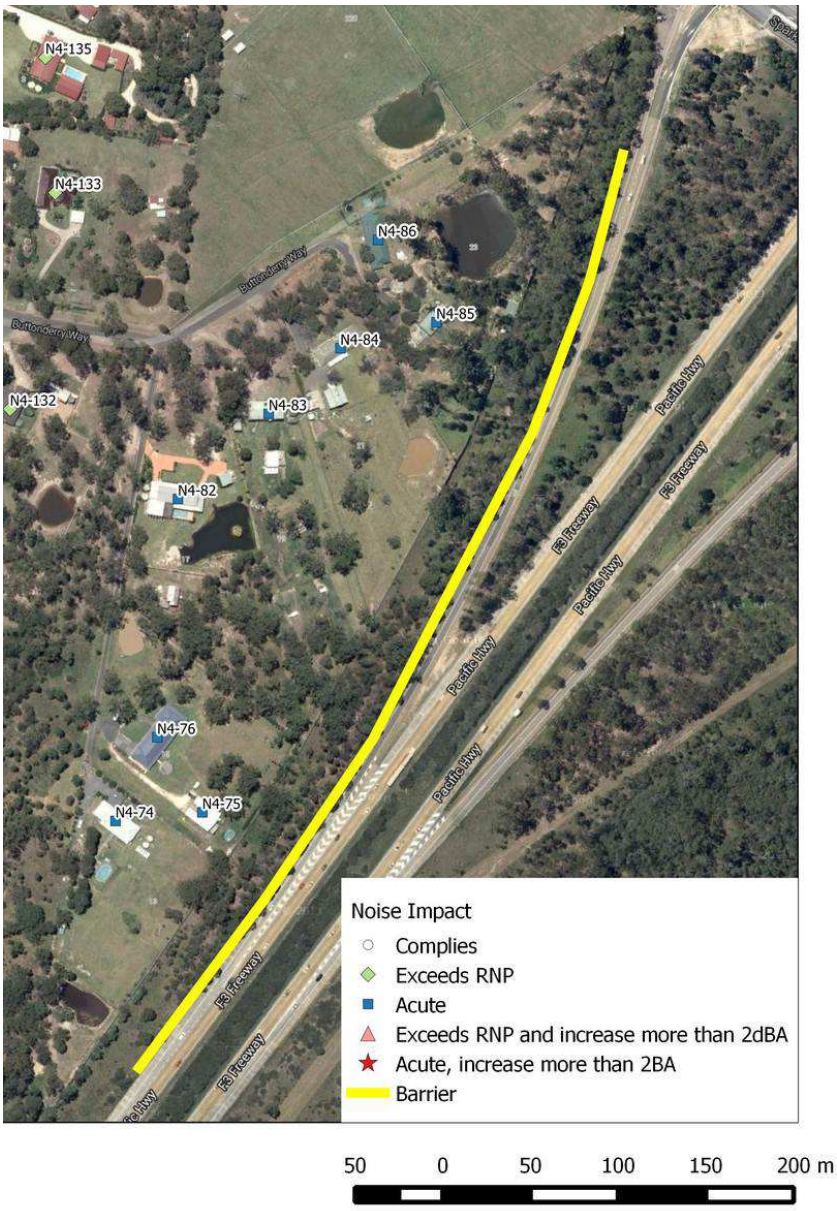
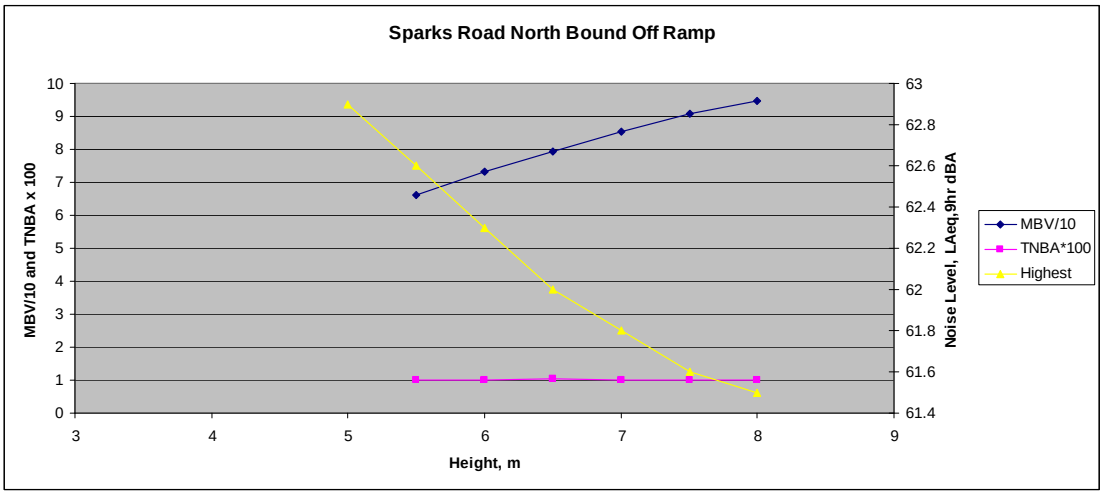


Table 9-5 Hue Hue Road Barrier – Insertion Loss at Most Affected Receiver

Height	Insertion Loss, dBA at Most Affected (N4-74)
5	5
5.5	6
6	6
6.5	7
7	7
7.5	7
8	8

Figure 9-10 *ENMM* analysis of Barrier on Northbound Exit Ramp



9.9 Architectural Treatment

At receivers where the *RNP* criteria are exceeded and the noise is not predicted to be acute or more than 2dBA higher than under the "no-build" option, it is not considered feasible and reasonable to consider architectural treatment.

At receivers where *RNP* criteria are exceeded and the predicted level is acute or more than 2dBA higher than under the "no-build" option, and mitigation of road noise at source is not considered feasible and reasonable, architectural treatment should be considered.

There are 69 receivers with noise levels predicted to be acute under the "build" option. These are spread along the route, with a few low density clusters as discussed in the barrier analyses in Section 9. The receivers are, by NCA, are presented in Table 9-6.

Table 9-6 Receivers with Acute Noise Levels

NCA	Receivers with acute levels that would not be mitigated by barriers	Receivers with acute noise levels that may be mitigated by barriers if considered feasible and reasonable.
1	N1 30, N1 33, N1 375	
2		N2 3, N2 4, N2 14, N2 16, N2 17, N2 18 (4m barrier)
3	N3 27, N3 28, N3 29, N3 30, N3 31, N3 35, N3 36, N3 37, N3 41, N3 42	N3 1, N3 2, N3 12, N3 20, N3 21, N3 22, N3 24, N3 26 (4m barrier)
4	N4 1, N4 2, N4 12, N4 13, N4 14, N4 18, N4 19, N4 20, N4 21, N4 22, N4 23, N4 24, N4 25, N4 27, N4 28, N4 29, N4 30, N4 31, N4 32, N4 33, N4 34, N4 35, N4 36, N4 37, N4 44, N4 59, N4 60, N4 61, N4 70, N4 74, N4 75, N4 79, N4 86, N4 139	N4 76, N4 82, N4 83, N4 84 and N4 85 (5.5m barrier at Sparks Road Off Ramp)
5	N5 1, N5 4, N5 5	
6		

In addition, there are four receivers with noise levels predicted to be above then *RNP* criterion but not acute, and to be increased by more than 2dBA due to the "build" option. They are:

- N3-25, N3-45, N4-26 and N4-38.

The receivers N3-25 and N3-45 would not require architectural treatment if the barrier discussed in Section 9.5 was considered reasonable and feasible.

At these receivers acoustic architectural treatment should be considered where the provision of barriers, as discussed above, is not feasible or not reasonable.

Depending on the exceedance of the target criteria, the following procedures are typically proposed:

- 1 – 10dBA. Air-conditioning with fresh air ventilation, check window seals and replace if necessary.
- >10dBA. Air-conditioning with fresh air ventilation, check window seals and replace if necessary. Where receivers are in suitable condition, upgrade glazing and doors exposed to road noise.

It is sometimes possible to provide localised shielding at a receiver, for example by building a wall around a courtyard or garden. This has the benefit of reducing noise at a façade, thus reducing requirements for treatment to the house itself, and providing outdoor areas with satisfactory noise levels.

The suitability of such treatment is decided on a case by case basis, and would be negotiated with property owners.

Appendix B lists predicted noise levels at all receivers. The final column indicates whether the receiver could be considered for mitigation due to an increase of more than 2dBA, or acute noise levels.

10 NON RESIDENTIAL NOISE SENSITIVE RECEIVERS

Two non-residential noise sensitive receivers were identified.

The Woodbury Park Community Centre is in NCA 1 on Woolmers Crescent, Mardi. The centre has interview rooms and activity rooms and the noise criterion is $L_{Aeq,1hr}$ 40dBA (internal) when the rooms are in use. The predicted $L_{Aeq,1hr}$ daytime noise is 57dBA external.

With windows closed the noise levels would comply in all rooms at the centre. The main windows at the centre face do not face the M1 Pacific Motorway. The predicted external noise levels on the façade facing away from the M1 Pacific Motorway is $L_{Aeq,1hr}$ 40-45dBA. The predicted noise level at the side facades is 53dBA. With windows open, the predicted levels in the centre are 30-43dBA. Hence there may be minor (3dBA) exceedances in some rooms if used at peak traffic times.

A childcare facility operates at 23 Buttonderry Drive, Jilliby (Receiver N4-86). The daytime noise level is predicted to be 65dBA in 2029. This is 10dBA above the recommended playground noise level, and 15dBA above the external goal for childcare facilities to provide suitable indoor levels. The change in noise level due to the proposal would be less than $L_{Aeq,1hr}$ 2dBA and is considered barely perceptible. The facility is one of the receivers considered in the analysis of the barrier beside the northbound off ramp in Section 9.8, and mitigation should also be considered for the childcare facility.

Other mitigations that could be considered for the childcare facility include a noise wall around a play area, or architectural treatment of care provision areas.

11 CONSTRUCTION NOISE ASSESSMENT

11.1 Construction Procedure

The Construction Methodology Report, June 2013, from AT&L and Associates, describes options for construction methodology.

The construction period for the proposal is expected to be approximately 2½ years.

The existing 9.2 kilometres of concrete carriageway will be removed to enable the new pavement to be constructed. Demolition of the concrete carriageway will be by concrete saw and rock breaker. A crusher plant will process the concrete at one of the site compounds to be determined.

The existing 2.1 kilometre section of asphalt pavement will be replaced, but the road base will not require complete demolition.

Construction of both sections will require stages in which traffic lanes are diverted to contraflows to allow activities to occur. Staging options are discussed in the Construction Methodology Report and are yet to be finalised. The details of the staging determine the timing of noise impact at receivers and presents opportunities for noise mitigation. For example, when construction occurs near receivers, the noisiest activities should occur during the daytime wherever reasonably practicable.

Construction activities continue for approximately one kilometre east along Sparks Road. This area is predominately industrial; however, there are two isolated receivers on the northern side of Sparks Road. Those receivers are more than 100 metres from the road, and appear to be commercial as well as residential. They may be impacted if there are night works on Sparks Road.

Other works at Sparks Road interchange include a new north bound on ramp and a pedestrian bridge. Works on these aspects will be more than 200 metres from the nearest receiver, but may cause impact if work during night time hours is necessary.

A new off ramp to the Doyalson Link Road is also proposed. This is isolated and not expected to cause major impact.

11.2 Construction Noise Goals

The NSW EPA *Interim Construction Noise Guideline (ICNG)* recommends the following objectives:

Recommended standard hours of work

- Monday to Friday 7.00am to 6.00pm
- Saturday 8.00am to 1.00pm
- No work on Sundays or Public Holiday

Noise goals are detailed in Table 11-1.

Table 11-1 Noise at Receivers using Quantitative Assessment

Time of Day	Management Level $L_{Aeq,(15min)}$ *	How to Apply
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Noise affected RBL + 10dB(A)	• The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured $L_{Aeq,(15min)}$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to minimise noise. • 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.
Recommended Standard Hours: Monday to Friday 7am to 6pm Saturday 8am to 1pm No work on Sundays or Public Holidays	Highly noise affected 75dB(A)	• The highly noise affected level represents the point above which there may be strong community reaction to noise. • Where noise is above this level, the 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 standard hours	Noise affected + 5dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5dBA above the noise affected level, the proponent should negotiate with the community.

11.3 Proposed Working Hours

In accordance with the *ICNG* some construction works are typically restricted to the hours of:

- Monday to Friday 7.00am to 6.00pm.
- Saturday 8.00am to 1.00pm.
- No construction work is to take place on Sundays or Public Holidays.

It is proposed that construction may occur on a 24-hour basis wherever there is sufficient justification for out-of-hours work, or noise impact is negligible or manageable.

Works that are justified on safety or other reasons would be assessed on as they occur.

Concerning out-of-hours works that could occur when noise emission is negligible or manageable, the work day has been broken into the following hours to allow maximum flexibility in scheduling:

- Evening (6.00pm-10.00pm);
- Night time (10.00pm-7.00am);
- Early Morning (6.00am-7.00am); and
- Early Evening (6.00pm-8.00pm).

Early Morning and Early Evening are "shoulder periods". Background levels and noise management levels, based on background noise plus 5dBA, have been set for each period.

11.3.1 Justification for Working Hours

Traffic Flow

These extended hours are intended to achieve the shortest construction duration achievable in order to achieve the lowest level of impact on the M1 Pacific Motorway traffic.

Concrete Paving & Saw Cutting

Roads and Maritime has specifications for placement and cutting of concrete pavement that relate to temperature and rainfall. While construction details have not been finalised, it is probable that the techniques to be used will require work to be carried out during non-standard hours.

Noise Impact

Some activities can be carried out at specific locations without causing noise impact. For other combinations of location and activity the noise impact is minimal to moderate (say less than 5dBA above the management level), and it occurs at few receivers. There may be occasions when such impacts are considered reasonable and manageable.

11.4 Management Levels

To assess construction noise across all NCAs based on these three measurement locations, a Rating Background Level (RBL) was assigned to each receiver in order to set noise management levels. At receivers close to the M1 Pacific Motorway, the RBL is related to traffic noise emission. Moving away from the M1 Pacific Motorway, noises other than traffic begin to influence the RBL.

The RBLs for the proposed construction periods are shown in Table 11-2, based on the measured RBLs at the traffic noise model validation points. Location L2 was close to the M1 Pacific Motorway, and represents the typical maximum RBL at any location.

The measurement location in L1 was chosen to reflect the noise environment at the majority of houses in NCA 1. Those houses are generally in the Mardi suburban area and are shielded by topography from the M1 Pacific Motorway. Some isolated receivers are closer to the M1 Pacific Motorway, and in unshielded locations. The closest isolated receivers are at similar distances from the M1 Pacific Motorway as the background measurement location in L2. However, the road surface for the entire length of NCA 1 is open graded asphalt, and the road surface in L2 is concrete. It was assumed that the maximum RBL in NCA 1 was 5dBA lower than the measured RBL at L2 due to the lower emission from road sections paved with OGAC. While there is no direct relation between traffic noise emission and RBL, this procedure is considered reasonable for setting RBLs for construction noise assessment.

The noise environment at isolated receivers in NCA 2 would be similar to that in NCA 1, and the same procedure was used to set RBLs at each receiver location.

For NCAs 3, 4, 5 and 6 the maximum RBL was taken from L2 and the minimum RBL was taken from L3. At intermediate points the RBL was scaled between L2 and L3 based on the predicted traffic noise from the highway.

The minimum and maximum RBLs for each NCA, and the derived Noise Management Levels for each working period, are given in Table 11-3.

Table 11-2 Rating Background Levels

Rec.	Address	RBL / Management Level	Period				
			Day	Evening	Night	Early Morning	Early Evening
L1	10 Woolmers Crescent, Mardi	RBL dBA	46	46	38	41	46
L2	93 Hue Hue Road, Alison	RBL dBA	68	64	46	54	66
L3	34 Holloway Drive, Jilliby	RBL dBA	51	49	42	48	51

Table 11-3 Construction Noise Management Levels

Rec		RBL/ Manage. Level	Period					
			Early Morning	Day	Evening	Night	Early Morning	Early Evening
NCA 1 and NCA 2	RBL	Min	41	46	46	38	41	46
		Max	49	63	59	41	49	61
	Management Level	Min	46	56	51	43	46	51
		Max	54	73	64	46	54	56
NCA 3, NCA 4, NCA 5, NCA 6	RBL	Min	48	51	49	42	48	51
		Max	54	68	64	46	54	66
	Management Level	Min	53	61	54	47	53	56
		Max	59	78	69	51	59	71

11.5 Mobile Plant Source Noise Levels

Sound levels of typical equipment are listed in Table 11-4. The Table gives both Sound Power Level (SWL) and Sound Pressure Level (SPL) at seven metres for the equipment. SWL is independent of measurement position. Verification of plant noise is typically done by measuring the SPL at seven metres.

Table 11-4 Typical Construction Plant Sound Levels

Plant	Sound Power Level (dBA)	Sound Pressure Level at 7m (dBA)
Front End Loader	111	86
Grader	107	82
Smooth Drum Roller	107	82
Spoil, Materials or Concrete Truck	109	84
Tower Crane or Mobile Crane	105	80
Truck mounted Shotcrete Pump	106	81
Excavator or Bobcat	107	82
Concrete Pump	105	80
Concrete Vibrator	103	78
Concrete Cutter	109	84
Large Bored Drilling Rig	112	87
Small Bored Drilling Rig	108	83
Powered Hand Tools	109	84
30t Excavator operating with Hydraulic hammer	122	97
Rock Saw	116	91
Water Cart	110	85
Kerbing Machine	99	74
Chainsaw	106	81
Forklift	106	81
Mulcher	106	81
Articulated Dump Truck	113	88
Handheld Jackhammer	113	88
Air Compressor (Power Tools)	98	73
Asphalt Paving Plant	114	89

Based on the above, noise from some example activities has been predicted. While noise has not been predicted from every activity shown in Table 11-5, the stages are considered representative of the majority of activities. Typical worst-case activities are presented in the table. Some activities with low impact, such as traffic control installation and line marking, have not been presented.

Sawcutting, hammering and piling activities include a 5dBA adjustment for impulsiveness as required by the *ICNG*.

The approximate duration of activities is included in Table 11-5. The Construction Methodology Report notes that the options for construction of the complete project vary from 24 months to 30 months.

Table 11-5 Calculation of Total Sound Power Level (SWL)

Activity	Typical Equipment Used	Approximate Duration	Total $L_{Aeq,15min}$ Sound Power Level (SWL) used for Calculations
Site establishment	Excavators, Chainsaws, Mulching plant and Chipper, Cranes, Generators	4 months	110
Removal of corridor vegetation	25t Excavator, Mulcher, Chainsaw, Trucks, Grader, Combination Backhoe FEL		110
Earthworks	Road Trucks, Compactor, Grader, Steel, multi tyred and Vibratory Rollers, Concrete pour, including Trucks and Concrete Vibrator, Asphalt paving plant, Backhoe, Sweeper, Compressors, Generators, (Excavator with hammer)	12 months	114
Earthworks (with hammer)	Excavator with hammer		125
Piling	Bored or driven piling rigs		115 (bored) 125 (driven)
Bridge works	Piling rigs, cranes		115 125 (possible when piling)
Paving	Road Trucks, Compactor, (Jackhammers), Steel, multi tyred and vibratory Rollers, Concrete Pour, including Trucks & Concrete Vibrator, Asphalt paving plant, Backhoe, (Concrete saw), Profiler, Sweeper, Compressors, Generators	12 months	110 Paving 115 Sawcutting
Landscaping of exposed areas	Excavator/Bobcat, Powered Hand Tools, Air Compressor, Spoil, Material or Concrete truck, Jackhammer (for concrete embedded parts)	6 months	110

11.6 Noise Impact during Standard Hours

The noise level experienced at any receiver along the route will depend upon many factors, such as distance to the construction site, shielding between the site and the receiver, and the activity occurring at the construction site. There would typically be a 20dBA range of noise levels depending on the construction activity taking place; the quietest activities include site preparation, and the noisiest activity would be earthworks using rock breakers. Further, noise levels would be quieter whenever the construction takes place in cut compared with that undertaken on fill.

As the construction site moves, receivers are typically not exposed to line of sight view of paving equipment for an extended period of time; however, there would be periodic exposure during different construction stages.

Noise impact at some receivers is therefore restricted to a limited time period.

The construction noise emission was predicted using the CadnaA software and based on the model used for road traffic noise assessment.

Table 11-6 shows the number of receivers where noise is predicted to exceed the criteria for various activities during standard hours. These receivers are spread along the 12.1 kilometre route, and the exceedance would not be for the full construction period.

In NCA 4, only one exceedance is predicted. However three receivers are predicted to have noise levels above 75dBA, the level the ICNG considers "highly noise affected". As the RBL at these receivers is 68dBA, the daytime management level is 78dBA, thus noise levels can comply while being considered "highly noise affected".

Table 11-6 Number of Receivers at which Construction Noise Guidelines are Predicted to be Exceeded during Standard Hours

NCA	Activity and Sound Power Level, L_{Aeq} dBA				
	Clearing or Paving	Earthworks	Sawcutting	Piling or Hammering	Landscaping
	110	114	115	125	110
1	1	2	4	16	11
2	0	1	1	22	0
3	0	0	0	0	0
4	0	0	0	1	0
5	0	0	0	0	0
6	0	0	0	0	0

11.7 Construction Noise Impact for Out-of-Hours Works

This section presents the potential noise impact of out-of-hours construction works. The tables below show the potential number of exceedances that could occur if out-of-hours work was done in every time period along the entire length of the project. As this is unlikely, the exceedances have been plotted for each time period in Appendix F. Those plots also show sections of the project where construction could be undertaken without causing noise impact.

Because work could be undertaken at night time, meteorological conditions should be considered. Noise propagation can be enhanced by meteorological conditions such as temperature inversions and wind. This is not discussed in the *ICNG*; however, the NSW *Industrial Noise Policy (INP)* states that if temperature inversions occur for 30% of the total night-time during winter, the impact of those inversions should be assessed. Given the potential duration of the works, the impact of temperature inversions will therefore be assessed. Concerning wind, as the project area is relatively flat it will be assumed that drainage winds from source to receiver not significant.

Data on temperature inversions are not available for the project area. Appendix F of the *INP* has percentage occurrences of F-class temperature inversions for the Hunter Valley. Data for the south-east Hunter Valley indicated that temperature inversions would occur for 25-30% of the time during winter. The impact of those inversions will therefore be assessed.

The exceedances are given in:

- Table 11-7 for evening exceedances. See also Pages 1 and 2 of Appendix F;
- Table 11-8 for night time (isothermal conditions) exceedances. See also Pages 3 and 4 of Appendix F;
- Table 11-9 for night time (temperature inversion conditions) exceedances. See also Pages 5 and 6 of Appendix F;
- Table 11-10 for early morning conditions. See also Pages 7 and 8 of Appendix F;
- Table 11-11 for early evening exceedances. See also Pages 9 and 10 of Appendix F.

Table 11-7 Number of Receivers at which Construction Noise Guidelines are Predicted to be Exceeded during Evening

NCA	Activity and Sound Power Level, L_{Aeq} dBA				
	Clearing or Paving	Earthworks	Sawcutting	Piling or Hammering	Landscaping
	110	114	115	125	110
1	4	7	8	68	4
2	1	8	9	31	1
3	0	0	0	20	0
4	0	0	0	31	0
5	0	0	0	2	0

Table 11-8 Number of Receivers at which Construction Noise Guidelines are Predicted to be Exceeded during Night Time – Isothermal Meteorological Conditions

NCA	Activity and Sound Power Level, L_{Aeq} dBA				
	Clearing or Paving	Earthworks	Sawcutting	Piling or Hammering	Landscaping
	110	114	115	125	110
1	16	25	31	177	16
2	21	25	27	31	21
3	9	18	22	44	9
4	17	32	39	151	17
5	2	2	2	7	2
6	0	0	0	1	0

Table 11-9 Number of Receivers at which Construction Noise Guidelines are Predicted to be Exceeded during Night Time – Temperature Inversion Meteorological Conditions

NCA	Activity and Sound Power Level, L_{Aeq} dBA				
	Clearing or Paving	Earthworks	Sawcutting	Piling or Hammering	Landscaping
	110	114	115	125	110
1	21	74	91	244	21
2	25	31	31	31	25
3	13	26	29	45	13
4	24	70	82	156	24
5	2	3	3	7	2
6	0	0	0	2	0

Table 11-10 Number of Receivers at which Construction Noise Guidelines are Predicted to be Exceeded during Early Morning

NCA	Activity and Sound Power Level, L_{Aeq} dBA				
	Clearing or Paving	Earthworks	Sawcutting	Piling or Hammering	Landscaping
	110	114	115	125	110
1	12	17	18	143	12
2	13	22	22	31	13
3	0	2	4	30	0
4	4	9	12	79	4
5	1	2	2	3	1
6	0	0	0	0	0

Table 11-11 Number of Receivers at which Construction Noise Guidelines are Predicted to be Exceeded during Early Evening

NCA	Activity and Sound Power Level, L_{Aeq} dBA				
	Clearing or Paving	Earthworks	Sawcutting	Piling or Hammering	Landscaping
	110	114	115	125	110
1	4	7	7	68	4
2	1	4	6	31	1
3	0	0	0	12	0
4	0	0	0	20	0
5	0	0	0	2	0
6	0	0	0	0	0

11.8 Construction Noise – Sleep Disturbance

For assessment of sleep disturbance from construction noise the *ICNG* refers to guidance in the EPA's *Environmental Criteria for Road Traffic Noise (ECRTN)*. The *RNP* supersedes the *ECRTN*; however, it contains a summary of the discussion of sleep disturbance.

While noting that sleep disturbance is poorly understood, the *ECRTN* recommends consideration of these points determined from research on sleep disturbance:

- Maximum internal noise levels below 50-55dBA are unlikely to cause awakening reactions; and
- One or two noise events per night, with maximum internal noise levels of 65-70dBA, are not likely to affect health and wellbeing significantly.

The noise reduction through a façade with windows open for ventilation is typically 10dBA (this applies to a window open area up to 5% of floor area, as required by the National Construction Code). So an external noise level of 65dBA corresponds to an internal level of 55dBA with windows open, and is unlikely to cause sleep disturbance. This is assessed at the façade.

Table 11-12 gives an indication of the number of receivers where the L_{A1} 65dBA level would be exceeded for two worst-case night time activities: concrete saw and hammering. This was determined from the CadnaA noise model of the alignment, and assuming the sound power levels as shown in the table. The table also gives an indication of the distance from the construction site where the noise level could exceed 65dBA, given a clear view of the construction site. The clear view assumption represents the worst-case distance, as most receivers would have only a limited view of the M1 Pacific Motorway, and would therefore be shielded to some extent from most construction activities.

Table 11-12 Receivers at which an External Noise Level of 65dBA would be Exceeded for Night Time Construction Activities

Criterion	Activity and Sound Power Level, $L_{A1,1min}$ dBA	
	Concrete Saw	Hammering
	120	125
Number of Receivers Predicted to exceed 65dBA	180	196
Typical distance where noise could exceed 65dBA, m[1]	300	400

Note 1 – Exceedances may occur at receivers within this distance, and with clear view of noise source.

12 NOISE FROM ANCILLARY SITES

Five potential ancillary sites are discussed in the Construction Methodology Report. Five potential sites were considered as shown on Figure 2-1. The sites are located at:

- Hue Hue Road
- McPherson Road
- Sparks Road
- Warnervale Airport
- Warren Road

The Construction Methodology Report, June 2013, from AT&L and Associates, considered the Hue Hue Road and Sparks Road sites most suitable for batch plants. Roads and Maritime are also considering the McPherson Road site for location of a batch plant. The sites may be used as equipment compounds and material storage areas.

12.1 Noise from Batch Plants

The source noise level of batch plants can be as low as 108dBA. The total noise is increased by operation of other equipment such as front end loaders and movement of concrete trucks.

A typical total level of $L_{Aeq,15min}$ 115dBA is considered reasonable to assess the potential for siting of batch plants – equivalent to one truck and one front end loader.

For sleep disturbance assessment a maximum level of L_{A1} 120dBA is assumed.

The noise criteria and indicative predicted noise levels at receivers are shown in Figure 12-1. The predictions indicate that sites at Hue Hue Road and Sparks Road would be suitable for batch plants. Although exceedances are predicted these could be mitigated, for example by:

- Selection of quieter plant
- Shielding of access roads
- Cessation of noisy activities during night time periods
- Siting noisy plant as far from receivers as practicable
- Specific mitigations will be designed at Detailed Design stage.

Table 12-1 Noise Assessment of Batch Plants – $L_{Aeq,15min}$

Site	Potential Use	Receivers Impacted	Noise Level at Receiver	Noise Management Levels (Early Morn/Day/Eve)	Approx. no. of Receivers Impacted w/out Mitigation (Early Morn/Day/Eve)	Impact
Sparks Road	Batch plant, compound	North side of Sparks Road, low density scattered houses. 200m from plant	40 55dBA	59/61/56 <100m from M1 Pacific Motorway 53/61/56 (at >100m from M1 Pacific Motorway	0/3/15	Batch plant will comply during daytime. Mitigation required for evening and night.
Hue Hue Road	Batch plant, compound	Scattered receivers between M1 Pacific Motorway and Hue Hue Road. Batch could be 400m from receivers	42 60dBA	59/61/56 <100m from M1 Pacific Motorway 53/61/56 (at >100m from M1 Pacific Motorway	0/3/12	Batch plant will comply during daytime. Mitigation required for evening and night.
Warren Road	Batch plant, concrete crushing and re processing	Three isolated receivers across Warren Road	40 55dBA	59/61/56 <100m from M1 Pacific Motorway 53/61/56 (at >100m from M1 Pacific Motorway	0/0/3	Batch plant will comply during daytime. Mitigation required for night.
McPherson Road	Batch plant	Approx 400m from the suburb of Mardi. Isolated receivers west of Motorway	45 55dBA	54/73/56 <100m from M1 Pacific Motorway 46/56/51 (at >100m from M1 Pacific Motorway	50/0/10	Batch plant may require mitigation for daytime, depending on location.

13 CONSTRUCTION NOISE MITIGATION

Reduction of construction noise for night time road works is often impractical. For example, if temporary screens are proposed, a significant part of the shift might be used in setting up and taking down noise control, thereby extending the duration of the proposal. Often it is appropriate to mitigate impacts in consultation with residents most affected by the noise.

Best practice mitigation and management measures will be used to minimise construction noise and vibration at noise sensitive receivers, and will be described in a construction noise management plan.

The plan would be in accordance with the *ENMM* and *ICNG*, and would include:

- Development of notification and negotiation procedure for receivers where noise impact cannot be mitigated to meet the criteria.
- A procedure assessing audibility at any sensitive receiver outside normal construction hours.
- A procedure for dealing with and responding to complaints.
- Development of noise monitoring and auditing procedures to verify compliance with the predicted noise impacts.

In general, management of noise and vibration requires attention to the following:

- Construction hours.
- Noise and vibration monitoring on site and at sensitive receivers.
- Training and awareness.
- Communication.
- Incident and emergency response.
- Non-conformance, preventative and corrective action.

Where appropriate the specific noise mitigation measures could include the following.

- Mitigation of specific noise sources, which may be possible by using portable temporary screens. Such screening could be set up during daytime for night work.
- Respite periods for noise from driven piling and rock breaking activities.
- Respite periods for all noisy activities.
- Maximising the offset distance between noisy plant items and sensitive receivers.
- Construction timetabling, in particular for works outside standard hours, to minimise noise impacts. This may include time and duration restrictions and respite periods.

- Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.
- Orienting equipment away from sensitive receivers.
- Carrying out loading and unloading away from sensitive receivers.
- Using dampened tips on rock breakers.
- Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks.
- Selecting plant and equipment based on noise emission levels.
- Using alternative construction methods.
- Providing alternative arrangements with affected residents such as temporary relocation.
- Selecting site access points and roads as far as possible away from sensitive receivers.
- Using spotters, closed circuit television monitors, "smart" reversing alarms, or "squawker" type reversing alarms in place of traditional reversing alarms.
- Education and training of site staff is necessary for satisfactory implementation of noise mitigation measures. Education and training strategies should focus on:
    - Site awareness training / environmental inductions that include a section on noise mitigation techniques / measures to be implemented throughout the proposal.
    - Ensuring work occurs within approved hours.
    - Locating noisy equipment away from sensitive receivers.
    - Using noise screens for mobile plant and equipment.
    - Ensuring plant and equipment is well maintained and not making excessive noise.
    - Turning off machinery when not in use.

The potential noise reduction that can be achieved by noise mitigation measures are shown in Table 13-1.

Table 13-1 Noise Mitigation Measures

Management Measure	Anticipated Noise Reduction, dBA
Administrative Controls	
Operate during approved hours	N/A
Undertake regular noise monitoring to determine the impact of operating plant on sensitive receivers	N/A
Appropriate training of onsite staff	N/A
Undertake community consultation and respond to complains in accordance with established project procedures	N/A
Turning off machinery when not in use	0 5
Respite periods for pile drivers and rock breakers	N/A
Engineering Controls	
Portable temporary screens	5 10
Screen or enclosure for stationary equipment	10 15
Maximising the offset distance between noisy plant items and sensitive receivers.	3 6
Avoiding using noisy plant simultaneously and/or close together, adjacent to sensitive receivers.	2 3
Orienting equipment away from sensitive receivers.	3 5
Carrying out loading and unloading away from sensitive receivers.	3 5
Using dampened tips on rock breakers.	3 6
Using noise source controls, such as the use of residential class mufflers, to reduce noise from all plant and equipment including bulldozers, cranes, graders, excavators and trucks	5 10
Selecting site access points and roads as far as reasonably practicable away from sensitive receivers	3 6
Using spotters, closed circuit television monitors, "smart" reversing alarms, or "squawker" type reversing alarms in place of traditional reversing alarms	2 5
Employ non noise generating structures such as site offices, storage sheds, stockpiles and tanks as noise barriers	5 10

14 ASSESSMENT OF CONSTRUCTION VIBRATION

14.1 Criteria

Impacts from vibration can be considered both in terms of effects on building occupants (human comfort) and the effects on the building structure (building damage). Of these considerations, the human comfort limits are the most stringent. Therefore, for occupied buildings, if compliance with human comfort limits is achieved, it will follow that compliance will be achieved with the building damage objectives.

14.1.1 Human Comfort

The EPA's *Assessing Vibration: A Technical Guideline* provides acceptable values for continuous and impulsive vibration in the range 1-80Hz. Both preferred and maximum vibration limits are defined for various locations and are shown in Table 14-1.

Table 14-1 Preferred & Maximum Peak Particle Velocity (PPV) Values for Continuous and Impulsive Vibration

Location	Assessment Period [1]	Preferred Values	Maximum Values
Continuous Vibration			
Critical areas	Day or night time	0.14	0.28
Receivers	Daytime	0.28	0.56
	Night time	0.20	0.40
Offices, schools, educational institutions and places of worship	Day or night time	0.56	1.1
Workshops	Day or night time	1.1	2.2
Impulsive Vibration			
Critical areas	Day or night time	0.14	0.28
Receivers	Daytime	8.6	17.0
	Night time	2.8	5.6
Offices, schools, educational institutions and places of worship	Day or night time	18.0	36.0
Workshops	Day or night time	18.0	36.0

Note 1 – Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.

These limits relate to a long-term (15 hours for daytime), continuous exposure to vibration sources. Where vibration is intermittent, a vibration dose is calculated and acceptable values are shown in Table 14-2.

Table 14-2 Acceptable Vibration Dose Values for Intermittent Vibration ($m/s^{1.75}$)

Location	Daytime (1)		Night Time (1)	
	Preferred Value	Maximum Values	Preferred Value	Maximum Value
Critical areas	0.10	0.20	0.10	0.20
Receivers	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note 1 – Daytime is 7.00am to 10.00pm and night time is 10.00pm to 7.00am.

14.1.2 Building Damage

In regard to potential building damage, German Standard DIN 4150 (Table 1) shows guideline values for short-term vibration for commercial buildings, houses and heritage buildings which are dependent on the frequency of vibration. The recommended vibration level for sensitive heritage buildings ranges from 3 to 10mm/s, and 5 to 20mm/s for dwellings.

14.2 Source Levels of Vibration

Table 14-3 provides some estimated vibration levels at a range of distances from the various construction activities.

Table 14-3 Typical Vibration Emission Levels from Construction Plant

Activity	PPV Vibration Level (mm/s) at Distance		
	10m	20m	30m
Concrete Sawing	0.5	0.3	0.2
4 Tonne Vibratory Roller (High)	2.0 2.4	0.4 1.2	0.2 0.8
Hydraulic Hammer (30t)	3	1.5	1.0

14.3 Vibration Levels at Residential Receivers

14.3.1 Human Comfort

The minimum distance identified from any house to the existing carriageway is 40m, and most houses are more than 100m away. Distance from houses to work areas will therefore be at least 40m, and typically more than 100m.

For works other than those requiring hydraulic hammers or vibratory rollers, the vibration is predicted to be below the criteria for human comfort at all receivers.

For work using a vibratory roller, work within 60m may cause vibration levels exceeding the criterion for continuous vibration (the lowest criterion is 0.2mm/s for night time continuous). In general, any work near a receiver would be temporary and intermittent. Even if the vibration level is above the criterion for continuous vibration, it may not exceed the criterion for intermittent vibration. This will depend on the duration of the activity and the number of repetitions through the work period.

For work using a hydraulic hammer, work within 80m may cause vibration levels exceeding the criterion for continuous vibration (the lowest criterion is 0.28mm/s for night time). The impacts are expected to be temporary as the construction site moves away from the residential areas. If vibration is expected to exceed the criteria, residents should be informed.

14.3.2 Building Damage

As construction will usually be more than 40m from houses, vibration levels will be below the criteria for building damage.

The vibration levels of this proposal will not result in levels that cause damage to buildings.

14.3.3 Vibration Levels at Heritage Structures

Figure 14-1 shows the location of heritage structures near the proposal (from Figure 2.1 of Report *M1 Pacific Motorway Widening – Tuggerah to Doyalson: Historic Heritage Impact Assessment*, Australian Museum Business Services, Draft June 2013).

The structures are:

- Jilliby Cemetery
- Alison Homestead – a homestead complex
- Former Wyong Dairy. A complex of buildings that has been adapted to house several commercial ventures including a fitness centre, a veterinarian, a café and a processed food factory.
- Road Bridge over Deep Creek
- Dwelling at 30 Mardi Road
- Old Maitland Road
- Felton Matthews Survey Tree

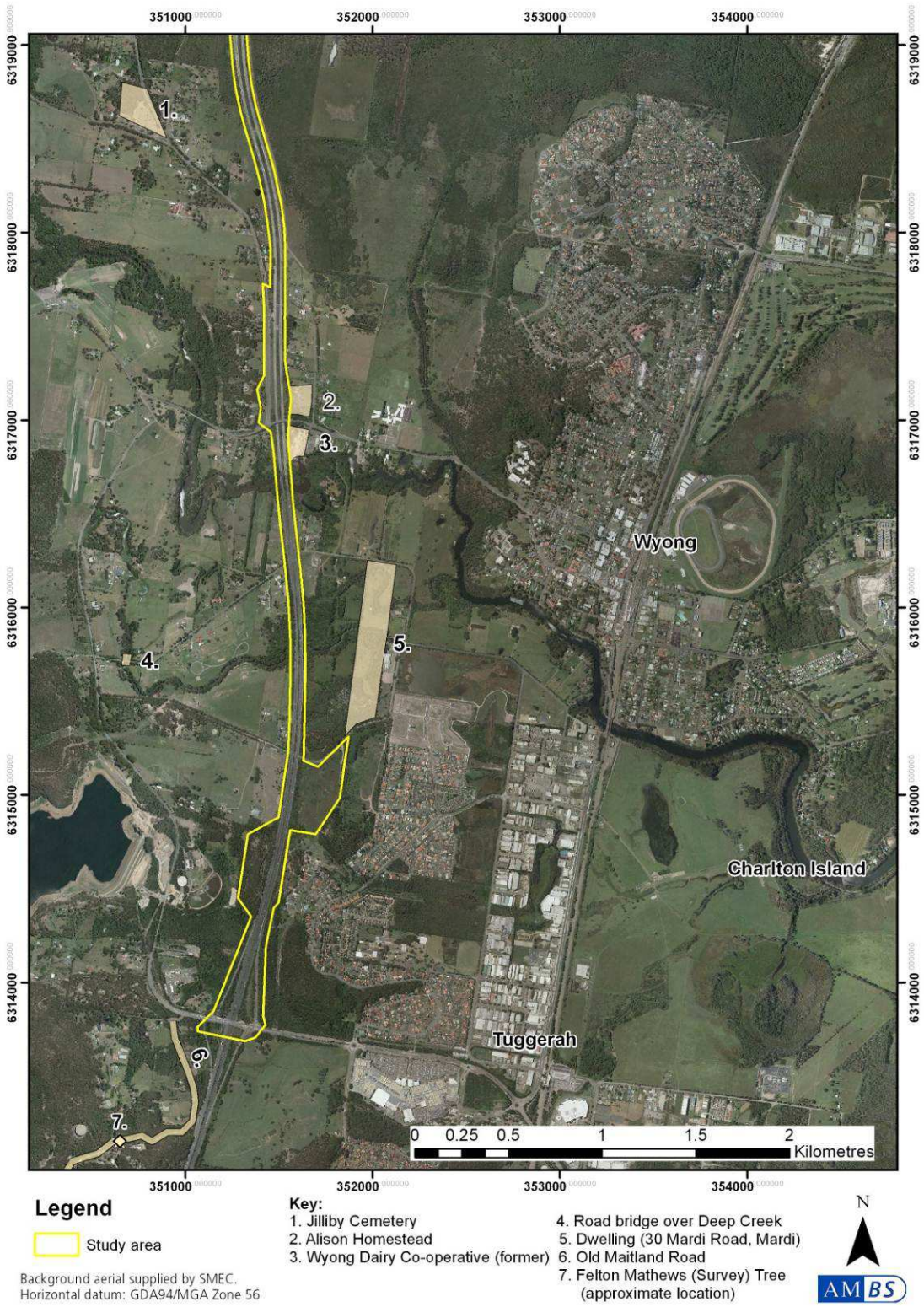
All identified heritage structures are more than 50 metres from any area proposed construction, and the vibration level is predicted to be less than 3mm/s. The vibration therefore complies with the lowest building damage criterion for heritage buildings.

14.4 Vibration Mitigation

Vibration is not predicted to exceed the building damage criterion. Vibration levels may exceed the criterion for continuous vibration human comfort for extended use of vibratory roller within 60m of a receiver, or use of a hydraulic hammer within 80m of a receiver.

If an exceedance is predicted, receivers should be informed of the duration of the vibration.

Figure 14-1 Location of Heritage Structures



15 CONCLUSION

15.1 Operational Noise Goals

It is proposed to widen the M1 Pacific Motorway between Tuggerah and Doyalson by building an extra lane in each direction on the existing median. The existing lanes will be replaced. As the alignment is not changed, this constitutes a "road redevelopment" for assessment according to the guidelines of the *Road Noise Policy (RNP).*

As well as comparing predictions to *RNP* goals, this report notes receivers where noise levels are predicted to be "acute" under the "build" and "no-build" options.

15.2 Noise Monitoring

Noise monitoring was performed at three locations. The noise monitoring determined background noise levels and provided existing traffic noise values for validation of the noise model.

15.3 Noise Modelling and Validation

Noise from the existing M1 Pacific Motorway was modelled. The model was validated using predicted noise from the existing M1 Pacific Motorway, by comparing these values with noise measured while traffic was counted. Good agreement was found. At one location there was an over-prediction of noise level in one time period. As the over-prediction was relatively minor, and indicated a conservative assessment model, this discrepancy was not considered sufficient to invalidate the model.

15.4 Summary of Proposed Mitigation of Operational Noise

Of the 621 receivers in the study area:

- Noise is predicted to be acute, but to have increased by 2dBA or less due to the project, at 47 receivers;
- Noise is predicted to be acute, and to have increased by more than 2dBA due to the project, at 22 receivers;
- Noise is predicted to be above the *RNP* criteria (but not acute) and to have increased by 2dBA or less at 182 receivers.
- Noise is predicted to be above the *RNP* criteria (but not acute) and to have increased by more than 2dBA at 4 receivers.

As the traffic flow under both options is the same, and the horizontal alignment very similar, the increase in noise impact is due to the change in vertical alignment. Some receivers are less shielded under the "build" option.

Low noise pavement is proposed at the southern 2.1 kilometres of the proposal.

Barriers were analysed for effectiveness of mitigation at several low-density housing groups. The analysis followed the procedures of the *ENMM* as well as analysing the number of houses where acute noise levels would be reduced.

At receivers where at-road treatments are not considered feasible and reasonable, architectural treatments should be considered if predicted noise levels due to the "build'" option are acute or more than 2dBA higher than the levels under the "no-build" option.

There are 69 receivers with noise levels predicted to be acute under the "build" option. These are spread along the route, with a few low density clusters as discussed in the barrier analyses in Section 9. The receivers are, by NCA, are presented in Table 15-1.

Table 15-1 Receivers with Acute Noise Levels

NCA	Receivers with acute levels that would not be mitigated by barriers	Receivers with acute noise levels that may be mitigated by barriers if considered feasible and reasonable
1	N1 30, N1 33, N1 375	
2		N2 3, N2 4, N2 14, N2 16, N2 17, N2 18 (4m barrier)
3	N3 27, N3 28, N3 29, N3 30, N3 31, N3 35, N3 36, N3 37, N3 41, N3 42	N3 1, N3 2, N3 12, N3 20, N3 21, N3 22, N3 24, N3 26 (4m barrier)
4	N4 1, N4 2, N4 12, N4 13, N4 14, N4 18, N4 19, N4 20, N4 21, N4 22, N4 23, N4 24, N4 25, N4 27, N4 28, N4 29, N4 30, N4 31, N4 32, N4 33, N4 34, N4 35, N4 36, N4 37, N4 44, N4 59, N4 60, N4 61, N4 70, N4 74, N4 75, N4 79, N4 86, N4 139	N4 76, N4 82, N4 83, N4 84 and N4 85 (5.5m barrier at Sparks Road Off Ramp)
5	N5 1, N5 4, N5 5	
6		

In addition, there are four receivers with noise levels predicted to be above then *RNP* criterion but not acute, and to be increased by more than 2dBA due to the "build" option. They are:

- N3-25, N3-45, N4-26 and N4-38.

The receivers N3-25 and N3-45 would not require architectural treatment if the barrier discussed in Section 9.5 was considered reasonable and feasible.

15.5 Construction Noise

Construction noise is predicted to exceed the management levels, particularly during night works. Construction vibration is predicted to be a minor issue with little or no impact at most receivers.

A construction noise management plan should be prepared prior to construction. The plan would include the following:

- Development of notification and negotiation procedure for receivers where noise impact cannot be mitigated to meet the criteria.
- Procedure for assessing audibility at any sensitive receiver outside normal construction hours.
- A procedure for dealing with and responding to complaints.
- Development of noise monitoring and auditing procedures to verify compliance with the predicted noise impacts.

APPENDIX A

NOISE MEASUREMENT RESULTS

Report 13042 – M1 Widening Noise Study

Noise Logger Results

Logger	L1
Address	10 Woolmers Cres, Mardi
Start	4 April 2013
Finish	16 April

Overall Noise – L_{Aeq} dBA

$L_{Aeq,15hr}$	55.6
$L_{Aeq,9hr}$	48.1

Source: Dept Lands

Rating Background Level (RBL)

Daytime (7.00am -10.00pm)	45
Evening (6.00pm-10.00pm)	36
Night time (10.00pm-7.00am)	38

For Logger Locations on Google Maps see: http://goo.gl/maps/1Qpf7

Location: 10 Woolmers Crescent, Mardi
Data shaded: extraneous; Met.; Rain

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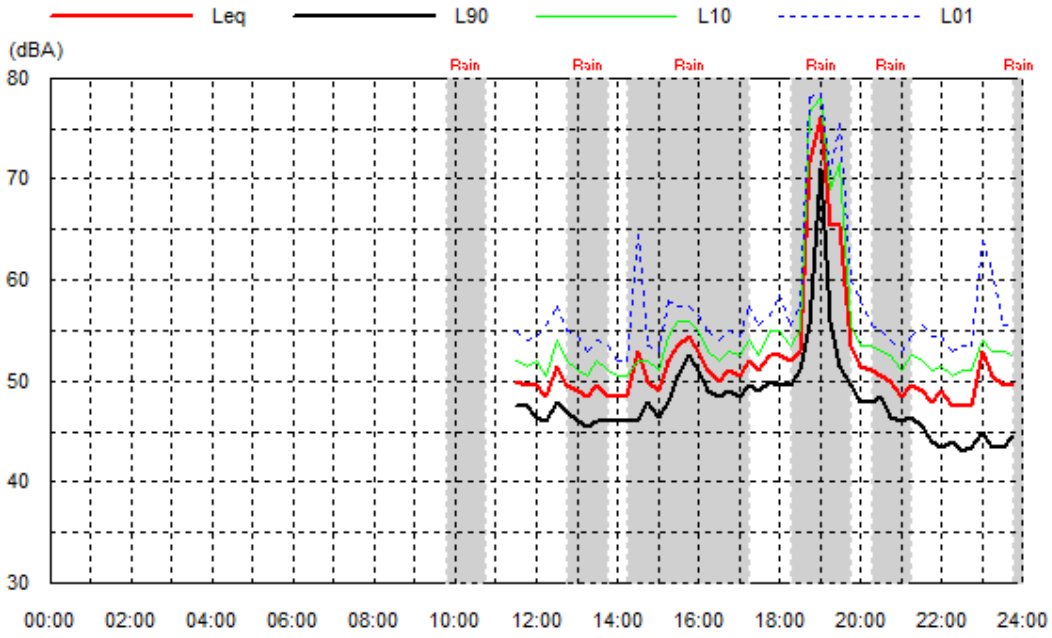

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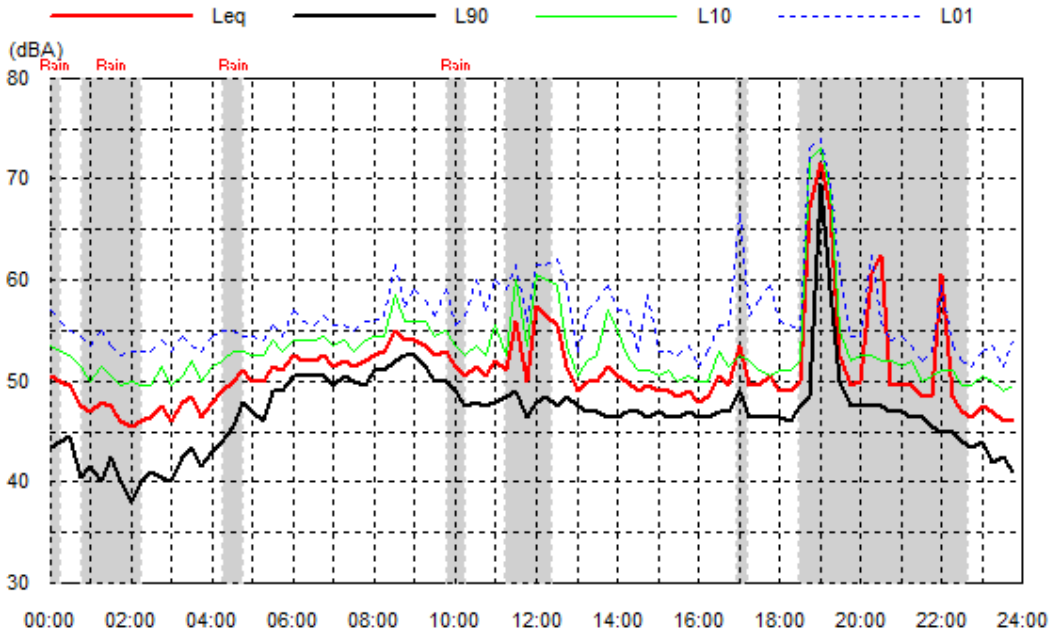

Location: 10 Woolmers Crescent, Mardi
Data shaded: extraneous; Met.; Rain

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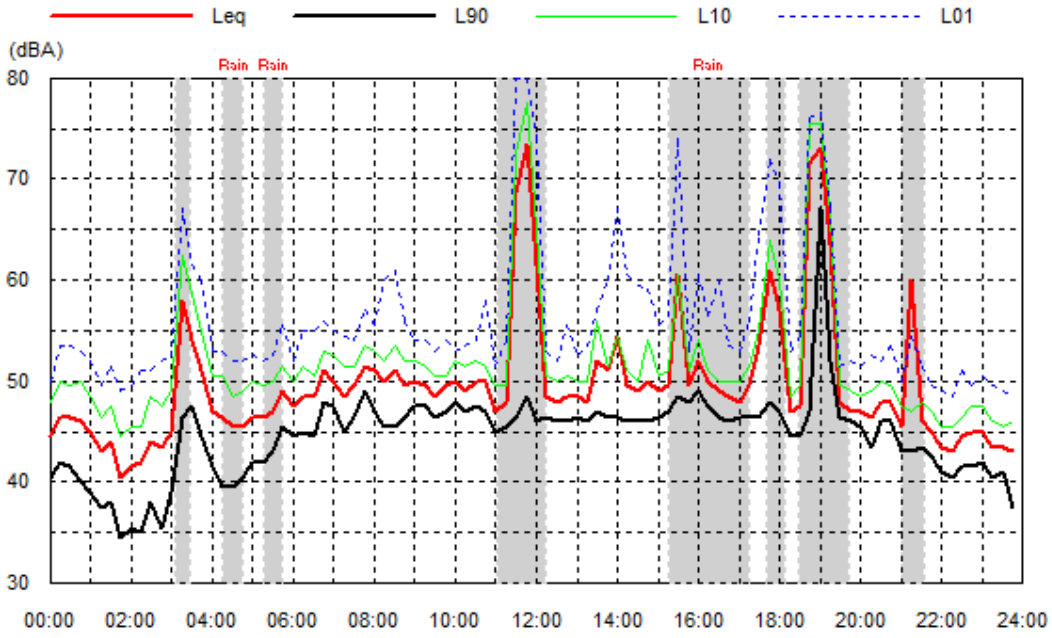

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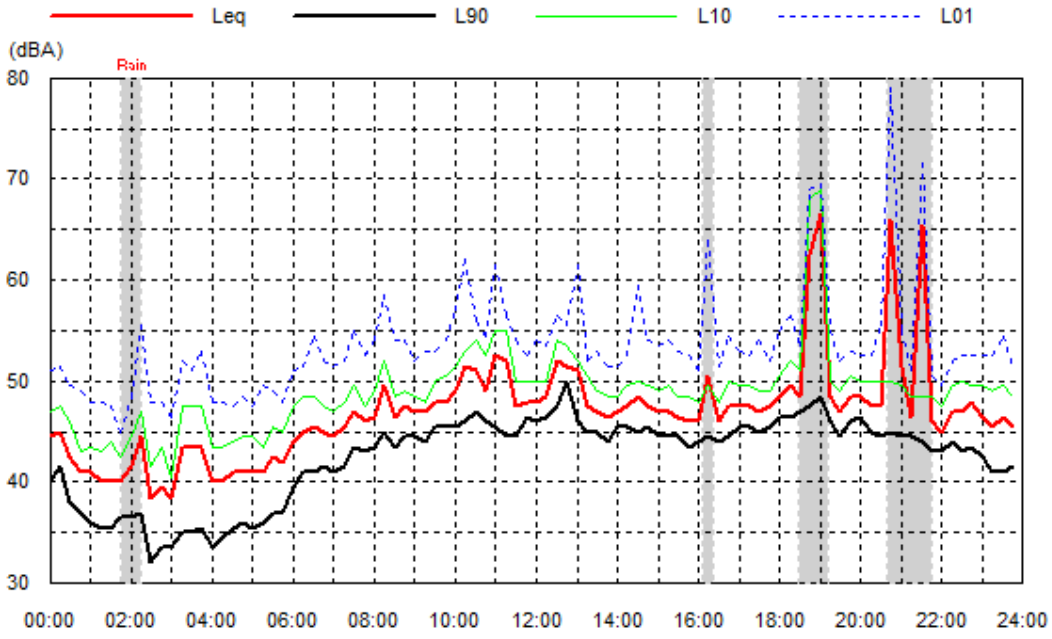

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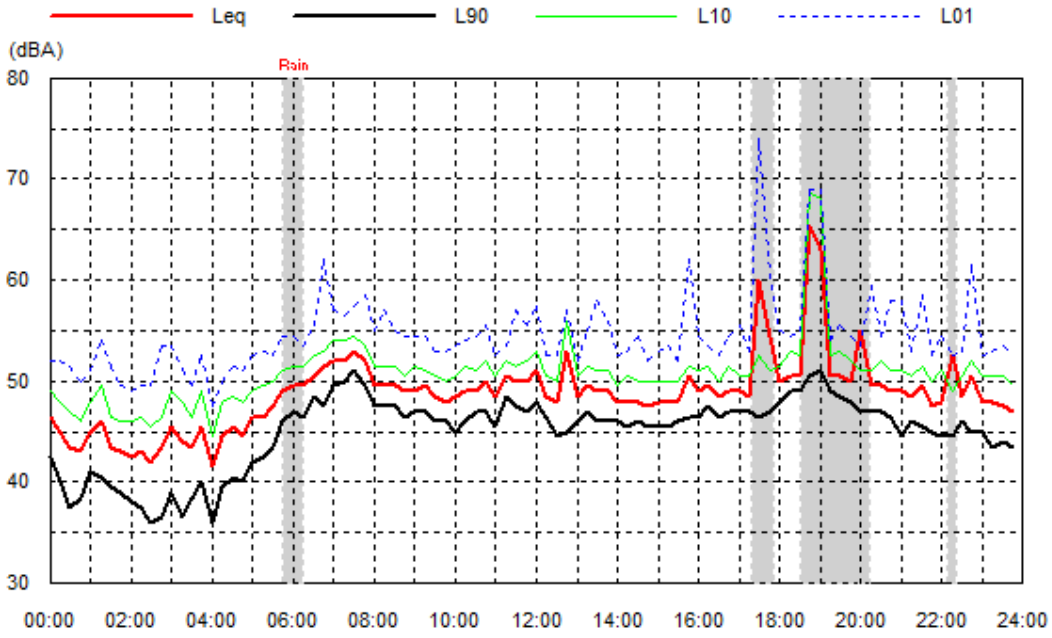

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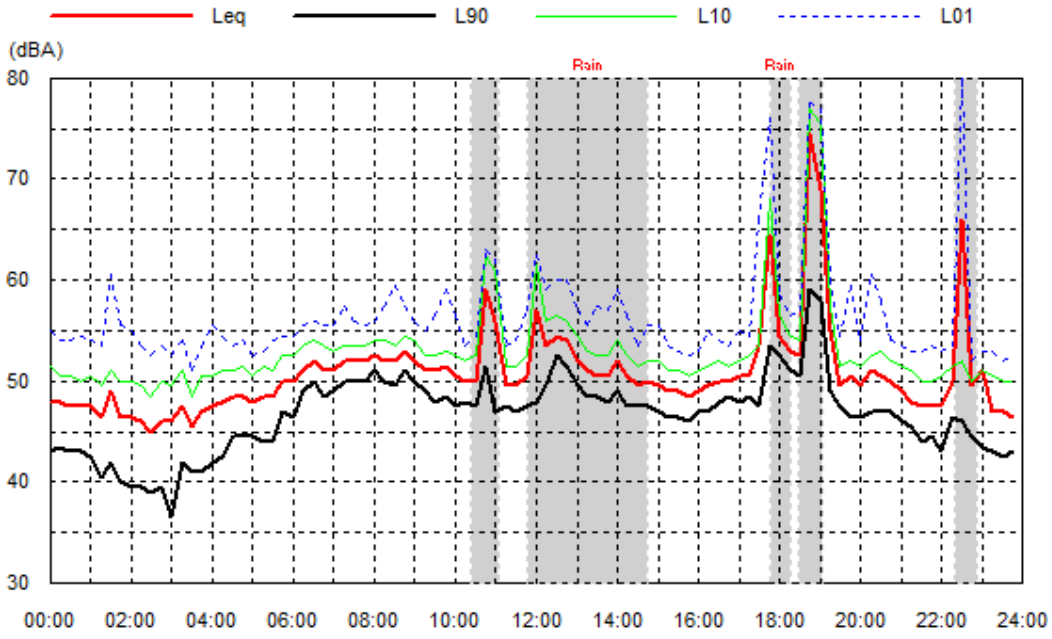

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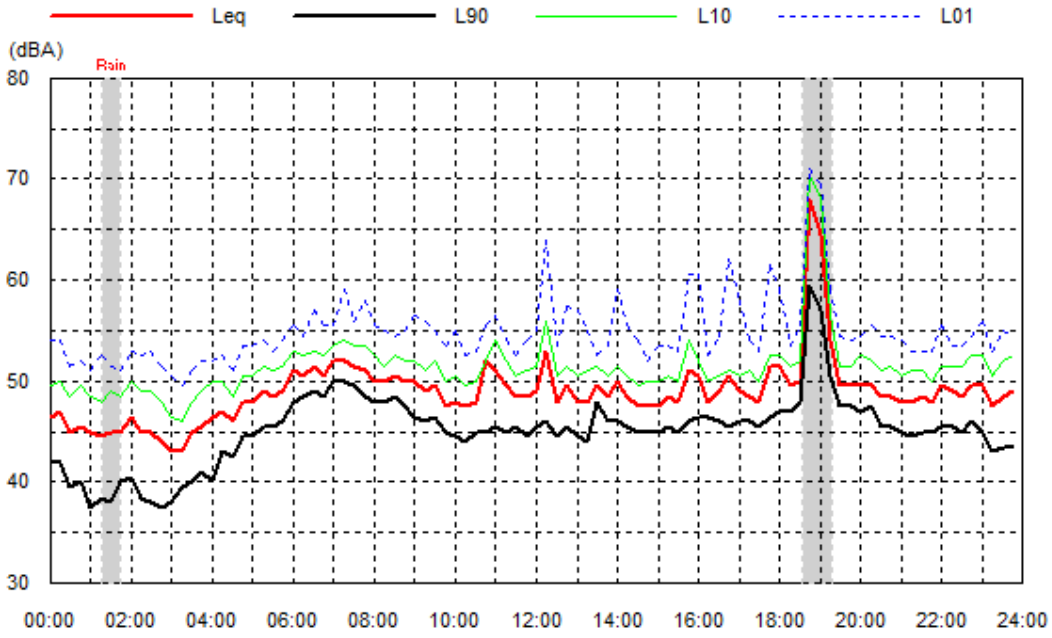

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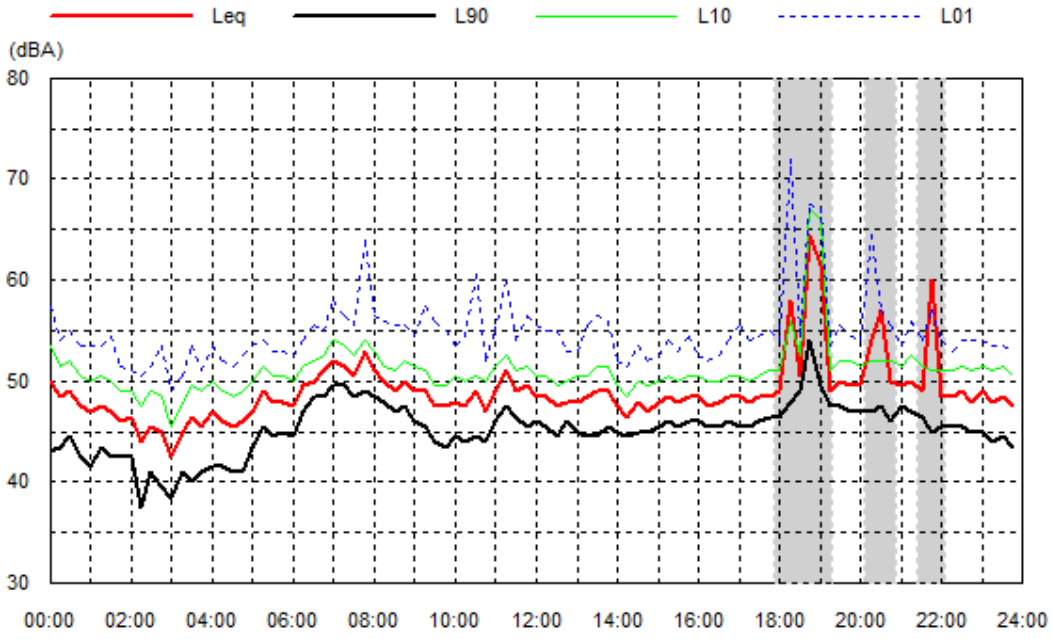

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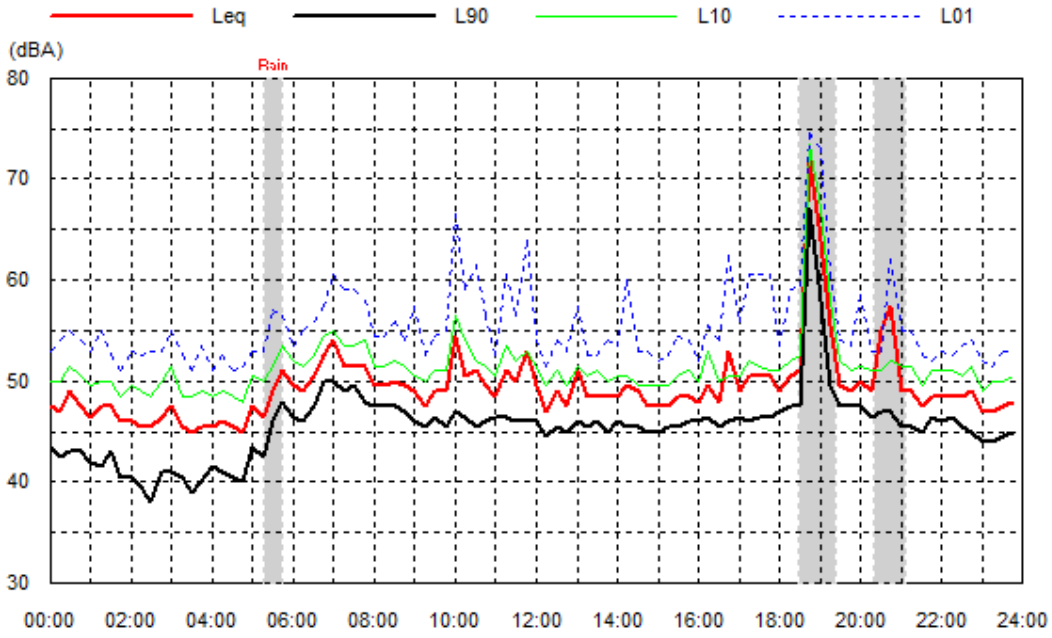

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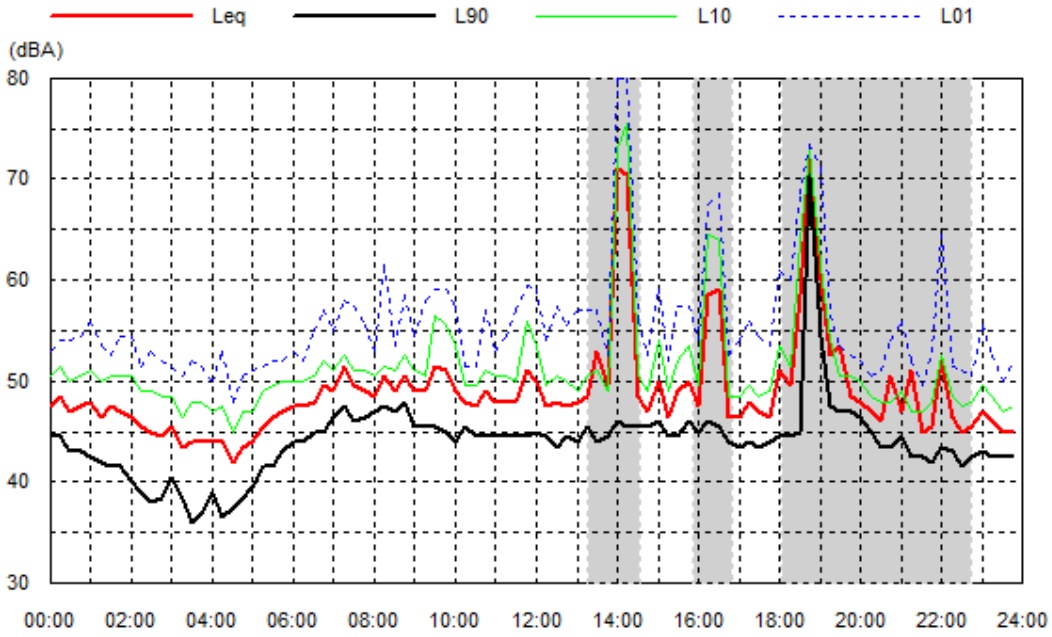

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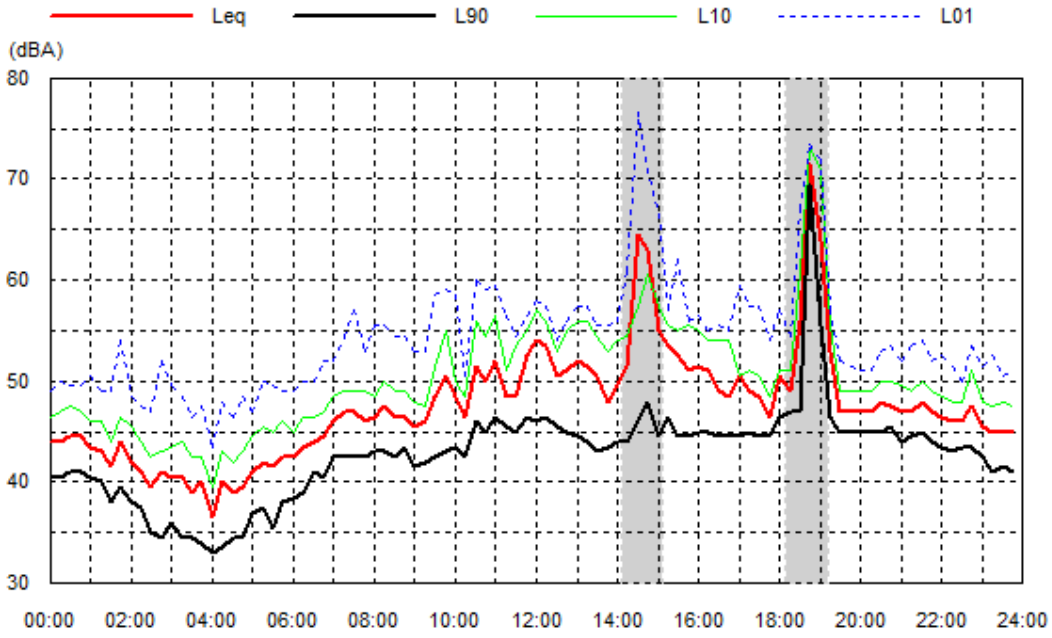

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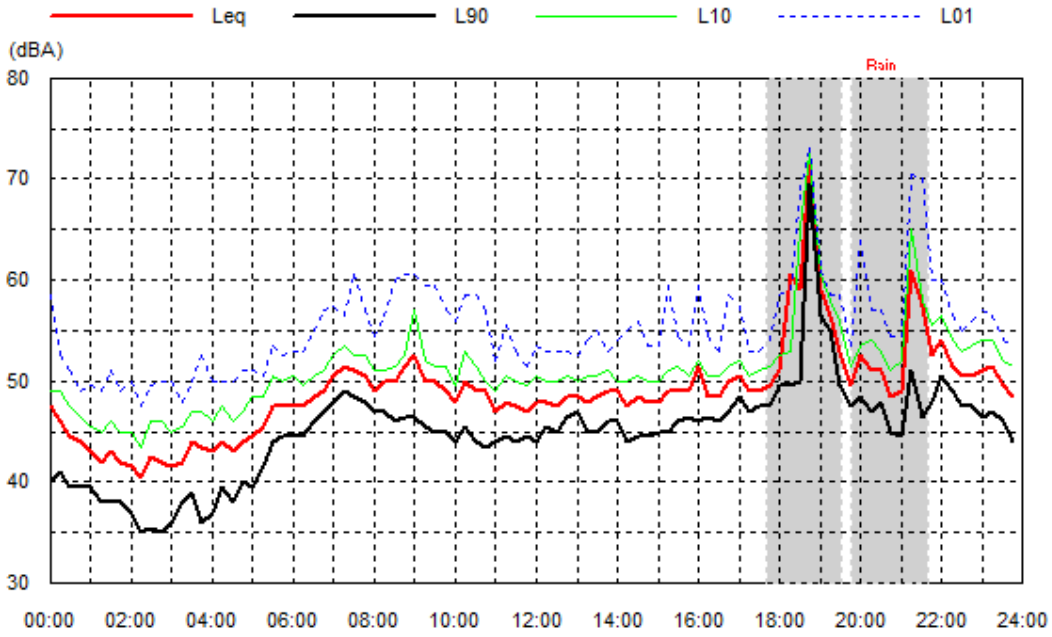

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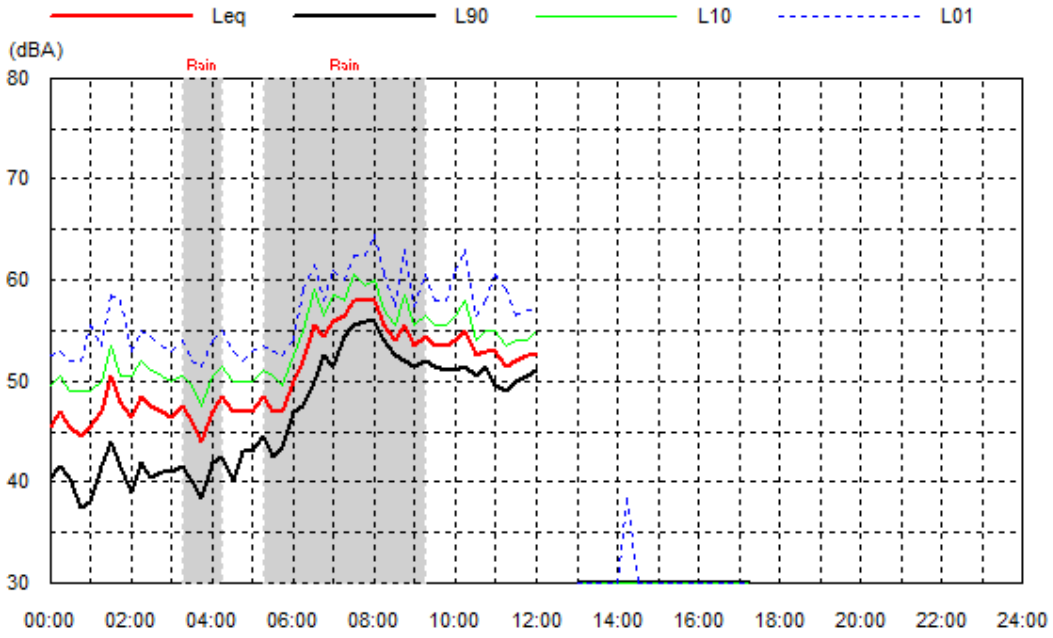

Report 13042 – M1 Widening Noise Study

Noise Logger Results

Logger	L2
Address	93 Hue Hue Rd, Alison
Start	4 April 2013
Finish	16 April

Overall Noise – L_{Aeq} dBA

$L_{Aeq,15hr}$	73.8
$L_{Aeq,9hr}$	69.4

Rating Background Level (RBL)

Daytime (7.00am -10.00pm)	68
Evening (6.00pm-10.00pm)	64
Night time (10.00pm-7.00am)	46

Source: Dept Lands

For Logger Locations on Google Maps see: http://goo.gl/maps/1Qpf7

Location: 93 Hue Hue Road, Alison
Data shaded: Rain

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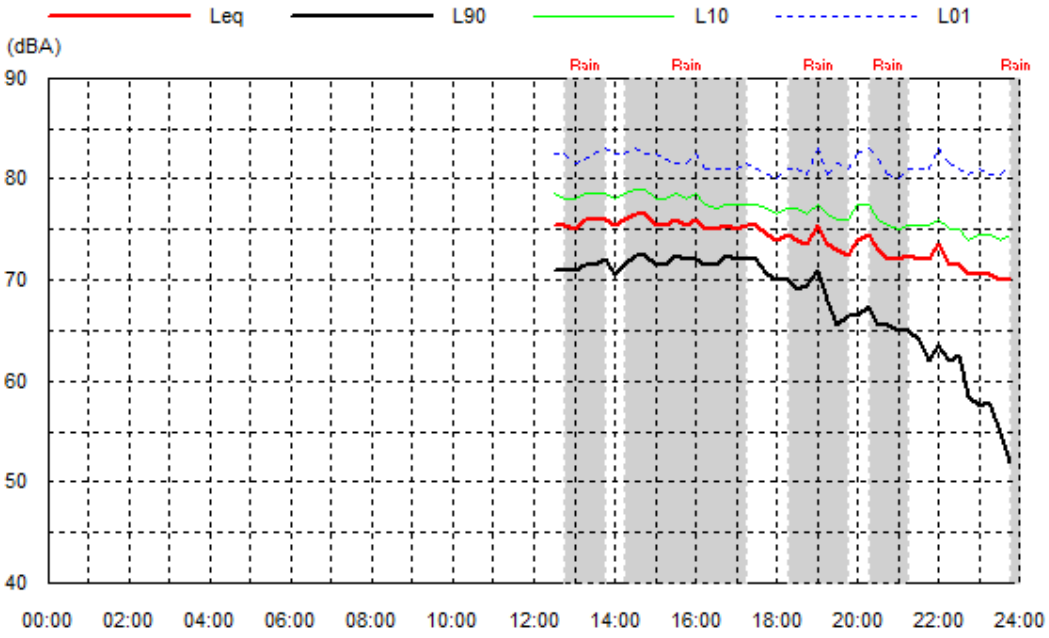

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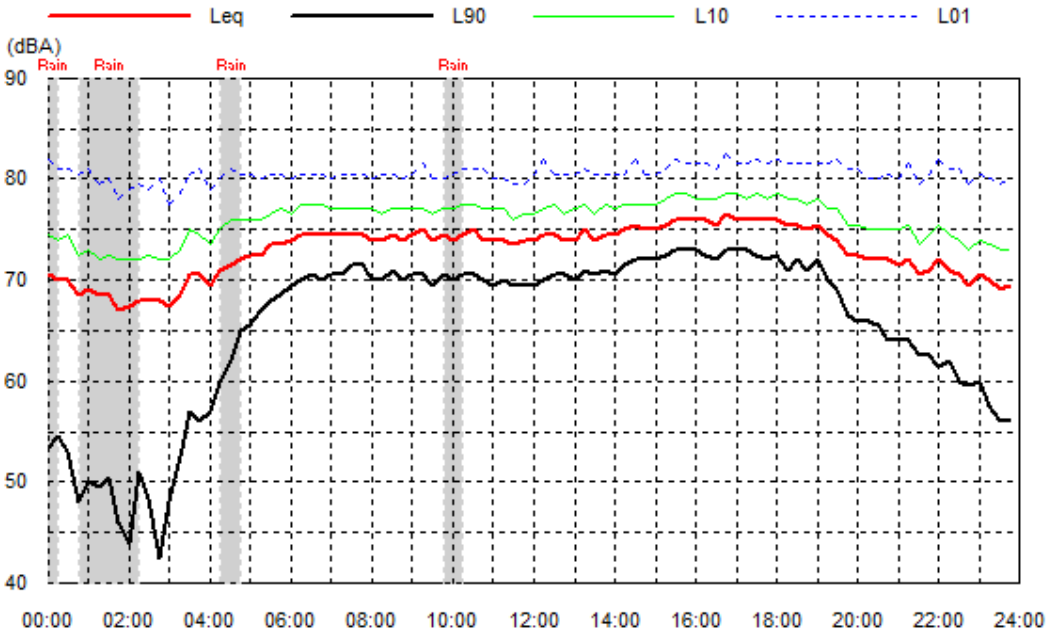

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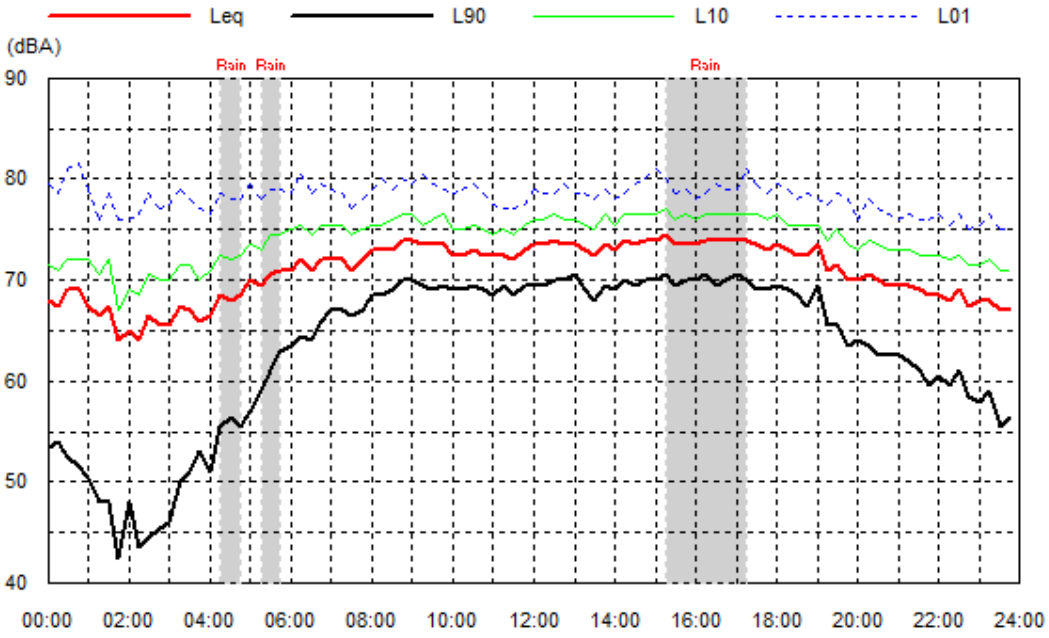

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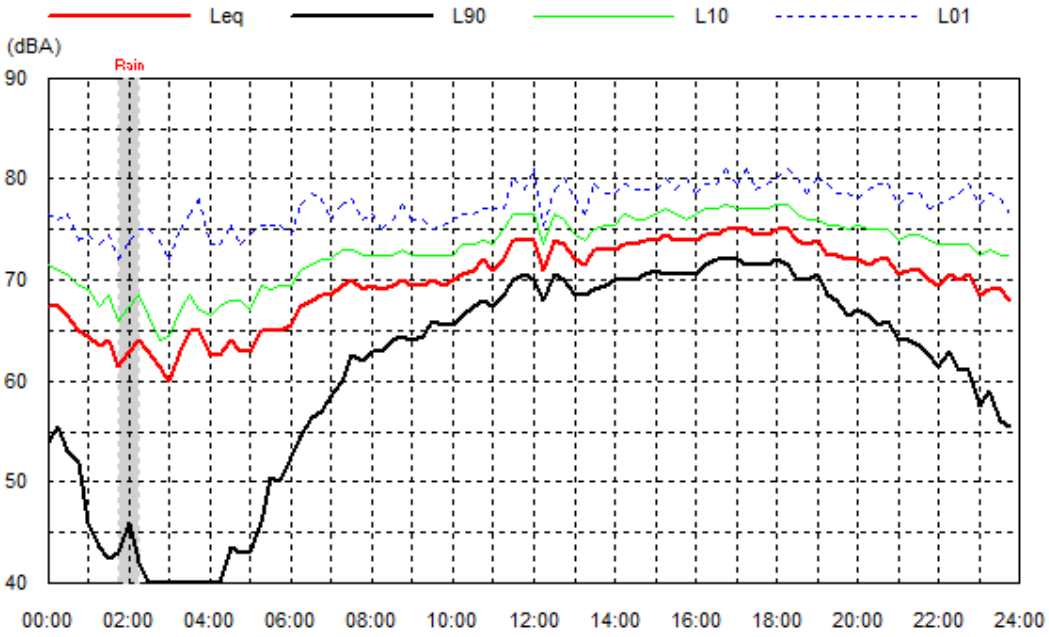

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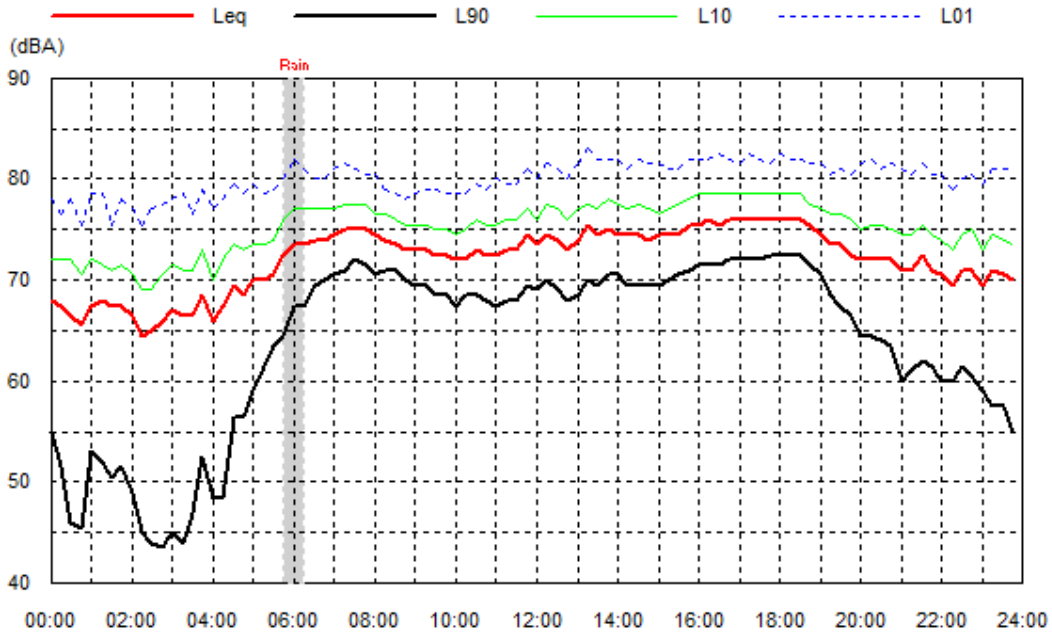

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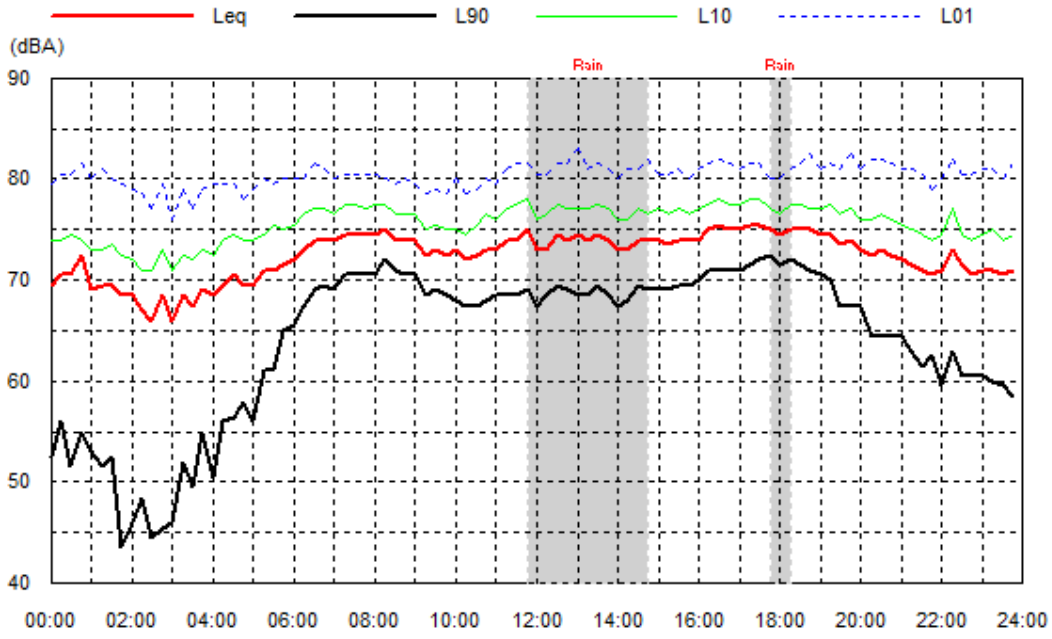

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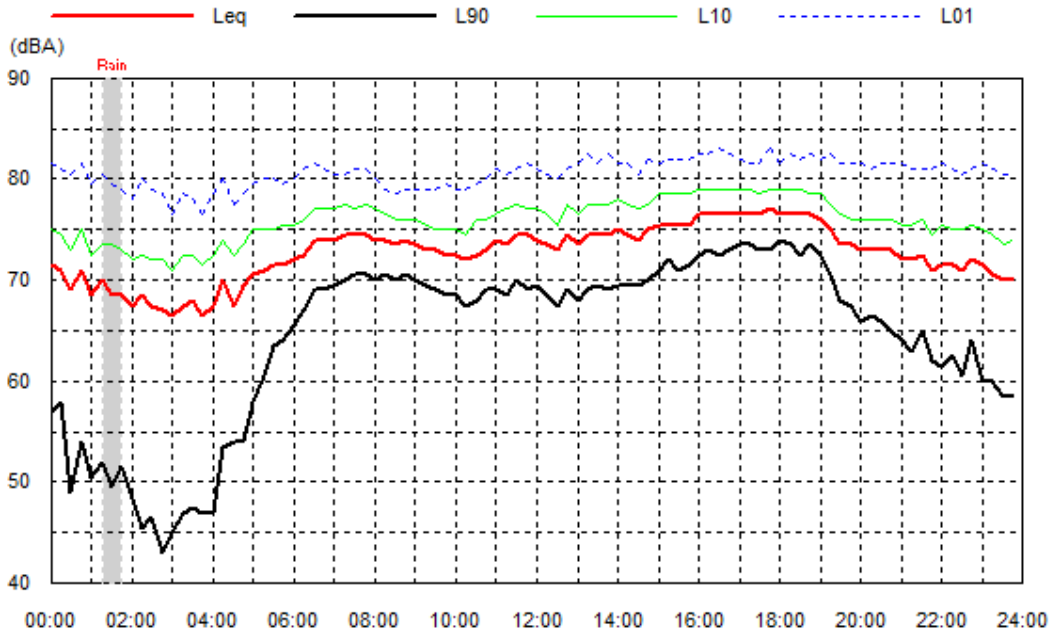

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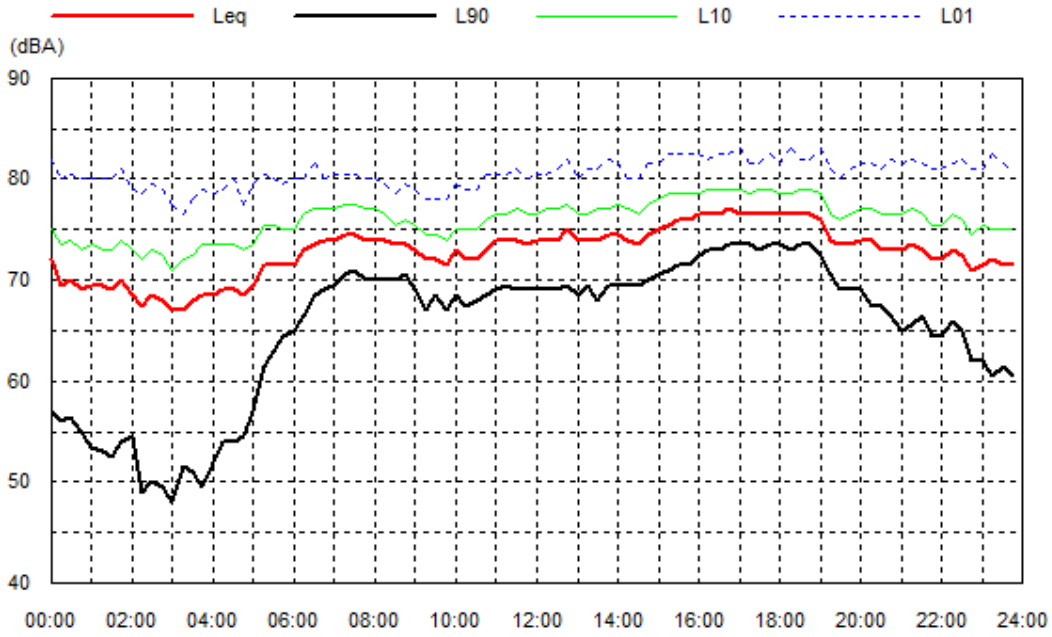

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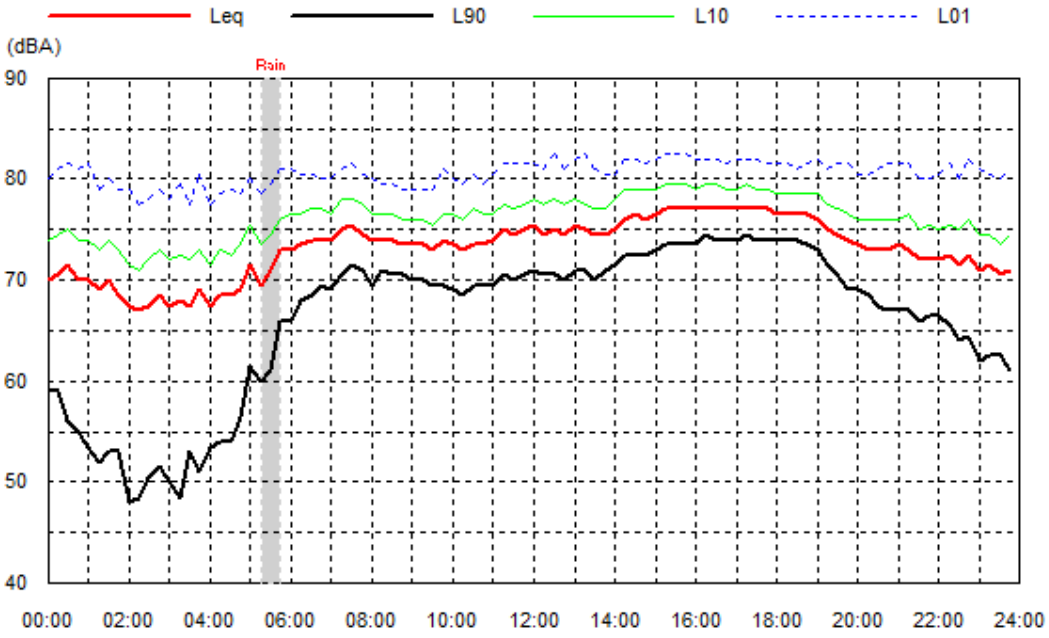

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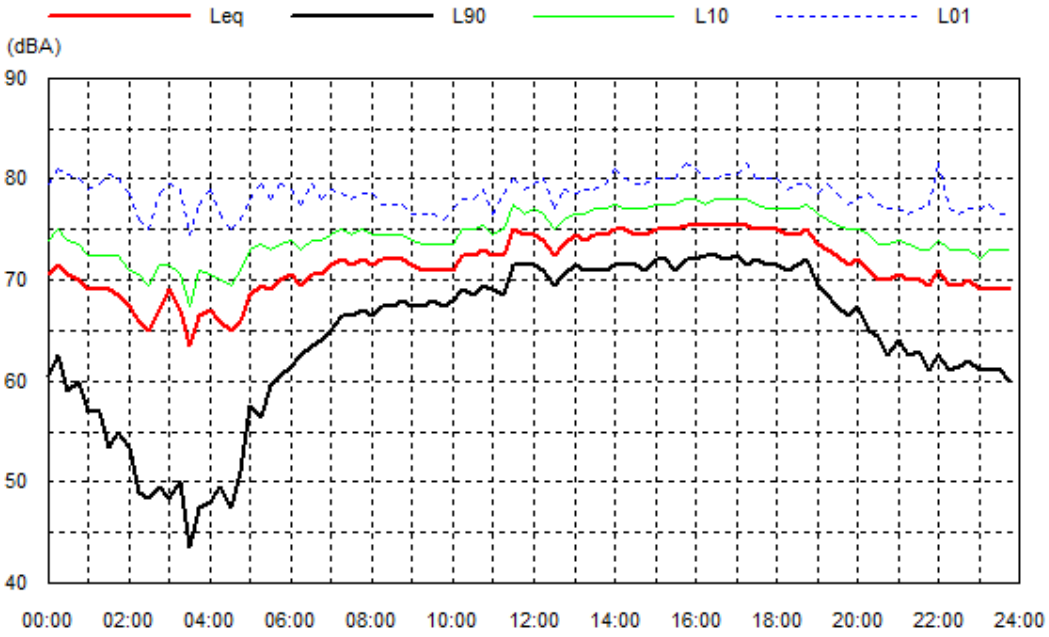

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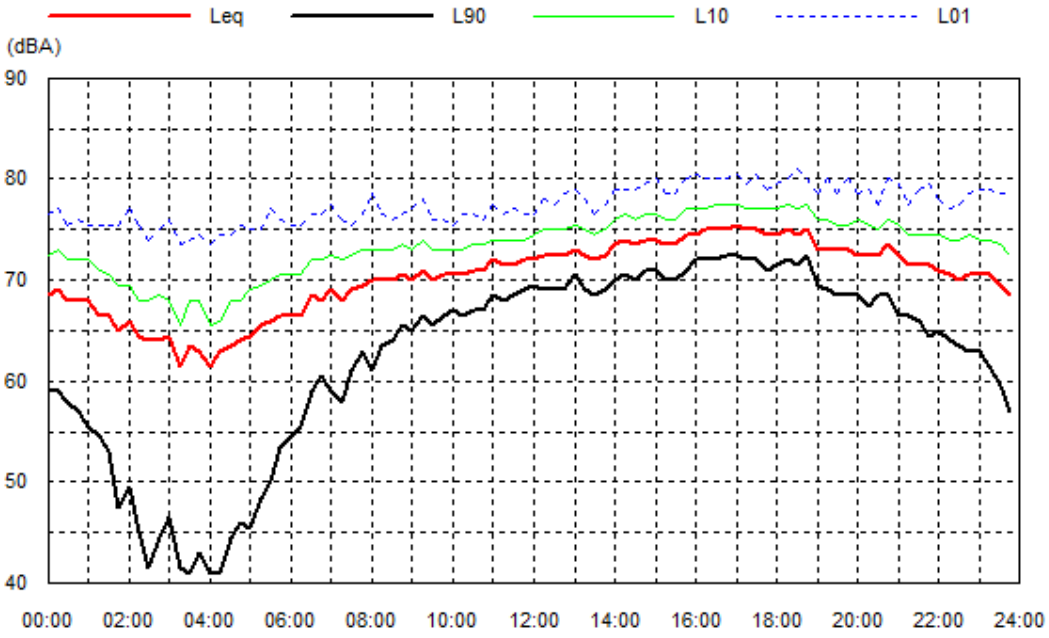

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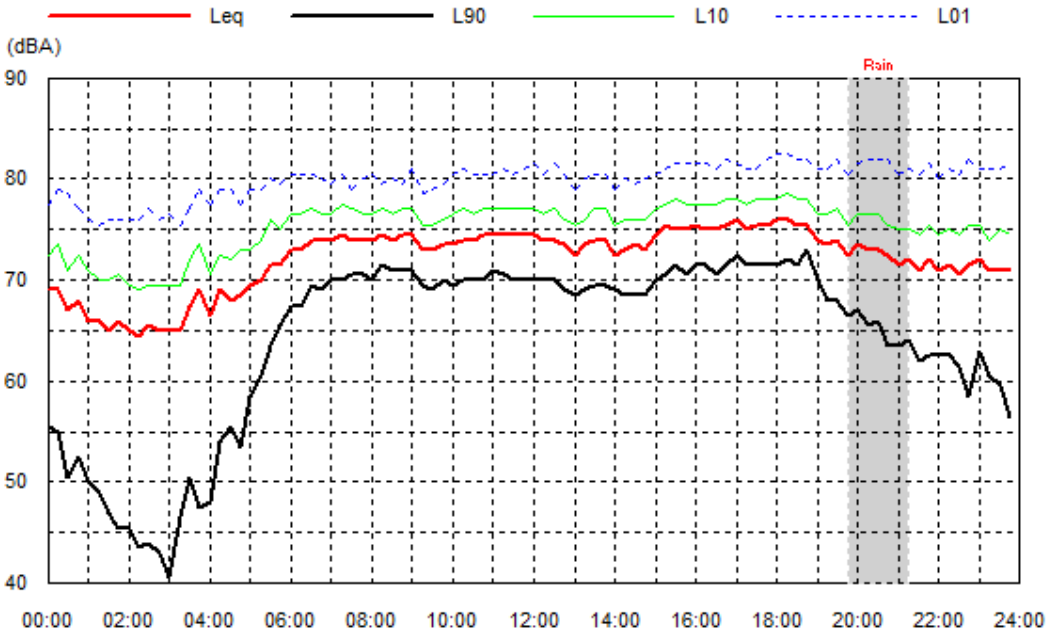

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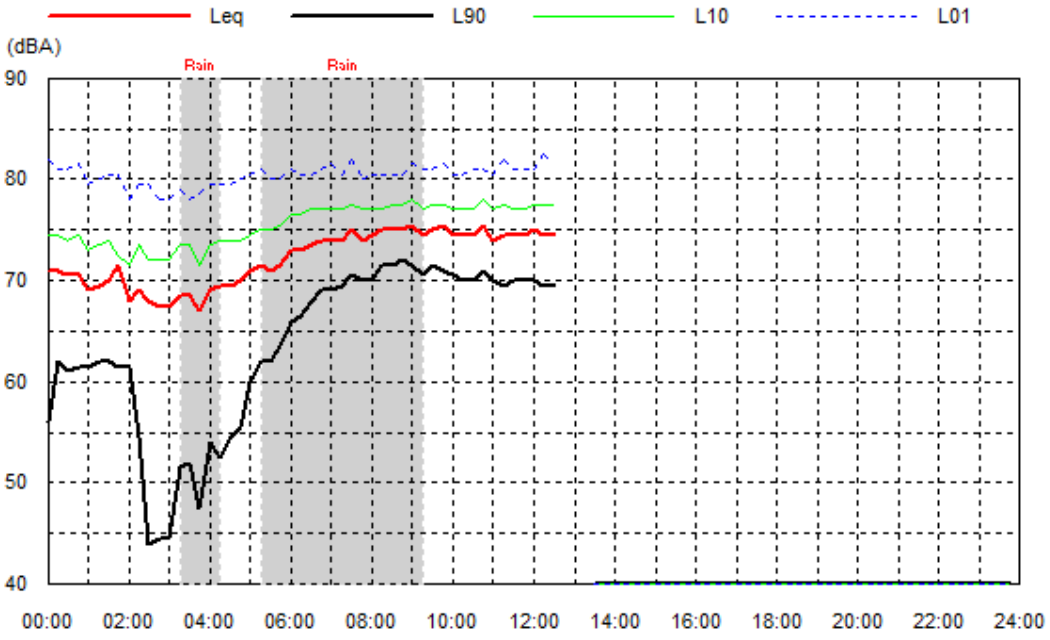

Report 13042 – M1 Widening Noise Study

Noise Logger Results

Logger	L3
Address	34 Holloway Dr, Jilliby
Start	4 April 2013
Finish	16 April

Overall Noise – L_{Aeq} dBA

$L_{Aeq,15hr}$	60.2
$L_{Aeq,9hr}$	53.5

Rating Background Level (RBL)

Daytime (7.00am - 10.00pm)	50
Evening (6.00pm-10.00pm)	49
Night time (10.00pm-7.00am)	46

Source: Dept Lands

For Logger Locations on Google Maps see: http://goo.gl/maps/1Qpf7

Location: 34 Holloway Drive, Jilliby
Data shaded: extraneous; Met.; Rain

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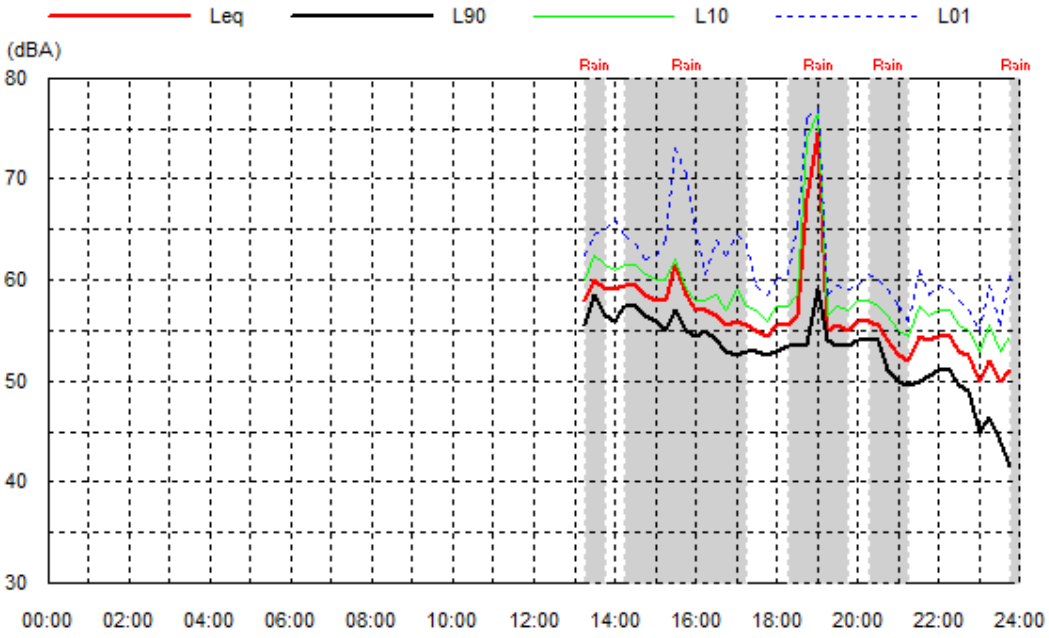

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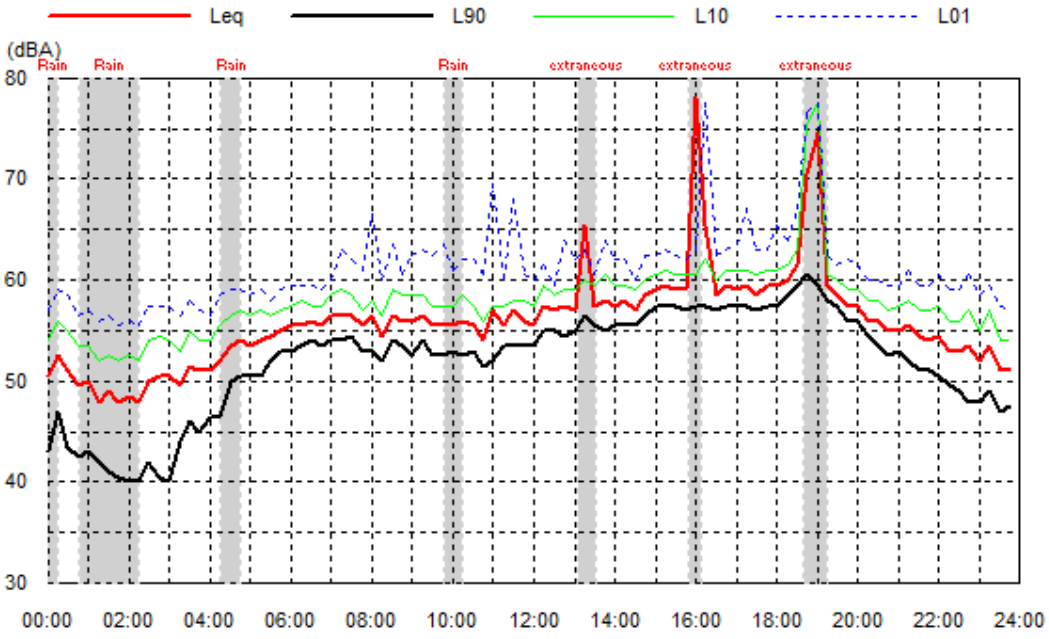

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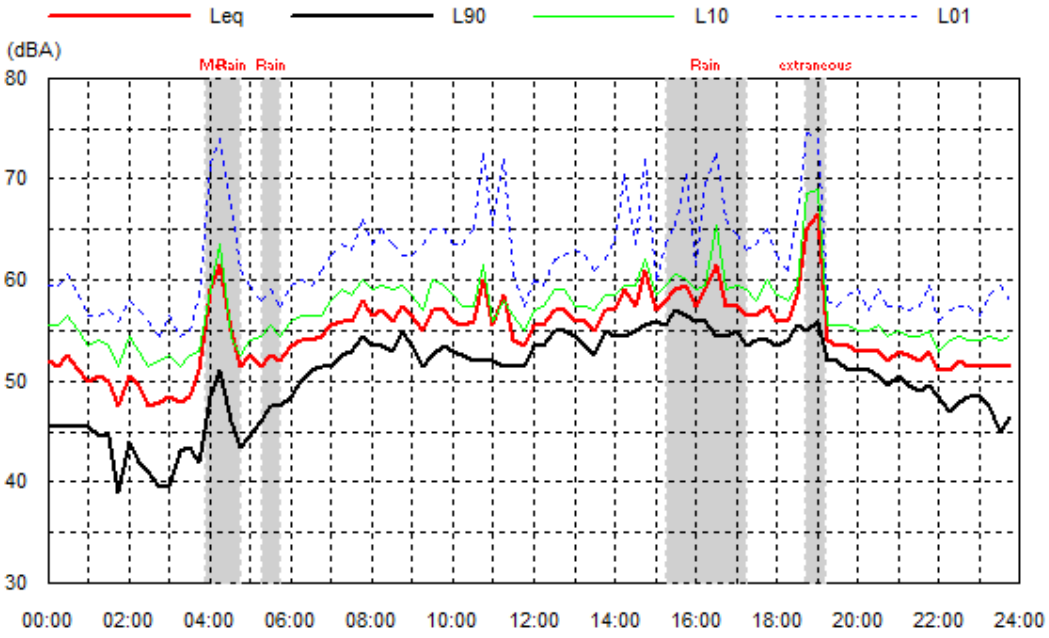

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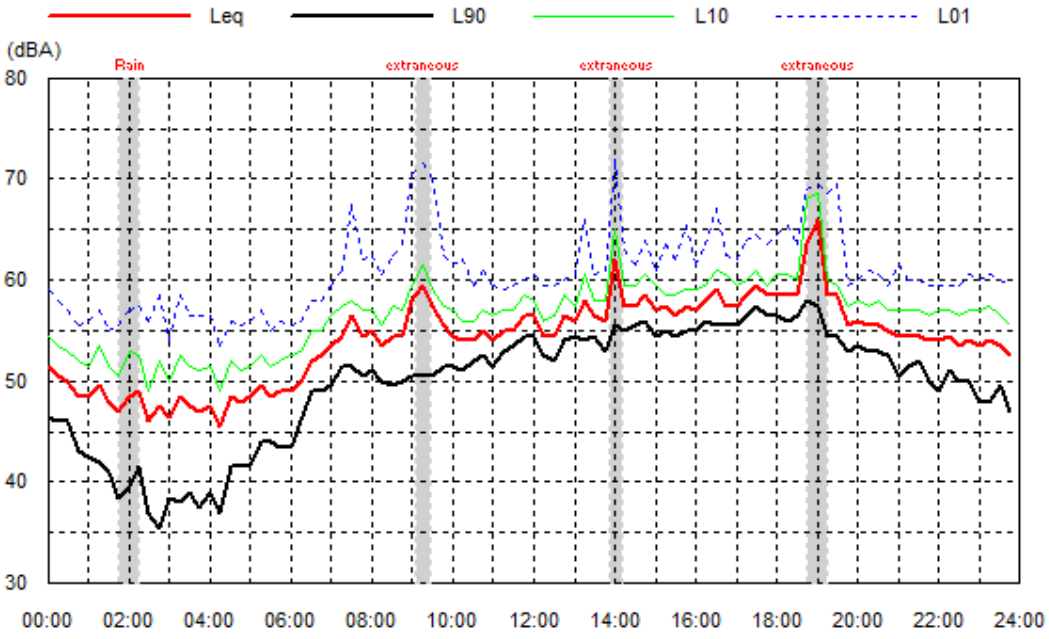

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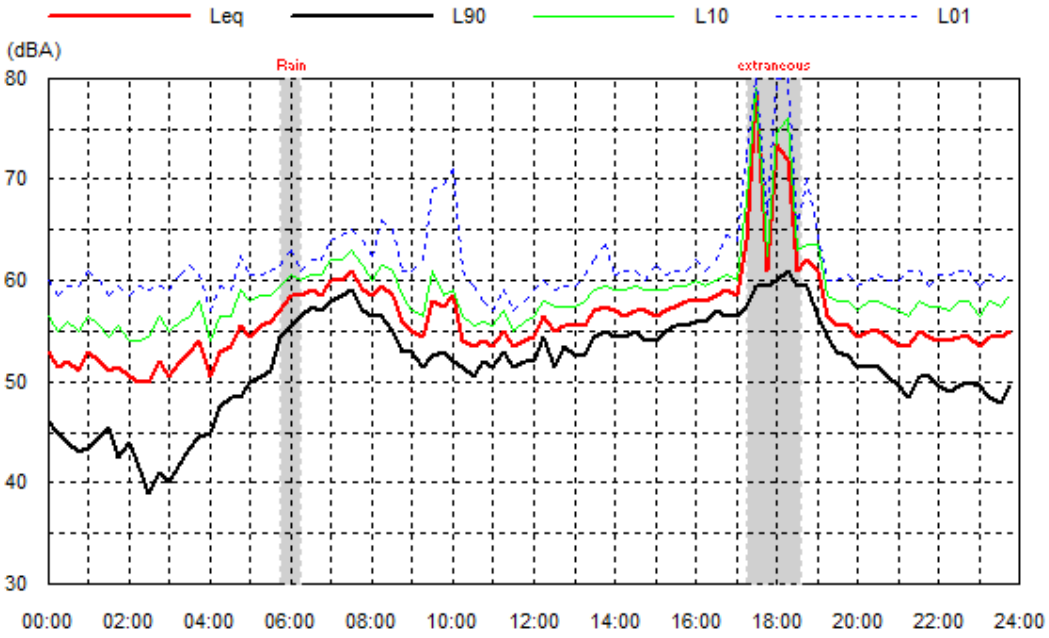

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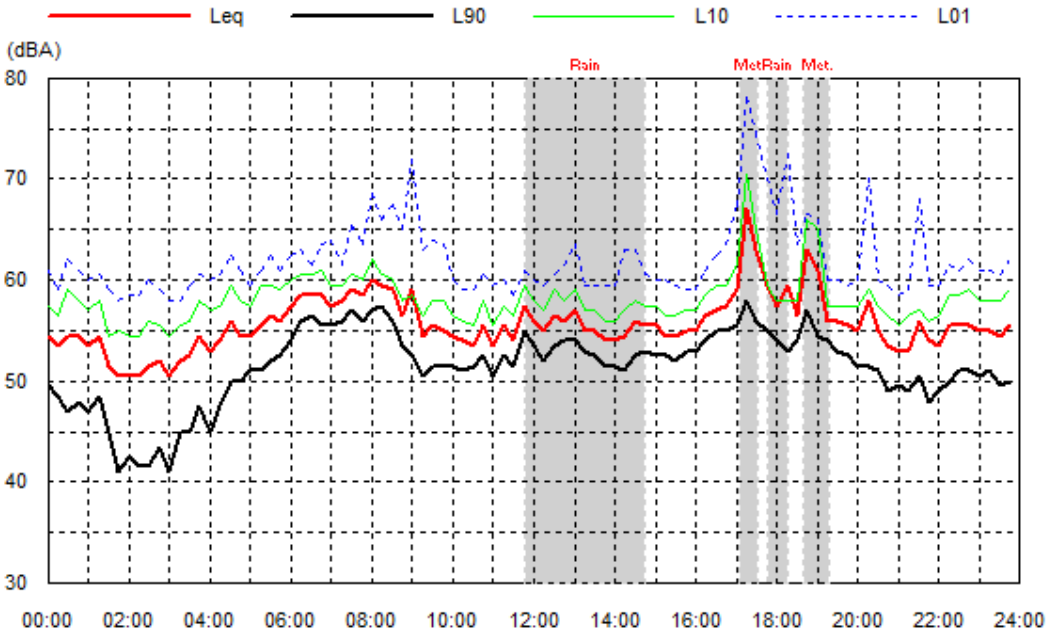

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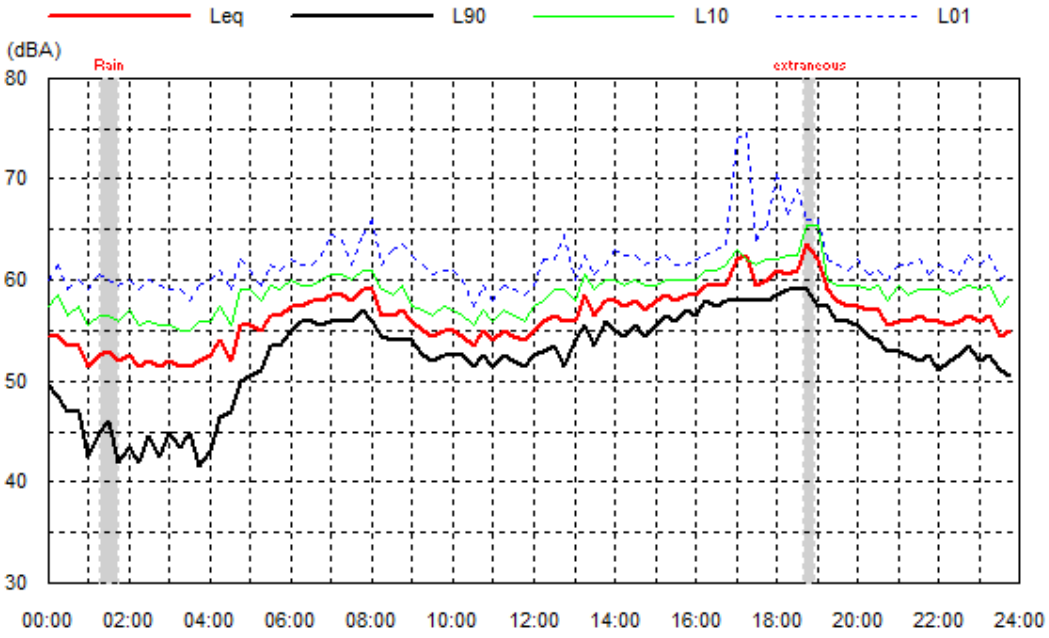

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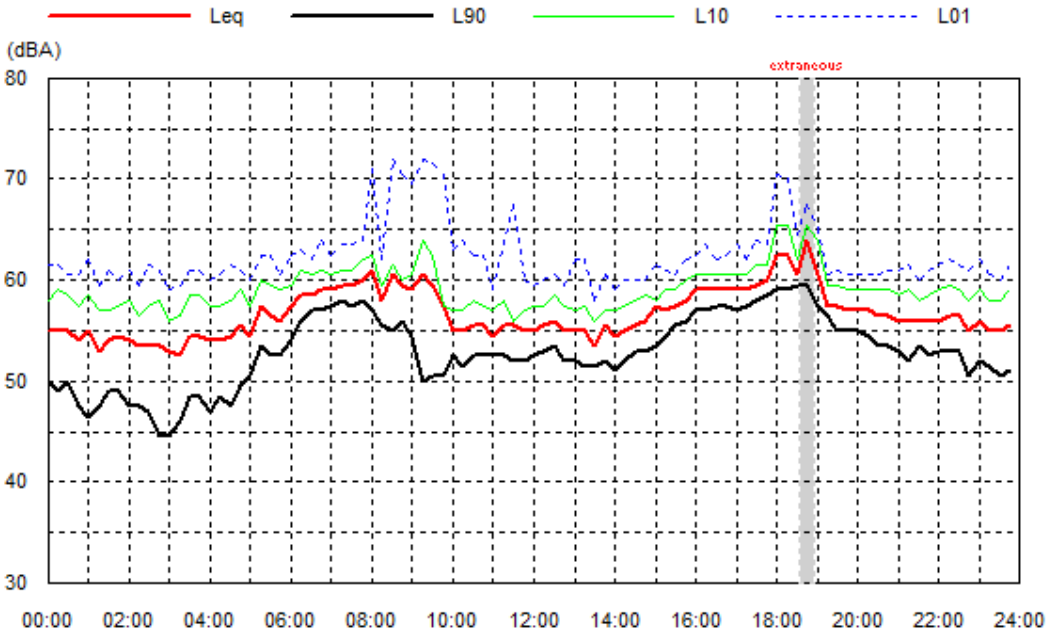

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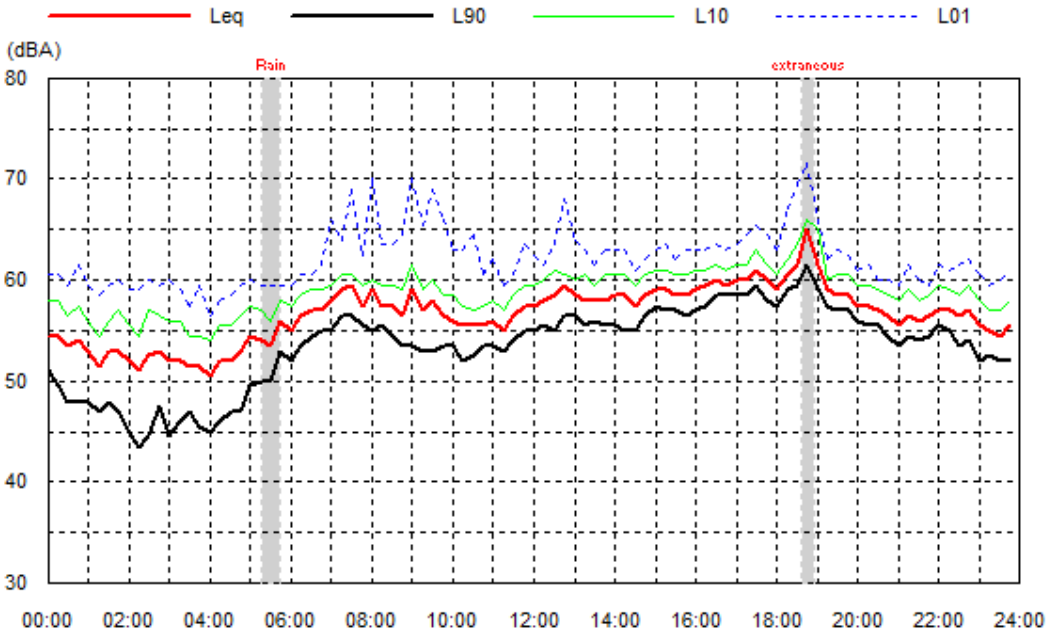

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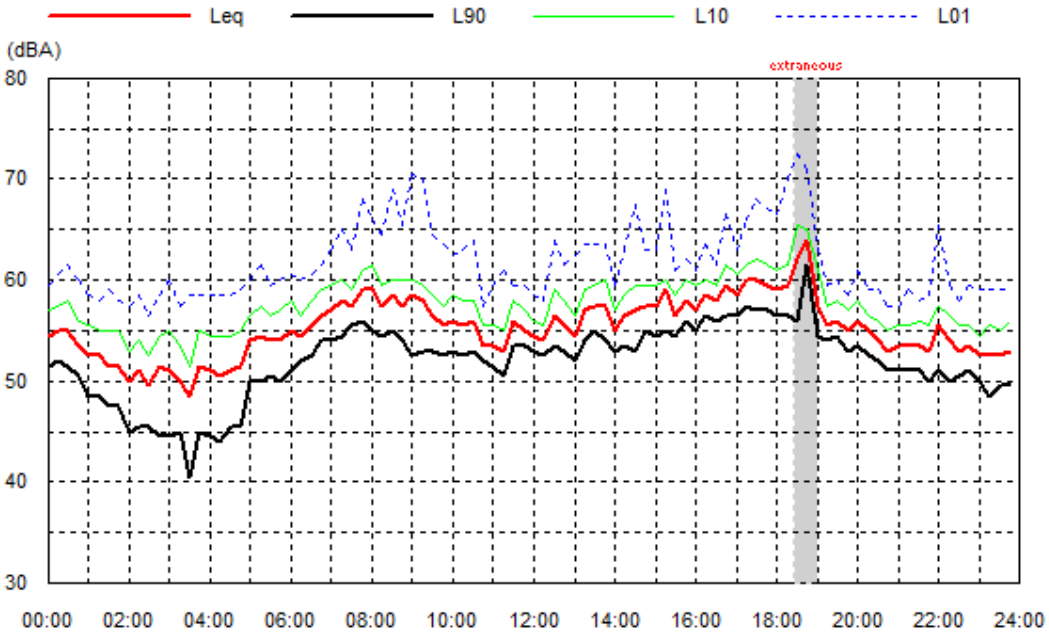

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Data shaded: extraneous; Met.; Rain

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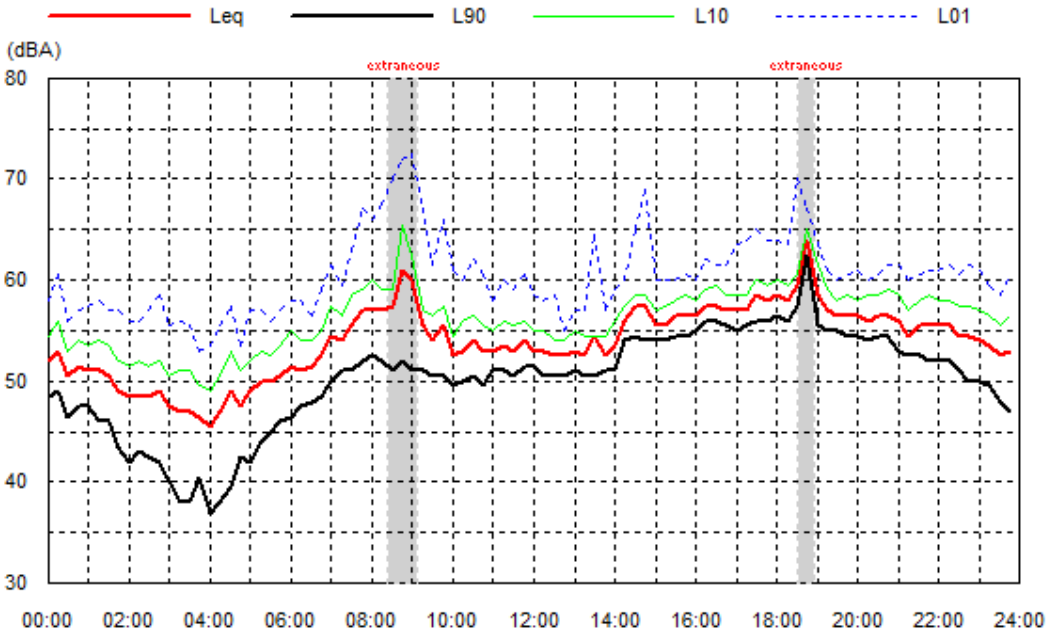

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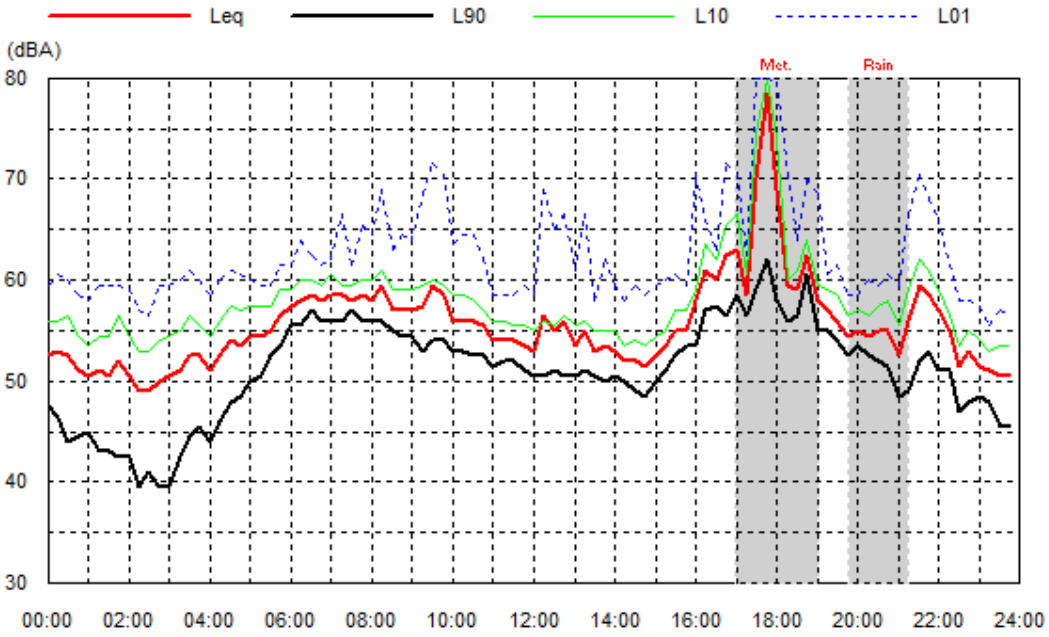

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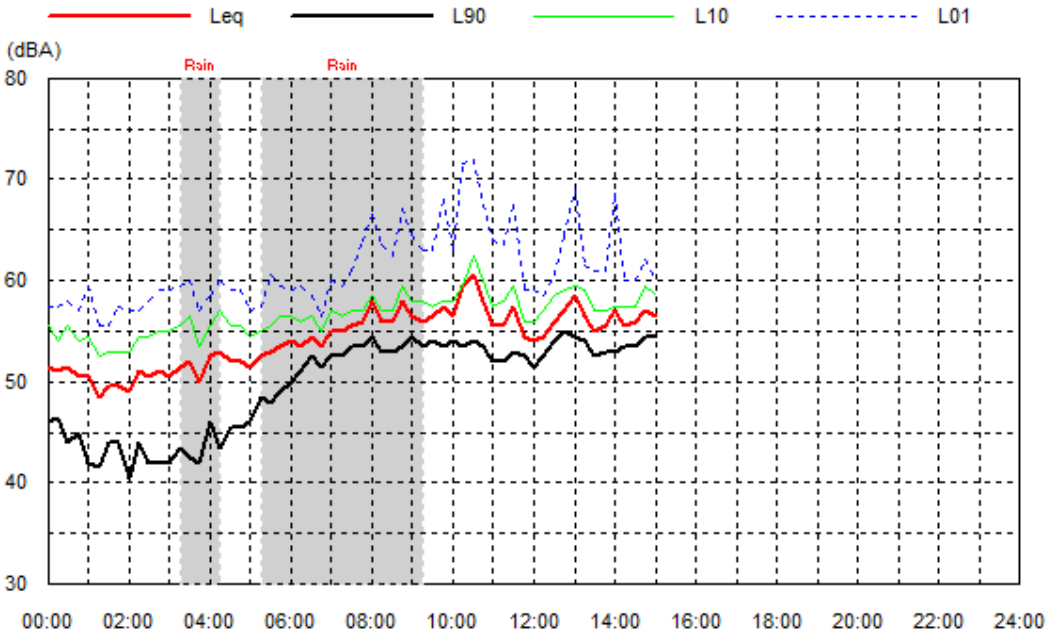

APPENDIX B

PREDICTED NOISE LEVELS

Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-1	59	54	59	54	60	55	60	55	60	55	no	no	0.2	0.5	0.4	0.4	no	no	no
N1-2	59	54	59	54	59	54	60	55	60	55	no	no	0.3	0.5	0.8	0.8	no	no	no
N1-3	60	55	60	56	61	56	61	56	60	55	yes	yes	0.3	0.6	0.3	0.3	no	no	yes
N1-4	62	57	62	58	62	58	63	58	60	55	yes	yes	0.4	0.6	0.5	0.3	no	no	yes
N1-5	60	56	61	56	61	56	61	57	60	55	yes	yes	0.3	0.5	-0.1	0.7	no	no	yes
N1-6	60	55	60	56	61	56	61	56	60	55	yes	yes	0.3	0.5	0.2	0.1	no	no	yes
N1-7	59	54	59	55	60	55	60	55	60	55	no	no	0.1	0.4	0.2	0.1	no	no	no
N1-8	58	54	59	54	59	54	59	55	60	55	no	no	0.1	0.4	-0.1	0.8	no	no	no
N1-9	56	51	57	52	57	52	57	53	60	55	no	no	0.2	0.5	0.0	0.9	no	no	no
N1-10	53	48	53	48	53	48	54	49	60	55	no	no	0.2	0.5	0.7	0.7	no	no	no
N1-11	54	49	54	49	54	49	54	50	60	55	no	no	0.1	0.3	-0.3	0.6	no	no	no
N1-12	53	48	53	48	53	48	53	49	60	55	no	no	-0.2	0.2	-0.5	0.5	no	no	no
N1-13	53	48	53	49	54	49	54	49	60	55	no	no	0.1	0.4	0.2	0.2	no	no	no
N1-14	58	53	57	52	58	53	57	53	60	55	no	no	-1.0	-0.7	-1.4	-0.4	no	no	no
N1-15	60	55	59	54	61	56	59	55	60	55	no	no	-1.6	-1.3	-2.0	-0.9	no	no	no
N1-16	63	58	61	56	64	59	62	57	60	55	yes	yes	-2.0	-1.7	-1.6	-1.6	no	no	yes
N1-17	59	54	59	55	60	55	60	55	60	55	no	no	0.3	0.5	0.3	0.1	no	no	no
N1-18	60	56	61	56	61	56	62	57	60	55	yes	yes	0.5	0.7	0.9	0.7	no	no	yes
N1-19	53	48	53	48	53	48	53	49	60	55	no	no	0.0	0.3	-0.3	0.6	no	no	no
N1-20	53	48	53	49	54	49	54	49	60	55	no	no	0.3	0.5	0.3	0.1	no	no	no
N1-21	53	48	54	49	54	49	54	50	60	55	no	no	0.3	0.6	0.1	1.0	no	no	no
N1-22	52	47	53	48	53	48	53	49	60	55	no	no	0.4	0.6	0.2	1.1	no	no	no
N1-23	53	48	54	49	54	49	54	50	60	55	no	no	0.2	0.5	0.0	0.9	no	no	no
N1-24	53	48	53	48	53	49	54	49	60	55	no	no	0.2	0.5	0.5	0.4	no	no	no
N1-25	55	50	55	50	56	51	56	51	60	55	no	no	0.1	0.4	0.4	0.3	no	no	no

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-26	54	49	54	50	55	50	55	51	60	55	no	no	0.2	0.5	0.1	1.0	no	no	no
N1-27	55	50	55	50	55	50	55	51	60	55	no	no	0.1	0.5	-0.3	0.7	no	no	no
N1-28	55	50	55	50	55	51	56	51	60	55	no	no	0.2	0.4	0.5	0.4	no	no	no
N1-29	63	58	60	56	63	58	61	56	60	55	yes	yes	-2.3	-1.9	-2.2	-2.2	no	no	yes
N1-30	70	66	67	63	71	66	68	64	60	55	yes	yes	-2.9	-2.7	-2.9	-2.2	yes	yes	yes, Acute
N1-31	62	57	60	56	63	58	61	56	60	55	yes	yes	-1.9	-1.6	-2.0	-2.0	no	no	yes
N1-32	66	61	63	59	66	61	64	59	60	55	yes	yes	-2.5	-2.1	-2.4	-2.4	no	no	yes
N1-33	69	64	66	62	69	64	67	62	60	55	yes	yes	-2.3	-2.0	-2.2	-2.3	yes	yes	yes, Acute
N1-34	63	58	62	57	64	59	63	58	60	55	yes	yes	-1.1	-0.7	-0.6	-0.6	no	no	yes
N1-36	45	40	45	40	46	41	46	41	60	55	no	no	-0.1	0.2	0.2	0.2	no	no	no
N1-37	45	40	45	40	46	41	46	41	60	55	no	no	-0.1	0.2	0.4	0.4	no	no	no
N1-38	45	40	45	40	46	41	46	41	60	55	no	no	-0.1	0.2	0.3	0.3	no	no	no
N1-39	45	40	45	40	46	41	46	41	60	55	no	no	-0.2	0.2	0.3	0.4	no	no	no
N1-40	45	40	45	40	46	41	46	41	60	55	no	no	-0.1	0.2	0.3	0.3	no	no	no
N1-41	45	40	45	40	46	41	46	41	60	55	no	no	-0.1	0.2	0.3	0.3	no	no	no
N1-42	44	39	44	39	45	40	45	40	60	55	no	no	-0.2	0.2	0.3	0.3	no	no	no
N1-43	44	39	44	39	45	40	45	40	60	55	no	no	-0.3	0.0	0.2	0.2	no	no	no
N1-44	44	39	44	39	45	40	45	40	60	55	no	no	-0.1	0.2	0.4	0.4	no	no	no
N1-45	44	39	44	39	45	40	45	40	60	55	no	no	-0.1	0.2	0.4	0.4	no	no	no
N1-46	43	38	43	38	44	39	43	39	60	55	no	no	-0.2	0.1	-0.6	0.4	no	no	no
N1-47	43	38	43	38	44	39	43	39	60	55	no	no	-0.3	0.0	-0.6	0.4	no	no	no
N1-48	43	38	43	38	44	39	43	39	60	55	no	no	-0.3	0.0	-0.7	0.3	no	no	no
N1-49	43	38	43	38	44	39	43	39	60	55	no	no	-0.3	0.0	-0.7	0.3	no	no	no
N1-50	43	38	43	38	44	39	44	39	60	55	no	no	-0.2	0.1	0.3	0.3	no	no	no
N1-51	43	38	43	38	44	39	44	39	60	55	no	no	-0.2	0.1	0.2	0.2	no	no	no
N1-52	43	38	43	38	44	39	44	39	60	55	no	no	-0.3	0.1	0.2	0.2	no	no	no

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-53	43	38	43	38	44	39	44	39	60	55	no	no	-0.3	0.0	0.2	0.2	no	no	no
N1-54	43	38	43	38	43	38	43	39	60	55	no	no	-0.3	0.0	-0.5	0.5	no	no	no
N1-55	43	38	42	38	43	38	43	38	60	55	no	no	-0.3	0.0	-0.4	-0.4	no	no	no
N1-56	43	38	42	38	43	38	43	38	60	55	no	no	-0.2	0.1	-0.3	-0.3	no	no	no
N1-57	43	38	42	38	43	38	43	38	60	55	no	no	-0.3	0.0	-0.4	-0.4	no	no	no
N1-58	43	38	42	38	43	38	43	38	60	55	no	no	-0.4	0.0	-0.4	-0.4	no	no	no
N1-59	43	38	42	38	43	38	43	38	60	55	no	no	-0.3	0.1	-0.3	-0.3	no	no	no
N1-60	43	38	42	38	43	38	43	38	60	55	no	no	-0.4	-0.1	-0.4	-0.4	no	no	no
N1-61	43	38	43	38	43	38	43	39	60	55	no	no	-0.3	0.0	-0.5	0.5	no	no	no
N1-62	43	38	43	38	43	38	43	39	60	55	no	no	-0.2	0.1	-0.4	0.6	no	no	no
N1-63	43	38	43	38	43	38	43	39	60	55	no	no	-0.1	0.3	-0.3	0.7	no	no	no
N1-64	43	38	43	38	44	39	43	39	60	55	no	no	-0.4	-0.1	-0.8	0.1	no	no	no
N1-65	43	38	43	38	44	39	43	39	60	55	no	no	-0.2	0.1	-0.6	0.4	no	no	no
N1-66	43	38	43	38	44	39	44	39	60	55	no	no	-0.1	0.1	0.2	0.2	no	no	no
N1-67	43	38	43	38	44	39	44	39	60	55	no	no	-0.2	0.1	0.0	0.0	no	no	no
N1-68	44	39	43	39	44	39	44	39	60	55	no	no	-0.2	-0.1	-0.2	-0.3	no	no	no
N1-69	44	39	44	39	45	40	44	40	60	55	no	no	-0.2	0.1	-0.6	0.4	no	no	no
N1-70	44	39	44	39	45	40	45	40	60	55	no	no	-0.1	0.2	0.1	0.1	no	no	no
N1-71	45	40	45	40	45	40	45	41	60	55	no	no	0.0	0.2	-0.3	0.7	no	no	no
N1-72	44	39	43	39	44	39	44	39	60	55	no	no	-0.3	-0.1	-0.4	-0.4	no	no	no
N1-73	44	39	44	39	45	40	44	40	60	55	no	no	-0.4	-0.1	-0.7	0.3	no	no	no
N1-74	44	39	44	39	45	40	45	40	60	55	no	no	-0.3	0.0	0.0	0.0	no	no	no
N1-75	45	40	45	40	45	40	45	41	60	55	no	no	-0.1	0.2	-0.4	0.6	no	no	no
N1-76	45	40	45	40	46	41	46	41	60	55	no	no	-0.1	0.3	0.2	0.2	no	no	no
N1-77	45	40	45	40	46	41	46	41	60	55	no	no	-0.1	0.2	0.4	0.4	no	no	no
N1-78	45	40	45	40	46	41	46	41	60	55	no	no	0.0	0.3	0.2	0.2	no	no	no

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N1-79	46	41	46	41	46	41	46	42	60	55	no	no	0.0	0.3	-0.2	0.8	no	no	no
N1-80	47	42	47	42	48	43	48	43	60	55	no	no	0.2	0.5	0.4	0.4	no	no	no
N1-81	46	41	46	41	47	42	47	42	60	55	no	no	0.0	0.3	0.3	0.3	no	no	no
N1-82	45	40	45	41	46	41	46	41	60	55	no	no	0.0	0.3	-0.1	-0.1	no	no	no
N1-83	46	41	46	41	47	42	47	42	60	55	no	no	-0.1	0.2	0.4	0.4	no	no	no
N1-84	46	41	46	41	46	41	46	42	60	55	no	no	-0.1	0.2	-0.5	0.5	no	no	no
N1-85	46	41	46	41	46	41	46	42	60	55	no	no	-0.1	0.2	-0.3	0.7	no	no	no
N1-86	46	41	46	41	46	41	46	42	60	55	no	no	-0.1	0.2	-0.3	0.7	no	no	no
N1-87	46	41	45	41	46	41	46	41	60	55	no	no	-0.1	0.2	-0.2	-0.2	no	no	no
N1-88	46	41	46	41	46	41	46	42	60	55	no	no	-0.1	0.2	-0.4	0.6	no	no	no
N1-89	46	41	46	41	46	41	46	42	60	55	no	no	-0.1	0.3	-0.5	0.6	no	no	no
N1-90	45	40	46	41	46	41	46	42	60	55	no	no	0.1	0.4	-0.1	0.9	no	no	no
N1-91	46	41	47	42	47	42	47	43	60	55	no	no	0.1	0.4	-0.1	0.9	no	no	no
N1-92	46	41	46	42	47	42	47	42	60	55	no	no	0.0	0.3	-0.1	-0.1	no	no	no
N1-93	46	41	46	41	47	42	47	42	60	55	no	no	0.0	0.2	0.2	0.1	no	no	no
N1-94	45	41	45	41	46	41	46	42	60	55	no	no	0.0	0.3	-0.1	0.8	no	no	no
N1-95	45	40	45	40	46	41	46	41	60	55	no	no	-0.2	0.1	0.3	0.3	no	no	no
N1-96	44	39	44	40	45	40	45	40	60	55	no	no	-0.2	0.1	-0.1	-0.1	no	no	no
N1-97	44	39	44	39	45	40	44	40	60	55	no	no	-0.2	0.1	-0.6	0.4	no	no	no
N1-98	44	39	43	39	44	39	44	39	60	55	no	no	-0.2	0.1	-0.3	-0.3	no	no	no
N1-99	43	38	43	38	44	39	44	39	60	55	no	no	-0.2	0.1	0.1	0.1	no	no	no
N1-100	43	38	43	38	43	38	43	39	60	55	no	no	-0.1	0.1	-0.4	0.5	no	no	no
N1-101	42	37	42	38	43	38	43	38	60	55	no	no	-0.1	0.1	0.0	-0.1	no	no	no
N1-102	43	38	43	38	44	39	44	39	60	55	no	no	-0.1	0.2	0.3	0.3	no	no	no
N1-103	43	38	42	38	43	38	43	38	60	55	no	no	-0.2	0.1	-0.3	-0.3	no	no	no
N1-104	42	37	42	37	43	38	43	38	60	55	no	no	-0.1	0.2	0.2	0.2	no	no	no

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N1-105	42	37	42	37	43	38	42	38	60	55	no	no	-0.2	0.1	-0.6	0.4	no	no	no
N1-106	42	37	42	37	42	37	42	38	60	55	no	no	-0.3	0.0	-0.5	0.5	no	no	no
N1-107	42	37	41	37	42	37	42	37	60	55	no	no	-0.3	0.0	-0.3	-0.3	no	no	no
N1-108	41	36	41	36	42	37	42	37	60	55	no	no	-0.2	0.1	0.0	0.0	no	no	no
N1-109	41	36	41	36	42	37	42	37	60	55	no	no	-0.2	0.2	0.2	0.2	no	no	no
N1-110	41	36	41	36	42	37	42	37	60	55	no	no	-0.1	0.2	0.3	0.3	no	no	no
N1-111	41	36	41	36	42	37	42	37	60	55	no	no	-0.2	0.1	0.3	0.3	no	no	no
N1-112	41	36	41	36	42	37	42	37	60	55	no	no	-0.3	0.0	0.1	0.1	no	no	no
N1-113	41	36	41	36	42	37	42	37	60	55	no	no	-0.3	0.0	0.1	0.1	no	no	no
N1-114	41	36	41	36	42	37	42	37	60	55	no	no	-0.1	0.2	0.2	0.2	no	no	no
N1-115	41	36	41	36	42	37	42	37	60	55	no	no	-0.1	0.2	0.2	0.2	no	no	no
N1-116	41	36	41	36	42	37	42	37	60	55	no	no	-0.1	0.2	0.2	0.2	no	no	no
N1-117	41	36	41	36	42	37	42	37	60	55	no	no	-0.1	0.2	0.2	0.2	no	no	no
N1-118	41	36	41	36	42	37	42	37	60	55	no	no	-0.1	0.2	0.4	0.4	no	no	no
N1-119	41	36	41	37	42	37	42	37	60	55	no	no	-0.1	0.2	0.0	0.0	no	no	no
N1-120	42	37	41	37	42	37	42	37	60	55	no	no	-0.2	0.1	-0.2	-0.2	no	no	no
N1-121	42	37	42	37	42	37	42	38	60	55	no	no	-0.1	0.2	-0.3	0.7	no	no	no
N1-122	42	37	42	37	42	37	42	38	60	55	no	no	-0.2	0.1	-0.5	0.5	no	no	no
N1-123	41	36	41	37	42	37	42	37	60	55	no	no	-0.3	0.1	-0.1	-0.1	no	no	no
N1-124	42	37	41	37	42	37	42	37	60	55	no	no	-0.2	0.1	-0.2	-0.2	no	no	no
N1-125	42	37	42	37	42	37	42	38	60	55	no	no	-0.2	0.1	-0.4	0.6	no	no	no
N1-126	42	37	42	37	43	38	43	38	60	55	no	no	-0.3	0.0	0.0	0.0	no	no	no
N1-127	42	37	42	37	43	38	42	38	60	55	no	no	-0.3	0.1	-0.6	0.4	no	no	no
N1-128	42	37	42	37	43	38	42	38	60	55	no	no	-0.2	0.1	-0.6	0.4	no	no	no
N1-129	43	38	42	38	43	38	43	38	60	55	no	no	-0.3	0.1	-0.3	-0.3	no	no	no
N1-130	43	38	43	38	44	39	44	39	60	55	no	no	-0.2	0.2	0.3	0.3	no	no	no

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N1-131	43	38	43	38	44	39	44	39	60	55	no	no	-0.3	0.1	0.0	0.0	no	no	no
N1-132	44	39	43	39	44	39	44	39	60	55	no	no	-0.3	0.1	-0.3	-0.3	no	no	no
N1-133	44	39	43	39	44	39	44	39	60	55	no	no	-0.3	0.1	-0.2	-0.2	no	no	no
N1-134	44	39	43	39	44	39	44	40	60	55	no	no	-0.3	0.1	-0.4	0.6	no	no	no
N1-135	44	39	44	39	44	39	44	40	60	55	no	no	-0.3	0.1	-0.5	0.5	no	no	no
N1-136	44	39	44	39	45	40	44	40	60	55	no	no	-0.2	0.2	-0.6	0.4	no	no	no
N1-137	44	39	44	39	45	40	44	40	60	55	no	no	-0.2	0.2	-0.6	0.4	no	no	no
N1-138	44	39	44	39	45	40	45	40	60	55	no	no	-0.2	0.2	0.2	0.2	no	no	no
N1-139	44	39	44	40	45	40	45	40	60	55	no	no	-0.2	0.2	0.0	0.0	no	no	no
N1-140	44	39	44	40	45	40	45	40	60	55	no	no	-0.2	0.2	-0.1	-0.1	no	no	no
N1-141	45	40	44	40	45	40	45	41	60	55	no	no	-0.3	0.1	-0.4	0.6	no	no	no
N1-142	45	40	45	40	45	40	45	41	60	55	no	no	-0.2	0.0	-0.4	0.5	no	no	no
N1-143	45	40	45	40	46	41	45	41	60	55	no	no	-0.2	0.2	-0.6	0.4	no	no	no
N1-144	45	40	45	40	46	41	46	41	60	55	no	no	-0.1	0.2	0.2	0.1	no	no	no
N1-145	45	40	45	41	46	41	46	41	60	55	no	no	0.0	0.3	0.0	0.0	no	no	no
N1-146	46	41	46	41	47	42	46	42	60	55	no	no	-0.3	-0.1	-0.6	0.3	no	no	no
N1-147	47	42	46	42	47	42	47	42	60	55	no	no	-0.2	0.1	-0.2	-0.2	no	no	no
N1-148	47	42	47	42	47	42	47	43	60	55	no	no	-0.1	0.1	-0.4	0.6	no	no	no
N1-149	47	42	47	42	48	43	48	43	60	55	no	no	-0.2	0.0	0.2	0.2	no	no	no
N1-150	47	42	47	42	48	43	48	43	60	55	no	no	-0.4	-0.1	-0.1	-0.1	no	no	no
N1-151	47	42	47	42	48	43	48	43	60	55	no	no	-0.3	0.1	0.2	0.2	no	no	no
N1-152	47	42	47	42	48	43	48	43	60	55	no	no	-0.1	0.1	0.3	0.3	no	no	no
N1-153	47	42	47	42	48	43	48	43	60	55	no	no	0.0	0.3	0.3	0.3	no	no	no
N1-154	48	43	48	43	48	43	48	44	60	55	no	no	-0.1	0.2	-0.3	0.7	no	no	no
N1-155	48	43	48	43	49	44	49	44	60	55	no	no	-0.1	0.2	0.1	0.1	no	no	no
N1-156	49	44	49	44	49	44	49	45	60	55	no	no	0.0	0.3	-0.2	0.8	no	no	no

Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-157	48	43	48	43	49	44	49	44	60	55	no	no	0.1	0.4	0.3	0.3	no	no	no
N1-158	48	43	48	43	48	43	48	44	60	55	no	no	0.0	0.4	-0.4	0.6	no	no	no
N1-159	48	43	48	43	49	44	48	44	60	55	no	no	-0.4	0.0	-0.8	0.1	no	no	no
N1-160	48	43	48	43	48	43	48	44	60	55	no	no	-0.3	0.1	-0.5	0.5	no	no	no
N1-161	48	43	48	43	49	44	48	44	60	55	no	no	-0.5	0.0	-0.8	0.2	no	no	no
N1-162	47	42	47	42	48	43	48	43	60	55	no	no	0.0	0.3	0.2	0.2	no	no	no
N1-163	50	45	50	45	51	46	50	46	60	55	no	no	-0.2	0.0	-0.6	0.4	no	no	no
N1-164	51	46	51	46	52	47	51	47	60	55	no	no	-0.3	0.0	-0.7	0.3	no	no	no
N1-165	52	47	51	47	52	47	52	47	60	55	no	no	-0.4	-0.1	-0.5	-0.5	no	no	no
N1-166	52	47	52	47	53	48	53	48	60	55	no	no	-0.4	0.0	0.1	0.1	no	no	no
N1-167	52	47	52	47	53	48	53	48	60	55	no	no	-0.4	0.0	0.1	0.1	no	no	no
N1-168	50	45	49	45	50	45	50	45	60	55	no	no	-0.5	-0.2	-0.3	-0.4	no	no	no
N1-169	50	45	50	45	51	46	51	46	60	55	no	no	-0.4	-0.1	0.0	0.0	no	no	no
N1-170	51	46	50	46	51	46	51	46	60	55	no	no	-0.4	-0.1	-0.3	-0.4	no	no	no
N1-171	51	45	51	46	51	46	51	47	60	55	no	no	0.0	0.5	-0.2	0.9	no	no	no
N1-172	51	46	51	46	51	46	52	47	60	55	no	no	0.3	0.6	0.8	0.8	no	no	no
N1-173	50	45	51	46	51	46	51	47	60	55	no	no	0.2	0.6	0.0	1.0	no	no	no
N1-174	50	45	50	46	50	45	51	46	60	55	no	no	0.5	0.9	0.7	0.7	no	no	no
N1-175	50	45	50	46	50	46	51	46	60	55	no	no	0.3	0.6	0.5	0.4	no	no	no
N1-176	49	44	49	44	50	45	50	45	60	55	no	no	-0.2	0.1	0.1	0.0	no	no	no
N1-177	51	46	51	46	51	46	52	47	60	55	no	no	0.2	0.6	0.6	0.5	no	no	no
N1-178	52	47	52	48	53	48	53	48	60	55	no	no	0.2	0.5	0.3	0.2	no	no	no
N1-179	48	43	48	43	48	43	49	44	60	55	no	no	0.3	0.6	0.5	0.5	no	no	no
N1-180	61	56	59	54	61	56	59	55	60	55	no	no	-2.2	-1.8	-2.4	-1.3	no	no	no
N1-181	54	49	53	49	55	50	54	49	60	55	no	no	-1.0	-0.6	-0.8	-0.8	no	no	no
N1-182	52	47	52	47	53	48	53	48	60	55	no	no	-0.4	-0.1	0.1	0.1	no	no	no

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-183	52	47	52	47	53	48	53	48	60	55	no	no	-0.4	0.1	0.1	0.2	no	no	no
N1-184	43	38	43	38	44	39	44	39	60	55	no	no	-0.1	0.2	0.3	0.3	no	no	no
N1-185	44	39	44	39	44	39	44	40	60	55	no	no	-0.1	0.2	-0.4	0.6	no	no	no
N1-186	44	39	44	39	45	40	45	40	60	55	no	no	-0.1	0.1	0.2	0.1	no	no	no
N1-187	45	40	44	40	45	40	45	40	60	55	no	no	-0.4	0.0	-0.4	-0.4	no	no	no
N1-188	46	41	45	41	47	42	46	41	60	55	no	no	-0.6	-0.2	-0.6	-0.6	no	no	no
N1-189	46	41	46	41	47	42	47	42	60	55	no	no	-0.3	0.0	0.0	0.0	no	no	no
N1-190	47	42	47	42	47	42	47	43	60	55	no	no	0.0	0.2	-0.3	0.6	no	no	no
N1-191	48	43	47	43	48	43	48	43	60	55	no	no	-0.2	0.1	-0.2	-0.2	no	no	no
N1-192	47	42	47	42	47	42	47	43	60	55	no	no	-0.1	0.2	-0.4	0.6	no	no	no
N1-193	45	40	45	40	45	40	45	41	60	55	no	no	-0.2	0.1	-0.5	0.5	no	no	no
N1-194	44	39	44	39	45	40	45	40	60	55	no	no	-0.5	-0.1	-0.1	-0.1	no	no	no
N1-195	43	38	43	38	44	39	44	39	60	55	no	no	-0.3	0.1	0.2	0.2	no	no	no
N1-196	42	37	42	37	43	38	43	38	60	55	no	no	-0.2	0.1	0.0	0.0	no	no	no
N1-197	42	37	41	36	42	37	42	37	60	55	no	no	-0.5	-0.2	-0.3	-0.3	no	no	no
N1-198	42	37	42	37	43	38	43	38	60	55	no	no	-0.3	0.0	0.0	0.0	no	no	no
N1-199	43	38	42	38	43	38	43	38	60	55	no	no	-0.5	-0.1	-0.4	-0.4	no	no	no
N1-200	43	38	42	38	43	38	43	38	60	55	no	no	-0.5	-0.2	-0.4	-0.4	no	no	no
N1-201	43	38	43	38	44	39	44	39	60	55	no	no	-0.5	-0.2	-0.1	-0.1	no	no	no
N1-202	43	38	43	38	44	39	43	39	60	55	no	no	-0.5	-0.2	-0.8	0.2	no	no	no
N1-203	44	39	43	38	44	39	44	39	60	55	no	no	-0.7	-0.4	-0.4	-0.4	no	no	no
N1-204	44	39	43	38	44	39	44	39	60	55	no	no	-0.8	-0.4	-0.4	-0.3	no	no	no
N1-205	44	39	43	39	45	40	44	39	60	55	no	no	-0.6	-0.3	-0.7	-0.7	no	no	no
N1-206	44	39	44	39	45	40	45	40	60	55	no	no	-0.5	-0.2	0.0	0.0	no	no	no
N1-207	45	40	44	40	45	40	45	40	60	55	no	no	-0.3	0.0	-0.3	-0.3	no	no	no
N1-208	46	41	45	41	46	41	46	41	60	55	no	no	-0.2	0.1	-0.3	-0.3	no	no	no

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-209	44	39	44	39	45	40	45	40	60	55	no	no	-0.4	0.0	0.1	0.1	no	no	no
N1-210	44	39	44	39	45	40	44	40	60	55	no	no	-0.3	0.0	-0.6	0.4	no	no	no
N1-211	44	39	44	39	45	39	44	40	60	55	no	no	-0.4	0.0	-0.6	0.5	no	no	no
N1-212	44	39	43	39	44	39	44	39	60	55	no	no	-0.3	0.0	-0.2	-0.2	no	no	no
N1-213	44	39	43	38	44	39	44	39	60	55	no	no	-0.4	-0.1	-0.2	-0.2	no	no	no
N1-214	42	37	42	37	43	38	43	38	60	55	no	no	-0.4	-0.1	0.0	0.0	no	no	no
N1-215	42	37	42	37	43	38	42	38	60	55	no	no	-0.4	-0.1	-0.8	0.2	no	no	no
N1-216	42	37	42	37	43	38	42	38	60	55	no	no	-0.5	-0.1	-0.8	0.2	no	no	no
N1-217	42	37	42	37	43	38	42	38	60	55	no	no	-0.6	-0.2	-0.8	0.3	no	no	no
N1-218	43	38	42	37	43	38	43	38	60	55	no	no	-0.7	-0.3	-0.2	-0.2	no	no	no
N1-219	42	37	42	37	43	38	42	38	60	55	no	no	-0.7	-0.3	-1.1	-0.1	no	no	no
N1-220	43	38	43	38	44	39	43	39	60	55	no	no	-0.6	-0.3	-0.8	0.2	no	no	no
N1-221	43	38	43	38	44	39	43	39	60	55	no	no	-0.7	-0.3	-0.9	0.2	no	no	no
N1-222	44	38	43	38	44	39	43	39	60	55	no	no	-0.8	-0.4	-1.2	-0.1	no	no	no
N1-223	43	38	42	38	44	39	43	38	60	55	no	no	-0.7	-0.4	-0.7	-0.7	no	no	no
N1-224	42	37	42	37	43	38	42	38	60	55	no	no	-0.9	-0.5	-1.1	-0.1	no	no	no
N1-225	42	37	42	37	43	38	42	38	60	55	no	no	-0.8	-0.4	-1.0	0.0	no	no	no
N1-226	42	37	42	37	43	38	42	38	60	55	no	no	-0.7	-0.3	-1.1	-0.1	no	no	no
N1-227	42	37	41	37	43	38	42	38	60	55	no	no	-0.7	-0.3	-0.8	0.2	no	no	no
N1-228	42	37	41	37	43	38	42	37	60	55	no	no	-0.7	-0.3	-0.7	-0.7	no	no	no
N1-229	42	37	41	37	43	38	42	37	60	55	no	no	-0.8	-0.4	-0.6	-0.6	no	no	no
N1-230	41	36	40	36	41	36	41	37	60	55	no	no	-0.4	0.0	-0.5	0.5	no	no	no
N1-231	41	36	41	36	42	37	41	37	60	55	no	no	-0.3	0.0	-0.6	0.4	no	no	no
N1-232	41	36	40	36	41	36	41	36	60	55	no	no	-0.4	0.0	-0.3	-0.3	no	no	no
N1-233	42	37	41	36	42	37	42	37	60	55	no	no	-0.8	-0.4	-0.4	-0.4	no	no	no
N1-234	42	37	41	37	43	38	42	37	60	55	no	no	-1.0	-0.6	-1.0	-1.0	no	no	no

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N1-235	42	37	41	37	43	38	42	37	60	55	no	no	-1.0	-0.7	-1.0	-1.0	no	no	no
N1-236	42	37	41	37	43	38	42	37	60	55	no	no	-0.9	-0.6	-1.0	-1.0	no	no	no
N1-237	43	38	42	38	44	39	43	38	60	55	no	no	-0.8	-0.5	-0.8	-0.8	no	no	no
N1-238	43	38	42	37	44	39	43	38	60	55	no	no	-0.9	-0.5	-0.7	-0.6	no	no	no
N1-239	44	39	43	38	44	39	43	39	60	55	no	no	-0.9	-0.6	-1.3	-0.3	no	no	no
N1-240	45	40	44	39	45	40	45	40	60	55	no	no	-0.8	-0.4	-0.5	-0.5	no	no	no
N1-241	41	35	39	35	41	36	40	35	60	55	no	no	-1.3	-0.9	-1.2	-1.1	no	no	no
N1-242	42	37	41	36	42	37	42	37	60	55	no	no	-0.9	-0.5	-0.4	-0.3	no	no	no
N1-243	45	40	45	40	46	41	46	41	60	55	no	no	-0.4	0.0	-0.1	0.0	no	no	no
N1-244	48	43	47	42	48	43	47	43	60	55	no	no	-1.2	-0.8	-1.5	-0.4	no	no	no
N1-245	50	45	48	44	50	45	49	44	60	55	no	no	-1.3	-0.9	-1.4	-1.3	no	no	no
N1-246	52	47	50	46	53	48	51	46	60	55	no	no	-2.0	-1.6	-2.0	-1.9	no	no	no
N1-247	51	46	49	45	52	47	50	45	60	55	no	no	-1.7	-1.3	-1.7	-1.6	no	no	no
N1-248	50	45	48	44	50	45	49	44	60	55	no	no	-1.1	-0.8	-1.2	-1.2	no	no	no
N1-249	50	45	49	44	51	46	50	45	60	55	no	no	-1.2	-0.8	-0.7	-0.6	no	no	no
N1-250	50	45	49	44	50	45	50	45	60	55	no	no	-0.7	-0.3	-0.3	-0.2	no	no	no
N1-251	46	41	46	41	47	42	46	42	60	55	no	no	-0.9	-0.5	-1.1	0.0	no	no	no
N1-252	52	47	50	46	52	47	51	46	60	55	no	no	-1.3	-0.8	-1.3	-1.2	no	no	no
N1-253	49	44	48	44	50	45	49	44	60	55	no	no	-1.0	-0.7	-1.1	-1.1	no	no	no
N1-254	48	43	47	42	48	43	48	43	60	55	no	no	-0.9	-0.5	-0.5	-0.4	no	no	no
N1-255	47	42	46	41	47	42	46	42	60	55	no	no	-1.0	-0.5	-1.4	-0.3	no	no	no
N1-256	46	41	45	41	47	42	46	41	60	55	no	no	-0.8	-0.5	-0.8	-0.8	no	no	no
N1-257	51	46	50	45	52	47	50	46	60	55	no	no	-1.6	-1.2	-2.0	-0.9	no	no	no
N1-258	48	43	47	42	49	44	48	43	60	55	no	no	-1.2	-0.9	-0.9	-0.9	no	no	no
N1-259	47	42	46	41	47	42	46	42	60	55	no	no	-1.2	-0.8	-1.5	-0.5	no	no	no
N1-260	45	40	44	39	46	41	45	40	60	55	no	no	-1.1	-0.6	-0.8	-0.7	no	no	no

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	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-261	45	40	44	39	45	40	44	40	60	55	no	no	-1.0	-0.6	-1.4	-0.3	no	no	no
N1-262	44	39	43	39	45	40	44	39	60	55	no	no	-1.0	-0.6	-1.1	-1.0	no	no	no
N1-263	45	40	44	40	46	41	45	40	60	55	no	no	-1.1	-0.6	-1.0	-0.9	no	no	no
N1-264	46	41	45	40	46	41	45	41	60	55	no	no	-1.0	-0.7	-1.3	-0.3	no	no	no
N1-265	43	38	42	37	44	39	43	38	60	55	no	no	-0.8	-0.5	-0.6	-0.6	no	no	no
N1-266	43	38	43	38	44	39	43	39	60	55	no	no	-0.8	-0.4	-1.1	0.0	no	no	no
N1-267	44	39	43	39	45	40	44	39	60	55	no	no	-0.8	-0.4	-0.8	-0.8	no	no	no
N1-268	41	36	40	36	42	36	41	36	60	55	no	no	-0.6	-0.2	-0.6	-0.5	no	no	no
N1-269	42	37	42	37	43	38	42	38	60	55	no	no	-0.6	-0.3	-1.0	0.0	no	no	no
N1-270	36	31	35	30	36	31	35	30	60	55	no	no	-1.1	-0.8	-1.3	-1.2	no	no	no
N1-271	36	31	35	30	37	31	36	31	60	55	no	no	-0.9	-0.5	-0.7	-0.5	no	no	no
N1-272	38	33	37	32	38	33	38	33	60	55	no	no	-0.8	-0.4	-0.3	-0.2	no	no	no
N1-273	36	31	35	31	37	32	36	31	60	55	no	no	-0.9	-0.5	-0.8	-0.7	no	no	no
N1-274	35	29	33	29	35	30	34	29	60	55	no	no	-1.2	-0.7	-1.3	-1.1	no	no	no
N1-275	33	28	32	28	34	29	33	28	60	55	no	no	-1.2	-0.8	-1.1	-1.0	no	no	no
N1-276	34	28	32	27	34	29	33	28	60	55	no	no	-1.5	-1.1	-1.2	-1.1	no	no	no
N1-277	34	28	32	27	34	29	32	28	60	55	no	no	-1.9	-1.5	-2.2	-1.1	no	no	no
N1-277	60	55	61	57	60	55	62	57	60	55	yes	yes	1.6	1.9	1.6	1.5	no	no	yes
N1-278	34	29	32	28	35	30	33	28	60	55	no	no	-1.8	-1.4	-1.9	-1.7	no	no	no
N1-279	38	32	37	32	38	33	38	33	60	55	no	no	-0.7	-0.2	-0.3	-0.1	no	no	no
N1-280	41	36	40	35	42	37	40	36	60	55	no	no	-1.6	-1.2	-1.9	-0.8	no	no	no
N1-281	44	39	42	37	45	40	43	38	60	55	no	no	-2.3	-1.9	-2.0	-1.9	no	no	no
N1-282	46	41	44	39	46	41	44	40	60	55	no	no	-2.1	-1.7	-2.4	-1.3	no	no	no
N1-283	45	40	43	38	46	41	43	39	60	55	no	no	-2.3	-2.0	-2.7	-1.6	no	no	no
N1-284	46	41	44	39	47	42	44	40	60	55	no	no	-2.5	-2.1	-2.9	-1.8	no	no	no
N1-285	52	46	50	45	52	47	51	46	60	55	no	no	-1.4	-1.0	-1.2	-1.1	no	no	no

Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-286	49	44	47	43	50	45	48	43	60	55	no	no	-1.9	-1.6	-2.0	-1.9	no	no	no
N1-287	50	44	48	43	50	45	48	44	60	55	no	no	-1.9	-1.6	-2.2	-1.1	no	no	no
N1-288	49	44	46	42	49	44	47	42	60	55	no	no	-2.3	-2.0	-2.3	-2.2	no	no	no
N1-289	50	44	47	42	50	45	48	43	60	55	no	no	-2.3	-2.0	-2.2	-2.1	no	no	no
N1-290	57	51	55	51	57	52	56	51	60	55	no	no	-1.2	-0.8	-1.2	-1.1	no	no	no
N1-291	50	45	48	43	51	46	49	44	60	55	no	no	-2.3	-1.9	-2.0	-1.9	no	no	no
N1-292	50	45	48	43	51	46	49	44	60	55	no	no	-2.2	-1.9	-2.0	-1.9	no	no	no
N1-293	50	45	48	44	51	46	49	44	60	55	no	no	-2.1	-1.8	-2.1	-2.0	no	no	no
N1-294	50	45	48	43	51	46	49	44	60	55	no	no	-2.1	-1.7	-1.9	-1.8	no	no	no
N1-295	50	45	48	43	51	45	49	44	60	55	no	no	-2.1	-1.6	-1.6	-1.4	no	no	no
N1-296	56	51	54	49	56	51	54	50	60	55	no	no	-2.0	-1.6	-2.3	-1.2	no	no	no
N1-297	57	52	55	50	58	53	55	51	60	55	no	no	-2.4	-2.0	-2.7	-1.6	no	no	no
N1-298	57	52	55	50	58	53	56	51	60	55	no	no	-2.3	-2.0	-2.1	-2.0	no	no	no
N1-299	60	55	57	53	60	55	58	53	60	55	no	no	-2.4	-2.0	-2.3	-2.2	no	no	no
N1-300	60	55	57	53	60	55	58	53	60	55	no	no	-2.4	-1.9	-2.4	-2.2	no	no	no
N1-301	60	55	57	53	60	55	58	53	60	55	no	no	-2.4	-2.0	-2.4	-2.3	no	no	no
N1-302	60	55	57	53	60	55	58	53	60	55	no	no	-2.3	-1.9	-2.4	-2.3	no	no	no
N1-303	59	54	57	52	59	54	57	53	60	55	no	no	-2.2	-1.8	-2.5	-1.4	no	no	no
N1-304	55	50	53	48	56	51	54	49	60	55	no	no	-1.9	-1.5	-1.7	-1.6	no	no	no
N1-305	52	47	50	45	52	47	51	46	60	55	no	no	-1.6	-1.2	-1.4	-1.3	no	no	no
N1-306	56	51	54	50	57	52	55	50	60	55	no	no	-1.8	-1.4	-1.7	-1.6	no	no	no
N1-307	57	52	55	50	57	52	56	51	60	55	no	no	-1.9	-1.6	-1.5	-1.4	no	no	no
N1-308	57	52	55	50	57	52	55	51	60	55	no	no	-2.1	-1.7	-2.3	-1.2	no	no	no
N1-309	56	51	54	50	57	52	55	50	60	55	no	no	-2.2	-1.8	-2.1	-2.0	no	no	no
N1-310	54	49	53	48	55	50	54	49	60	55	no	no	-1.4	-1.1	-1.1	-1.0	no	no	no
N1-311	54	49	52	47	55	50	53	48	60	55	no	no	-2.3	-2.0	-1.8	-1.7	no	no	no

Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-312	57	52	54	50	58	53	55	50	60	55	no	no	-3.1	-2.7	-3.1	-3.0	no	no	no
N1-313	49	44	46	42	50	44	47	42	60	55	no	no	-2.5	-2.1	-2.6	-2.5	no	no	no
N1-314	49	44	46	42	49	44	47	42	60	55	no	no	-2.5	-2.1	-2.4	-2.3	no	no	no
N1-315	49	43	46	41	49	44	47	42	60	55	no	no	-2.5	-2.2	-2.2	-2.1	no	no	no
N1-316	47	42	46	41	47	42	47	42	60	55	no	no	-0.8	-0.4	-0.4	-0.3	no	no	no
N1-317	35	30	34	29	36	30	35	30	60	55	no	no	-1.2	-0.8	-0.7	-0.5	no	no	no
N1-318	39	34	37	32	40	34	37	33	60	55	no	no	-2.3	-1.9	-2.6	-1.5	no	no	no
N1-319	39	34	38	33	40	35	39	34	60	55	no	no	-1.5	-1.1	-1.0	-0.8	no	no	no
N1-320	40	35	39	34	41	36	40	35	60	55	no	no	-1.3	-1.0	-0.8	-0.7	no	no	no
N1-321	41	36	39	35	42	37	40	35	60	55	no	no	-2.0	-1.5	-1.9	-1.7	no	no	no
N1-322	42	37	40	35	42	37	40	36	60	55	no	no	-1.9	-1.6	-2.3	-1.2	no	no	no
N1-323	58	53	56	51	58	53	56	52	60	55	no	no	-2.2	-1.8	-2.5	-1.4	no	no	no
N1-324	57	52	55	51	58	53	56	51	60	55	no	no	-2.1	-1.7	-2.0	-1.9	no	no	no
N1-325	57	52	55	50	58	53	56	51	60	55	no	no	-2.1	-1.7	-1.7	-1.6	no	no	no
N1-326	57	52	55	50	58	52	56	51	60	55	no	no	-2.1	-1.7	-1.6	-1.5	no	no	no
N1-327	57	52	55	50	58	53	56	51	60	55	no	no	-2.1	-1.8	-1.6	-1.6	no	no	no
N1-328	57	52	55	50	58	53	56	51	60	55	no	no	-2.2	-1.8	-1.7	-1.6	no	no	no
N1-329	56	51	54	49	57	52	55	50	60	55	no	no	-2.1	-1.7	-1.7	-1.6	no	no	no
N1-330	57	52	55	50	58	53	56	51	60	55	no	no	-2.2	-1.8	-1.8	-1.7	no	no	no
N1-331	57	52	55	50	58	53	56	51	60	55	no	no	-2.3	-1.9	-2.1	-2.0	no	no	no
N1-332	57	52	55	50	58	53	56	51	60	55	no	no	-2.3	-1.9	-2.1	-2.0	no	no	no
N1-333	57	52	55	50	58	53	56	51	60	55	no	no	-2.3	-1.9	-2.0	-1.9	no	no	no
N1-334	57	52	55	50	58	53	56	51	60	55	no	no	-2.3	-1.9	-1.8	-1.7	no	no	no
N1-335	57	52	55	50	58	53	56	51	60	55	no	no	-2.2	-1.8	-1.7	-1.6	no	no	no
N1-336	56	51	54	49	57	52	55	50	60	55	no	no	-2.0	-1.6	-1.8	-1.7	no	no	no
N1-337	56	51	54	49	56	51	55	50	60	55	no	no	-1.9	-1.6	-1.5	-1.5	no	no	no

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-338	55	50	53	48	56	50	54	49	60	55	no	no	-1.8	-1.4	-1.6	-1.5	no	no	no
N1-339	55	49	53	48	55	50	53	49	60	55	no	no	-1.9	-1.5	-2.2	-1.1	no	no	no
N1-340	55	50	53	49	56	51	54	49	60	55	no	no	-1.9	-1.5	-1.8	-1.7	no	no	no
N1-341	55	50	53	49	56	51	54	49	60	55	no	no	-2.0	-1.6	-2.1	-2.0	no	no	no
N1-342	55	50	53	49	56	51	54	49	60	55	no	no	-2.1	-1.6	-2.1	-2.0	no	no	no
N1-343	56	51	54	49	56	51	54	50	60	55	no	no	-2.1	-1.7	-2.4	-1.4	no	no	no
N1-344	56	51	54	49	57	52	55	50	60	55	no	no	-2.1	-1.7	-1.9	-1.8	no	no	no
N1-345	56	51	54	50	57	52	55	50	60	55	no	no	-2.2	-1.8	-2.1	-2.0	no	no	no
N1-346	56	51	54	50	57	52	55	50	60	55	no	no	-2.1	-1.8	-2.0	-2.0	no	no	no
N1-347	56	51	54	49	57	52	55	50	60	55	no	no	-2.1	-1.8	-1.9	-1.9	no	no	no
N1-348	56	51	54	49	56	51	54	50	60	55	no	no	-2.1	-1.8	-2.4	-1.4	no	no	no
N1-349	55	50	53	48	56	51	54	49	60	55	no	no	-2.0	-1.7	-1.8	-1.8	no	no	no
N1-350	56	50	53	49	56	51	54	49	60	55	no	no	-2.1	-1.7	-2.2	-2.1	no	no	no
N1-351	55	50	53	48	55	50	54	49	60	55	no	no	-2.0	-1.6	-1.5	-1.5	no	no	no
N1-352	54	49	52	48	55	50	53	49	60	55	no	no	-2.0	-1.6	-2.1	-1.1	no	no	no
N1-353	53	48	51	47	54	49	52	47	60	55	no	no	-1.6	-1.2	-1.7	-1.6	no	no	no
N1-354	52	47	51	46	53	48	52	47	60	55	no	no	-1.6	-1.2	-1.1	-1.0	no	no	no
N1-355	52	47	51	46	53	48	51	47	60	55	no	no	-1.5	-1.1	-1.8	-0.7	no	no	no
N1-356	52	47	50	46	52	47	51	46	60	55	no	no	-1.5	-1.1	-1.4	-1.3	no	no	no
N1-357	57	52	55	50	57	52	55	51	60	55	no	no	-2.2	-1.9	-2.4	-1.4	no	no	no
N1-358	57	52	55	50	57	52	55	51	60	55	no	no	-2.2	-1.9	-2.4	-1.4	no	no	no
N1-359	57	52	55	50	57	52	55	51	60	55	no	no	-2.2	-1.8	-2.4	-1.4	no	no	no
N1-360	57	52	55	50	57	52	55	51	60	55	no	no	-2.2	-1.7	-2.4	-1.3	no	no	no
N1-361	57	52	55	50	57	52	55	51	60	55	no	no	-2.1	-1.7	-2.4	-1.3	no	no	no
N1-362	57	52	55	50	57	52	55	51	60	55	no	no	-2.1	-1.7	-2.4	-1.4	no	no	no
N1-363	57	52	55	50	57	52	55	51	60	55	no	no	-2.0	-1.7	-2.4	-1.4	no	no	no

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N1-364	57	52	55	50	57	52	55	51	60	55	no	no	-2.0	-1.7	-2.4	-1.4	no	no	no
N1-365	57	52	55	50	57	52	55	51	60	55	no	no	-2.0	-1.6	-2.4	-1.4	no	no	no
N1-366	57	52	55	51	58	53	56	51	60	55	no	no	-1.8	-1.4	-1.8	-1.7	no	no	no
N1-367	58	53	56	52	58	53	57	52	60	55	no	no	-1.5	-1.1	-1.4	-1.4	no	no	no
N1-368	58	53	56	52	59	54	57	53	60	55	no	no	-1.6	-1.2	-1.7	-0.7	no	no	no
N1-369	59	54	58	53	60	55	58	54	60	55	no	no	-1.4	-1.0	-1.7	-0.7	no	no	no
N1-370	56	51	56	51	56	52	57	52	60	55	no	no	0.2	0.3	0.6	0.4	no	no	no
N1-371	57	52	57	53	58	53	58	54	60	55	no	no	0.1	0.4	0.0	0.9	no	no	no
N1-372	58	53	58	53	58	53	59	54	60	55	no	no	0.2	0.4	0.7	0.6	no	no	no
N1-373	58	53	58	53	58	53	58	54	60	55	no	no	-0.1	0.2	-0.4	0.5	no	no	no
N1-374	58	53	58	54	59	54	59	54	60	55	no	no	-0.1	0.2	0.0	-0.1	no	no	no
N1-375	67	62	64	60	67	62	65	60	60	55	yes	yes	-2.3	-2.0	-2.2	-2.3	yes	yes	yes, Acute
N2-1	64	59	61	57	64	59	62	57	60	55	yes	yes	-2.3	-1.9	-2.2	-2.2	no	no	yes
N2-2	59	54	57	52	60	55	58	53	60	55	no	no	-2.5	-2.1	-2.0	-1.9	no	no	no
N2-3	66	61	64	60	67	62	65	61	60	55	yes	yes	-1.6	-1.2	-1.7	-1.0	yes	yes	yes, Acute
N2-4	67	62	65	61	67	63	66	61	60	55	yes	yes	-1.6	-1.2	-1.2	-1.6	yes	yes	yes, Acute
N2-5	65	60	62	58	65	60	63	58	60	55	yes	yes	-2.3	-1.9	-2.2	-2.3	no	no	yes
N2-6	61	56	59	55	62	57	60	55	60	55	no	no	-2.0	-1.7	-1.9	-2.0	no	no	no
N2-7	60	55	58	53	61	56	59	54	60	55	no	no	-2.3	-1.9	-2.0	-2.0	no	no	no
N2-8	58	53	56	51	58	53	56	52	60	55	no	no	-2.2	-1.8	-2.4	-1.4	no	no	no
N2-9	57	52	54	50	57	52	55	50	60	55	no	no	-2.2	-1.8	-2.3	-2.2	no	no	no
N2-10	58	53	56	52	59	54	57	52	60	55	no	no	-2.1	-1.6	-2.0	-1.9	no	no	no
N2-11	64	59	61	57	64	59	62	57	60	55	yes	yes	-2.2	-1.8	-2.2	-2.2	no	no	yes
N2-12	58	53	56	52	59	54	57	52	60	55	no	no	-2.0	-1.5	-1.8	-1.7	no	no	no
N2-13	55	50	54	49	56	51	55	50	60	55	no	no	-1.6	-1.3	-1.1	-1.1	no	no	no
N2-14	68	63	66	62	68	63	67	62	60	55	yes	yes	-1.6	-1.2	-1.4	-1.5	yes	yes	yes, Acute

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N2-15	62	57	60	55	63	58	61	56	60	55	yes	yes	-2.1	-1.8	-1.8	-1.9	no	no	yes
N2-16	67	62	65	60	67	62	65	61	60	55	yes	yes	-2.0	-1.7	-2.2	-1.4	yes	yes	yes, Acute
N2-17	68	63	66	61	68	63	67	62	60	55	yes	yes	-1.7	-1.3	-1.2	-1.3	yes	yes	yes, Acute
N2-18	67	62	66	61	68	63	66	62	60	55	yes	yes	-1.5	-1.1	-1.8	-0.9	yes	yes	yes, Acute
N2-19	63	58	61	56	63	58	61	57	60	55	yes	yes	-1.8	-1.5	-2.2	-1.3	no	no	yes
N2-20	60	55	59	54	61	56	59	55	60	55	no	no	-1.7	-1.3	-2.0	-1.0	no	no	no
N2-21	60	55	57	52	60	55	58	53	60	55	no	no	-2.5	-2.1	-2.2	-2.2	no	no	no
N2-22	58	53	56	51	59	54	57	52	60	55	no	no	-1.9	-1.5	-1.6	-1.6	no	no	no
N2-23	60	55	59	55	61	56	60	55	60	55	no	no	-1.0	-0.6	-0.9	-0.9	no	no	no
N2-24	54	49	55	51	55	50	56	51	60	55	no	no	0.7	1.2	0.9	0.9	no	no	no
N2-25	59	54	58	54	60	55	59	54	60	55	no	no	-0.8	-0.5	-0.6	-0.7	no	no	no
N2-26	60	55	59	55	61	56	60	55	60	55	no	no	-1.0	-0.6	-1.0	-1.0	no	no	no
N2-27	60	55	60	55	61	56	60	56	60	55	no	yes	-0.9	-0.5	-1.1	-0.1	no	no	yes
N2-28	57	52	55	50	58	53	56	51	60	55	no	no	-2.4	-2.0	-2.0	-1.9	no	no	no
N2-29	57	52	55	50	58	52	55	51	60	55	no	no	-2.4	-2.0	-2.6	-1.5	no	no	no
N2-30	57	52	55	50	58	53	55	51	60	55	no	no	-2.4	-2.0	-2.7	-1.6	no	no	no
N2-31	57	51	54	49	57	52	55	50	60	55	no	no	-2.4	-2.0	-2.3	-2.1	no	no	no
N3-1	69	64	70	65	70	65	70	66	60	55	yes	yes	0.8	1.1	0.4	1.2	yes	yes	yes, Acute
N3-2	64	59	65	60	64	59	65	61	60	55	yes	yes	1.0	1.3	0.8	1.6	yes	yes	yes, Acute
N3-3	62	57	61	56	62	57	62	57	60	55	yes	yes	-0.5	-0.2	-0.2	-0.3	no	no	yes
N3-4	62	57	62	57	62	57	62	58	60	55	yes	yes	-0.1	0.3	-0.5	0.5	no	no	yes
N3-5	62	57	62	57	63	58	63	58	60	55	yes	yes	-0.2	0.1	0.2	0.2	no	no	yes
N3-6	62	57	61	57	62	57	62	57	60	55	yes	yes	-0.3	0.1	-0.3	-0.3	no	no	yes
N3-7	59	54	58	54	60	55	59	54	60	55	no	no	-1.1	-0.6	-1.0	-0.9	no	no	no
N3-8	60	55	59	55	60	55	60	55	60	55	no	no	-0.2	0.1	-0.2	-0.2	no	no	no
N3-9	56	51	57	52	56	51	58	53	60	55	no	no	1.2	1.5	1.7	1.5	no	no	no

Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N3-10	56	52	57	53	57	52	58	54	60	55	no	no	1.2	1.4	1.1	1.8	no	no	no
N3-11	56	51	57	52	56	52	58	53	60	55	no	no	1.2	1.5	1.6	1.4	no	no	no
N3-12	63	59	65	60	64	59	65	61	60	55	yes	yes	1.1	1.5	0.9	1.8	yes	yes	yes, Acute
N3-13	60	55	61	56	61	56	61	57	60	55	yes	yes	0.3	0.7	0.0	1.0	no	no	yes
N3-14	61	56	62	57	61	56	63	58	60	55	yes	yes	1.3	1.5	1.8	1.5	no	no	yes
N3-15	57	52	58	54	57	52	59	54	60	55	no	no	1.4	1.7	1.7	1.5	no	no	no
N3-16	57	52	58	54	57	53	59	54	60	55	no	no	1.3	1.5	1.5	1.3	no	no	no
N3-17	58	54	60	55	59	54	61	56	60	55	yes	yes	1.5	1.6	1.9	1.5	no	no	yes
N3-18	58	53	60	55	59	54	60	56	60	55	no	yes	1.5	1.7	1.3	2.0	no	no	yes
N3-19	61	57	63	59	62	57	64	59	60	55	yes	yes	1.7	1.8	1.9	1.6	no	no	yes
N3-20	62	58	64	60	63	58	65	60	60	55	yes	yes	1.8	1.9	2.1	1.7	yes	yes	yes, Acute
N3-21	62	58	64	59	63	58	65	60	60	55	yes	yes	1.7	1.8	2.2	1.8	yes	yes	yes, Acute
N3-22	67	63	69	65	68	63	70	66	60	55	yes	yes	2.4	2.3	2.3	2.8	yes	yes	yes, Acute
N3-23	60	55	61	57	60	55	62	58	60	55	yes	yes	1.9	2.0	1.8	2.5	no	no	yes
N3-24	64	59	66	61	65	60	67	62	60	55	yes	yes	2.0	2.0	2.4	2.1	yes	yes	yes, Acute
N3-25	61	57	63	59	62	57	64	59	60	55	yes	yes	2.1	2.0	2.0	1.6	no	no	yes
N3-26	62	58	65	60	63	58	65	61	60	55	yes	yes	2.1	2.0	1.9	2.5	yes	yes	yes, Acute
N3-27	62	57	64	59	63	58	65	60	60	55	yes	yes	2.0	2.0	2.4	2.0	yes	yes	yes, Acute
N3-28	67	62	69	64	68	63	70	65	60	55	yes	yes	1.9	1.9	2.4	2.0	yes	yes	yes, Acute
N3-29	67	62	68	64	67	63	69	65	60	55	yes	yes	1.7	1.9	1.6	2.2	yes	yes	yes, Acute
N3-30	68	64	70	66	69	64	71	66	60	55	yes	yes	1.8	1.8	2.1	1.5	yes	yes	yes, Acute
N3-31	63	58	64	60	64	59	65	60	60	55	yes	yes	0.9	1.2	0.9	0.9	yes	yes	yes, Acute
N3-32	62	57	63	59	63	58	64	59	60	55	yes	yes	1.2	1.4	1.2	1.1	no	no	yes
N3-32	56	51	54	49	57	52	55	50	60	55	no	no	-2.4	-2.0	-1.9	-1.8	no	no	no
N3-33	61	56	62	57	62	57	63	58	60	55	yes	yes	1.0	1.2	1.2	1.1	no	no	yes
N3-34	60	55	60	56	60	55	61	56	60	55	yes	yes	0.9	1.0	0.8	0.6	no	no	yes
N3-35	66	62	67	63	67	62	68	63	60	55	yes	yes	1.1	1.2	1.1	0.8	yes	yes	yes, Acute

Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N3-36	65	60	66	61	66	61	66	62	60	55	yes	yes	0.7	0.7	0.3	1.0	yes	yes	yes, Acute
N3-37	69	64	70	65	70	65	70	66	60	55	yes	yes	0.7	0.8	0.4	1.0	yes	yes	yes, Acute
N3-39	57	52	57	53	58	53	58	54	60	55	no	no	0.5	0.7	0.4	1.2	no	no	no
N3-40	57	53	58	53	58	53	59	54	60	55	no	no	0.5	0.7	1.0	0.8	no	no	no
N3-41	64	59	65	60	65	60	65	61	60	55	yes	yes	0.5	0.6	0.2	0.9	yes	yes	yes, Acute
N3-42	63	58	64	59	64	59	64	60	60	55	yes	yes	0.6	0.6	0.3	1.0	no	yes	yes, Acute
N3-43	62	58	63	58	63	58	64	59	60	55	yes	yes	0.5	0.5	1.0	0.7	no	no	yes
N3-44	60	56	61	56	61	56	61	57	60	55	yes	yes	0.5	0.5	0.1	0.8	no	no	yes
N3-45	57	52	60	55	58	53	60	56	60	55	no	yes	2.6	2.7	2.4	3.2	no	no	yes, Increase >2
N4-1	68	63	68	64	69	64	69	65	60	55	yes	yes	0.2	0.5	0.2	0.9	yes	yes	yes, Acute
N4-2	63	59	64	59	64	59	64	60	60	55	yes	yes	0.5	0.7	0.2	0.8	no	yes	yes, Acute
N4-3	61	56	61	57	62	57	62	57	60	55	yes	yes	0.0	0.3	0.2	-0.1	no	no	yes
N4-4	60	55	59	55	60	56	60	56	60	55	no	yes	-0.5	-0.2	-0.5	0.3	no	no	yes
N4-5	60	55	59	55	61	56	60	56	60	55	no	yes	-0.7	-0.4	-0.8	0.0	no	no	yes
N4-6	59	54	58	53	59	54	59	54	60	55	no	no	-0.7	-0.3	-0.3	-0.4	no	no	no
N4-7	59	54	58	54	60	55	59	55	60	55	no	no	-1.0	-0.6	-1.0	-0.1	no	no	no
N4-8	59	54	58	53	59	54	58	54	60	55	no	no	-1.0	-0.7	-1.2	-0.3	no	no	no
N4-9	58	53	57	53	59	54	58	53	60	55	no	no	-1.1	-0.7	-1.1	-1.1	no	no	no
N4-10	56	51	55	50	57	52	56	51	60	55	no	no	-1.4	-1.0	-1.1	-1.1	no	no	no
N4-11	55	50	54	49	55	50	55	50	60	55	no	no	-0.8	-0.4	-0.3	-0.3	no	no	no
N4-12	64	59	64	60	65	60	65	61	60	55	yes	yes	0.3	0.6	0.2	1.1	yes	yes	yes, Acute
N4-13	65	61	66	61	66	61	67	62	60	55	yes	yes	0.6	0.9	0.9	0.8	yes	yes	yes, Acute
N4-14	65	61	67	62	66	61	67	63	60	55	yes	yes	1.2	1.4	0.9	1.8	yes	yes	yes, Acute
N4-15	60	55	60	55	61	56	61	56	60	55	yes	yes	-0.3	0.1	0.1	0.1	no	no	yes
N4-16	58	53	57	52	58	53	58	53	60	55	no	no	-0.9	-0.5	-0.5	-0.5	no	no	no
N4-17	59	54	58	54	59	54	59	54	60	55	no	no	-0.6	-0.2	-0.5	-0.5	no	no	no

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N4-18	64	59	66	61	64	60	67	62	60	55	yes	yes	2.1	2.2	2.6	2.3	yes	yes	yes, Acute
N4-19	64	60	66	62	65	60	67	62	60	55	yes	yes	2.1	2.2	2.0	1.8	yes	yes	yes, Acute
N4-20	67	62	69	64	67	63	70	65	60	55	yes	yes	2.2	2.2	2.7	2.3	yes	yes	yes, Acute
N4-21	65	60	67	62	66	61	68	63	60	55	yes	yes	2.1	2.1	2.3	2.0	yes	yes	yes, Acute
N4-22	64	59	66	62	65	60	67	62	60	55	yes	yes	2.1	2.1	2.2	1.9	yes	yes	yes, Acute
N4-23	69	64	71	66	69	65	72	67	60	55	yes	yes	2.2	2.1	2.7	2.2	yes	yes	yes, Acute
N4-24	63	58	65	60	63	59	65	61	60	55	yes	yes	2.0	2.1	1.6	2.3	yes	yes	yes, Acute
N4-25	64	60	67	62	65	60	67	63	60	55	yes	yes	2.1	2.0	1.9	2.5	yes	yes	yes, Acute
N4-26	60	55	62	57	60	56	63	58	60	55	yes	yes	2.1	2.1	2.5	2.1	no	no	yes
N4-27	64	60	67	62	65	61	67	63	60	55	yes	yes	2.2	2.1	1.9	2.4	yes	yes	yes, Acute
N4-28	72	68	74	70	73	69	75	71	60	55	yes	yes	2.0	2.0	1.9	2.4	yes	yes	yes, Acute
N4-29	71	67	74	69	72	67	74	70	60	55	yes	yes	2.5	2.4	2.1	2.5	yes	yes	yes, Increase >2, Acute
N4-30	68	64	71	66	69	64	71	67	60	55	yes	yes	2.7	2.6	2.3	2.7	yes	yes	yes, Increase >2, Acute
N4-31	70	66	73	69	71	67	74	69	60	55	yes	yes	2.8	2.7	3.0	2.4	yes	yes	yes, Increase >2, Acute
N4-32	63	58	65	60	63	59	66	61	60	55	yes	yes	2.3	2.2	2.8	2.2	yes	yes	yes, Acute
N4-33	67	62	69	64	67	63	69	65	60	55	yes	yes	2.1	2.2	1.8	2.4	yes	yes	yes, Acute
N4-34	62	57	64	59	62	58	65	60	60	55	yes	yes	2.2	2.2	2.5	2.2	yes	yes	yes, Acute
N4-35	64	59	66	62	65	60	67	62	60	55	yes	yes	1.8	2.1	2.0	1.9	yes	yes	yes, Acute
N4-36	63	58	64	59	63	58	65	60	60	55	yes	yes	1.6	1.9	1.8	1.8	yes	yes	yes, Acute
N4-37	63	58	64	60	63	58	65	60	60	55	yes	yes	1.7	2.0	1.6	1.6	yes	yes	yes, Acute
N4-38	59	54	60	56	59	54	61	57	60	55	yes	yes	1.9	2.2	1.8	2.7	no	no	yes
N4-39	60	55	61	57	60	55	62	57	60	55	yes	yes	1.6	1.8	1.7	1.6	no	no	yes
N4-40	60	55	62	57	61	56	62	58	60	55	yes	yes	1.7	1.9	1.3	2.2	no	no	yes
N4-41	60	56	62	57	61	56	63	58	60	55	yes	yes	1.7	1.9	1.9	1.8	no	no	yes

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N4-42	61	56	62	58	61	56	63	58	60	55	yes	yes	1.7	2.0	1.8	1.8	no	no	yes
N4-43	60	55	61	57	60	55	62	57	60	55	yes	yes	1.5	1.9	1.7	1.7	no	no	yes
N4-44	62	57	64	59	62	57	64	60	60	55	yes	yes	1.7	2.1	1.5	2.5	no	yes	yes, Acute
N4-45	61	56	62	58	61	56	63	58	60	55	yes	yes	1.7	2.0	1.6	1.6	no	no	yes
N4-46	61	56	63	58	62	57	64	59	60	55	yes	yes	1.6	2.0	1.9	1.9	no	no	yes
N4-47	61	56	62	58	61	57	63	58	60	55	yes	yes	1.5	1.8	1.5	1.4	no	no	yes
N4-48	61	56	62	58	62	57	63	59	60	55	yes	yes	1.5	1.8	1.4	2.3	no	no	yes
N4-49	61	56	62	58	62	57	63	58	60	55	yes	yes	1.2	1.5	1.2	1.1	no	no	yes
N4-50	60	55	61	57	61	56	62	57	60	55	yes	yes	1.2	1.5	1.2	1.1	no	no	yes
N4-51	58	53	59	54	59	54	60	55	60	55	no	no	0.8	1.2	1.1	1.1	no	no	no
N4-52	61	56	62	57	61	56	62	58	60	55	yes	yes	1.1	1.4	0.8	1.7	no	no	yes
N4-53	59	54	60	55	60	55	61	56	60	55	yes	yes	0.7	0.9	1.1	0.9	no	no	yes
N4-54	61	56	62	57	62	57	62	58	60	55	yes	yes	0.4	0.6	0.2	1.0	no	no	yes
N4-55	61	56	62	57	62	57	62	58	60	55	yes	yes	0.4	0.7	0.2	1.1	no	no	yes
N4-56	61	56	61	57	61	57	62	57	60	55	yes	yes	0.4	0.5	0.5	0.3	no	no	yes
N4-57	60	55	60	55	60	55	61	56	60	55	yes	yes	0.4	0.5	0.8	0.6	no	no	yes
N4-58	62	57	62	57	62	57	63	58	60	55	yes	yes	0.3	0.4	0.8	0.5	no	no	yes
N4-59	66	61	66	62	67	62	67	62	60	55	yes	yes	0.3	0.3	0.4	0.1	yes	yes	yes, Acute
N4-60	64	60	65	60	65	60	66	61	60	55	yes	yes	0.4	0.4	0.9	0.6	yes	yes	yes, Acute
N4-61	65	61	65	61	66	61	66	62	60	55	yes	yes	0.1	0.1	0.0	0.6	yes	yes	yes, Acute
N4-62	63	58	63	59	64	59	64	59	60	55	yes	yes	0.3	0.3	0.4	0.0	no	no	yes
N4-63	63	58	63	59	63	59	64	59	60	55	yes	yes	0.4	0.4	0.5	0.1	no	no	yes
N4-64	63	58	63	59	63	59	64	59	60	55	yes	yes	0.3	0.3	0.5	0.1	no	no	yes
N4-65	63	58	63	58	63	59	64	59	60	55	yes	yes	0.2	0.2	0.6	0.2	no	no	yes
N4-66	62	58	63	58	63	58	63	59	60	55	yes	yes	0.2	0.3	0.0	0.7	no	no	yes
N4-67	62	58	62	58	63	58	63	58	60	55	yes	yes	0.2	0.1	0.2	-0.2	no	no	yes

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													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N4-68	61	57	62	57	62	57	62	58	60	55	yes	yes	0.2	0.2	-0.1	0.5	no	no	yes
N4-69	63	58	63	58	63	59	63	59	60	55	yes	yes	0.1	0.2	-0.3	0.4	no	no	yes
N4-70	64	59	64	60	65	60	65	60	60	55	yes	yes	0.1	0.1	0.3	-0.1	yes	yes	yes, Acute
N4-71	62	58	62	58	63	58	63	58	60	55	yes	yes	0.1	0.0	0.2	-0.2	no	no	yes
N4-72	63	58	63	58	63	59	64	59	60	55	yes	yes	0.1	0.1	0.6	0.3	no	no	yes
N4-73	63	58	63	58	63	59	63	59	60	55	yes	yes	0.1	0.0	-0.3	0.3	no	no	yes
N4-74	70	65	70	65	70	66	70	66	60	55	yes	yes	0.2	0.1	-0.2	0.3	yes	yes	yes, Acute
N4-75	73	68	73	68	73	69	73	69	60	55	yes	yes	-0.1	-0.2	-0.4	0.1	yes	yes	yes, Acute
N4-76	68	64	68	63	69	64	68	64	60	55	yes	yes	-0.4	-0.4	-0.8	-0.3	yes	yes	yes, Acute
N4-77	61	56	61	56	62	57	62	57	60	55	yes	yes	-0.1	-0.2	0.3	-0.1	no	no	yes
N4-78	63	58	63	58	63	59	63	59	60	55	yes	yes	-0.1	-0.1	-0.4	0.2	no	no	yes
N4-79	63	59	63	59	64	59	64	60	60	55	yes	yes	0.0	0.0	-0.1	0.5	no	yes	yes, Acute
N4-80	62	57	61	57	62	58	62	58	60	55	yes	yes	-0.1	-0.2	-0.2	0.3	no	no	yes
N4-81	61	56	61	56	61	57	61	57	60	55	yes	yes	0.0	0.0	-0.3	0.3	no	no	yes
N4-82	65	61	65	61	66	61	66	61	60	55	yes	yes	0.0	-0.2	0.2	-0.4	yes	yes	yes, Acute
N4-83	66	61	66	61	66	62	67	62	60	55	yes	yes	0.4	0.2	0.8	0.2	yes	yes	yes, Acute
N4-84	66	62	67	62	67	63	67	63	60	55	yes	yes	0.4	0.1	0.0	0.4	yes	yes	yes, Acute
N4-85	68	64	69	64	69	64	69	65	60	55	yes	yes	0.6	0.3	0.4	0.7	yes	yes	yes, Acute
N4-86	65	61	66	61	66	61	66	62	60	55	yes	yes	0.7	0.5	0.3	0.7	yes	yes	yes, Acute
N4-87	57	52	58	53	58	53	58	54	60	55	no	no	0.5	0.7	0.2	1.0	no	no	no
N4-88	56	51	56	51	56	52	57	52	60	55	no	no	0.3	0.3	0.6	0.3	no	no	no
N4-89	57	52	57	52	57	52	58	53	60	55	no	no	0.5	0.6	0.7	0.5	no	no	no
N4-90	59	54	59	55	59	55	60	55	60	55	no	no	0.6	0.7	0.6	0.4	no	no	no
N4-91	59	54	60	55	60	55	60	56	60	55	no	yes	0.6	0.8	0.3	1.1	no	no	yes
N4-92	59	55	60	55	60	55	61	56	60	55	yes	yes	0.6	0.7	0.9	0.7	no	no	yes
N4-93	59	54	59	55	60	55	60	55	60	55	no	no	0.4	0.5	0.3	0.1	no	no	no
N4-94	59	54	59	54	59	54	60	55	60	55	no	no	0.4	0.5	0.8	0.6	no	no	no

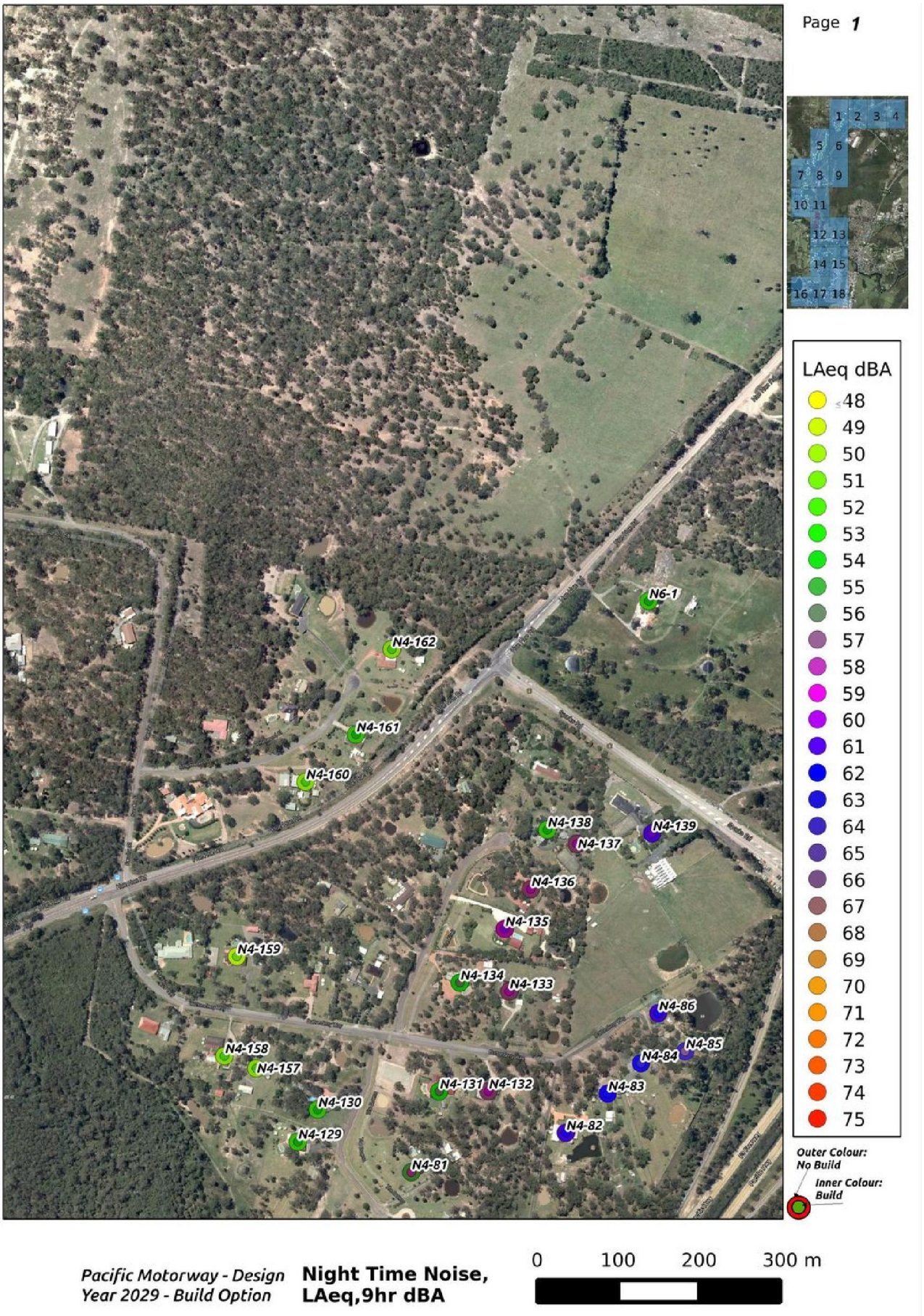
Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N4-95	59	54	60	55	59	54	60	56	60	55	no	yes	1.0	1.2	0.8	1.7	no	no	yes
N4-96	60	55	61	56	60	55	61	57	60	55	yes	yes	1.0	1.2	0.8	1.7	no	no	yes
N4-97	59	54	60	55	59	54	60	56	60	55	no	yes	1.1	1.3	0.8	1.6	no	no	yes
N4-98	60	55	60	56	60	55	61	56	60	55	yes	yes	0.9	1.1	0.8	0.7	no	no	yes
N4-99	57	52	58	53	58	53	59	54	60	55	no	no	0.7	0.8	1.1	0.9	no	no	no
N4-100	56	51	56	52	56	52	57	52	60	55	no	no	0.4	0.6	0.6	0.4	no	no	no
N4-101	55	50	55	51	56	51	56	51	60	55	no	no	0.4	0.5	0.3	0.1	no	no	no
N4-102	61	56	61	56	61	57	62	57	60	55	yes	yes	0.3	0.2	0.7	0.3	no	no	yes
N4-103	61	56	61	56	61	56	61	57	60	55	yes	yes	0.2	0.2	-0.2	0.5	no	no	yes
N4-104	60	55	60	56	61	56	61	56	60	55	yes	yes	0.3	0.4	0.3	0.0	no	no	yes
N4-105	60	55	60	56	61	56	61	56	60	55	yes	yes	0.3	0.3	0.3	0.0	no	no	yes
N4-106	61	56	61	57	62	57	62	57	60	55	yes	yes	0.3	0.3	0.4	0.1	no	no	yes
N4-107	59	55	60	55	60	55	60	56	60	55	no	yes	0.4	0.4	0.0	0.6	no	no	yes
N4-108	59	55	60	55	60	55	60	56	60	55	no	yes	0.3	0.3	0.1	0.8	no	no	yes
N4-109	59	55	59	55	60	55	60	55	60	55	no	no	0.3	0.2	0.2	-0.2	no	no	no
N4-110	57	52	57	53	57	53	58	53	60	55	no	no	0.6	0.6	0.6	0.3	no	no	no
N4-111	56	51	56	52	57	52	57	52	60	55	no	no	0.5	0.6	0.4	0.2	no	no	no
N4-112	59	54	59	54	59	55	60	55	60	55	no	no	0.5	0.5	0.7	0.4	no	no	no
N4-113	60	55	60	56	61	56	61	56	60	55	yes	yes	0.3	0.3	0.4	0.1	no	no	yes
N4-114	60	55	60	56	61	56	61	56	60	55	yes	yes	0.3	0.2	0.4	0.0	no	no	yes
N4-115	59	54	59	54	59	54	59	55	60	55	no	no	0.1	0.2	-0.2	0.5	no	no	no
N4-116	60	56	60	56	61	56	61	57	60	55	yes	yes	0.1	0.1	0.0	0.6	no	no	yes
N4-117	60	55	60	56	61	56	61	56	60	55	yes	yes	0.1	0.1	0.3	-0.1	no	no	yes
N4-118	61	57	62	57	62	57	62	58	60	55	yes	yes	0.2	0.1	0.0	0.6	no	no	yes
N4-119	60	55	60	55	61	56	61	56	60	55	yes	yes	0.2	0.1	0.4	0.0	no	no	yes
N4-120	61	57	61	57	62	57	62	57	60	55	yes	yes	0.1	0.0	0.1	-0.3	no	no	yes

Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N4-121	60	55	60	55	61	56	61	56	60	55	yes	yes	0.2	0.1	0.4	0.0	no	no	yes
N4-122	59	55	59	55	60	55	60	55	60	55	no	no	0.2	0.2	0.1	-0.2	no	no	no
N4-123	60	55	60	55	60	56	60	56	60	55	no	yes	0.0	0.0	-0.2	0.4	no	no	yes
N4-124	60	56	60	56	61	56	61	57	60	55	yes	yes	0.0	0.0	-0.1	0.5	no	no	yes
N4-125	59	54	59	54	59	55	60	55	60	55	no	no	0.0	0.0	0.5	0.1	no	no	no
N4-126	59	54	59	54	59	55	59	55	60	55	no	no	-0.1	-0.1	-0.3	0.3	no	no	no
N4-127	58	54	58	54	59	54	59	54	60	55	no	no	0.0	0.0	0.0	-0.4	no	no	no
N4-128	58	53	58	53	59	54	59	54	60	55	no	no	-0.1	-0.1	0.4	0.0	no	no	no
N4-129	59	54	59	54	59	55	59	55	60	55	no	no	-0.1	-0.1	-0.5	0.2	no	no	no
N4-130	59	55	59	55	60	55	60	55	60	55	no	no	0.0	0.0	0.2	-0.2	no	no	no
N4-131	60	56	60	56	61	56	61	56	60	55	yes	yes	0.0	0.0	0.0	-0.4	no	no	yes
N4-132	62	58	62	58	63	58	63	58	60	55	yes	yes	0.1	0.0	0.1	-0.3	no	no	yes
N4-133	62	57	62	57	62	58	63	58	60	55	yes	yes	0.2	0.0	0.5	0.0	no	no	yes
N4-134	60	56	61	56	61	56	61	57	60	55	yes	yes	0.2	0.1	0.0	0.6	no	no	yes
N4-135	63	59	63	58	64	59	64	59	60	55	yes	yes	-0.3	-0.4	0.2	-0.2	no	no	yes
N4-136	62	58	62	57	63	58	63	58	60	55	yes	yes	-0.3	-0.4	0.1	-0.4	no	no	yes
N4-137	62	57	62	57	63	58	62	58	60	55	yes	yes	-0.3	-0.4	-0.6	-0.1	no	no	yes
N4-138	59	54	59	54	59	55	60	55	60	55	no	no	0.4	0.0	0.7	0.0	no	no	no
N4-139	64	60	63	59	65	61	64	60	60	55	yes	yes	-0.9	-1.1	-1.0	-0.6	no	yes	yes, Acute
N4-140	59	54	60	56	59	54	61	56	60	55	yes	yes	1.7	2.0	1.8	1.7	no	no	yes
N4-141	58	53	59	55	58	54	60	56	60	55	no	yes	1.6	1.8	1.5	2.3	no	no	yes
N4-142	57	53	59	54	58	53	60	55	60	55	no	no	1.5	1.7	1.9	1.8	no	no	no
N4-143	60	55	59	55	60	55	60	55	60	55	no	no	-0.1	0.1	-0.2	-0.3	no	no	no
N4-144	58	53	58	53	58	53	59	54	60	55	no	no	0.4	0.6	0.8	0.6	no	no	no
N4-145	59	54	61	56	60	55	61	57	60	55	yes	yes	1.6	1.9	1.3	2.2	no	no	yes
N4-146	60	55	61	57	60	55	62	57	60	55	yes	yes	1.5	1.8	1.6	1.5	no	no	yes

Name	Year Opening "no build scenario" dBA		Year Opening "build scenario" dBA		Design year "no build" scenario dBA		Design year "build" scenario dBA		RNP criteria dBA		Are the RNP criteria exceeded?		Change in noise level, dBA				Acute level of noise		Consider Mitigation?
													Opening Year		Design Year				
	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	Day	Night	
N4-147	60	55	61	56	60	55	62	57	60	55	yes	yes	1.5	1.9	1.8	1.8	no	no	yes
N4-148	59	54	60	55	59	54	61	56	60	55	yes	yes	1.4	1.7	1.7	1.6	no	no	yes
N4-150	59	55	58	54	60	55	59	54	60	55	no	no	-0.8	-0.8	-0.9	-1.2	no	no	no
N4-151	56	51	58	53	57	52	58	54	60	55	no	no	1.4	1.7	1.0	1.9	no	no	no
N4-152	58	53	60	55	59	54	60	56	60	55	no	yes	1.3	1.5	1.0	1.9	no	no	yes
N4-153	59	54	60	56	60	55	61	56	60	55	yes	yes	1.3	1.5	1.4	1.2	no	no	yes
N4-154	59	54	60	56	60	55	61	56	60	55	yes	yes	1.1	1.3	1.3	1.1	no	no	yes
N4-155	59	54	60	55	60	55	61	56	60	55	yes	yes	1.1	1.3	1.4	1.2	no	no	yes
N4-156	59	54	59	54	60	55	60	55	60	55	no	no	-0.1	-0.1	0.3	-0.1	no	no	no
N4-157	57	53	57	53	58	53	58	54	60	55	no	no	0.1	0.1	0.0	0.6	no	no	no
N4-158	57	53	57	53	58	53	58	53	60	55	no	no	0.1	0.0	0.2	-0.2	no	no	no
N4-159	56	51	56	51	56	52	57	52	60	55	no	no	0.1	0.0	0.6	0.2	no	no	no
N4-160	57	53	58	53	58	53	58	54	60	55	no	no	0.3	0.2	0.1	0.7	no	no	no
N4-161	59	54	59	55	60	55	60	55	60	55	no	no	0.2	0.2	0.4	0.0	no	no	no
N4-162	57	52	57	52	57	53	58	53	60	55	no	no	0.1	0.0	0.5	0.0	no	no	no
N5-1	65	60	66	61	65	61	66	62	60	55	yes	yes	1.0	0.8	0.6	1.0	yes	yes	yes, Acute
N5-2	62	57	62	58	62	58	63	59	60	55	yes	yes	0.8	0.7	0.7	1.2	no	no	yes
N5-3	60	55	60	55	60	56	61	56	60	55	yes	yes	0.3	0.1	0.5	0.0	no	no	yes
N5-4	71	67	70	66	72	68	71	67	60	55	yes	yes	-0.8	-0.9	-0.9	-0.6	yes	yes	yes, Acute
N5-5	69	65	68	63	69	65	68	64	60	55	yes	yes	-1.2	-1.3	-1.5	-1.2	yes	yes	yes, Acute
N5-6	61	57	60	55	62	57	61	56	60	55	yes	yes	-1.3	-1.4	-0.8	-1.3	no	no	yes
N5-7	61	57	60	55	62	57	60	56	60	55	no	yes	-1.5	-1.6	-1.8	-1.3	no	no	yes
N6-1	59	54	59	54	59	55	60	55	60	55	no	no	0.0	-0.2	0.5	-0.1	no	no	no
N6-2	59	55	59	55	60	55	60	55	60	55	no	no	0.0	-0.1	0.2	-0.3	no	no	no

APPENDIX C

RECEIVER LOCATIONS & 2029 NIGHT TIME NOISE PREDICTIONS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LAeq dBA
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Outer Colour: No Build
Inner Colour: Build
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N4-158
N4-157
N4-130
N4-129
N4-81
N4-131
N4-132
N4-134
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N4-135
N4-136
N4-138
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N4-82
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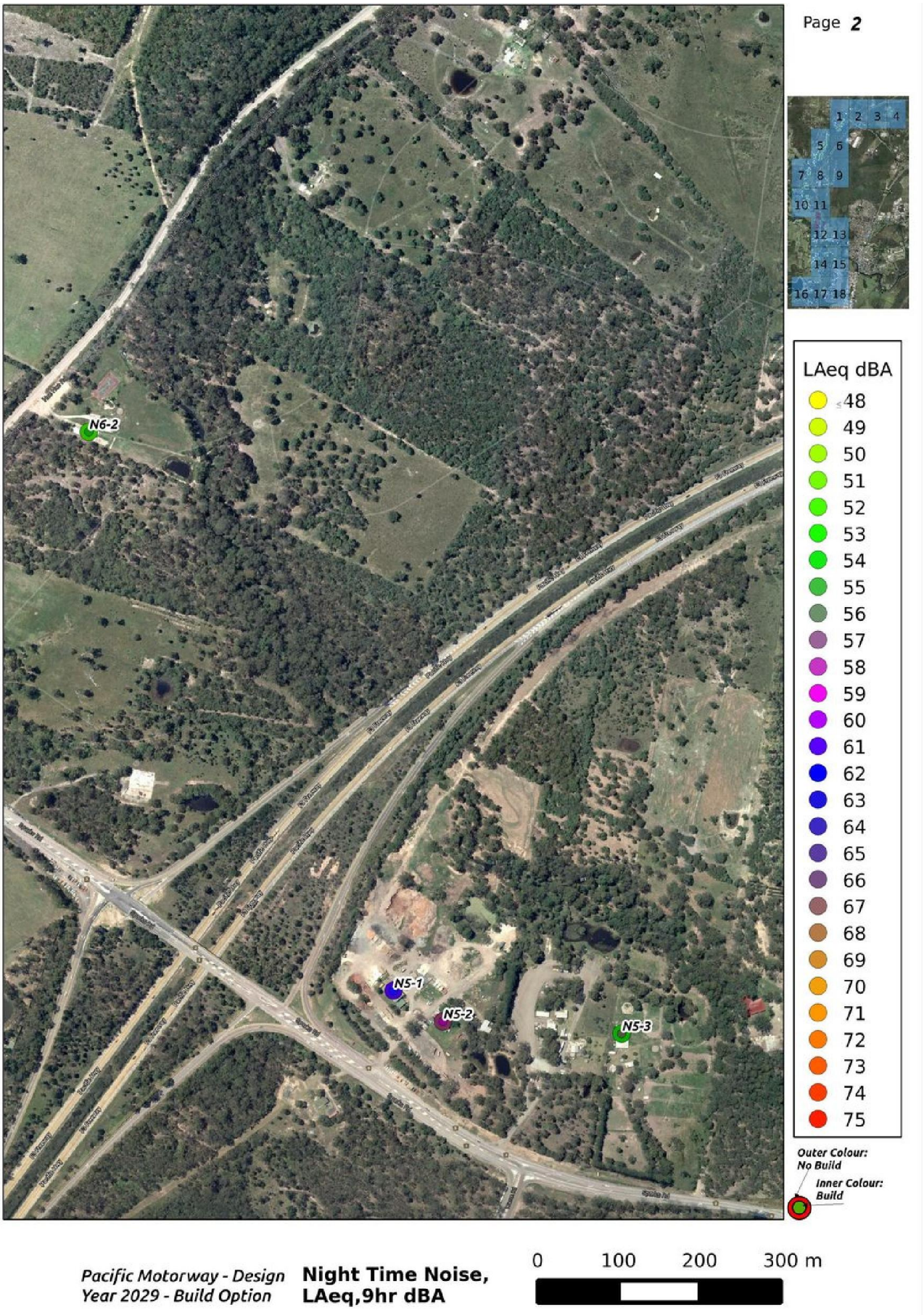
Pacific Motorway - Design
Year 2029 - Build Option
Night Time Noise,
LAeq,9hr dBA
0
100
200
300 m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Outer Colour: No Build
Inner Colour: Build
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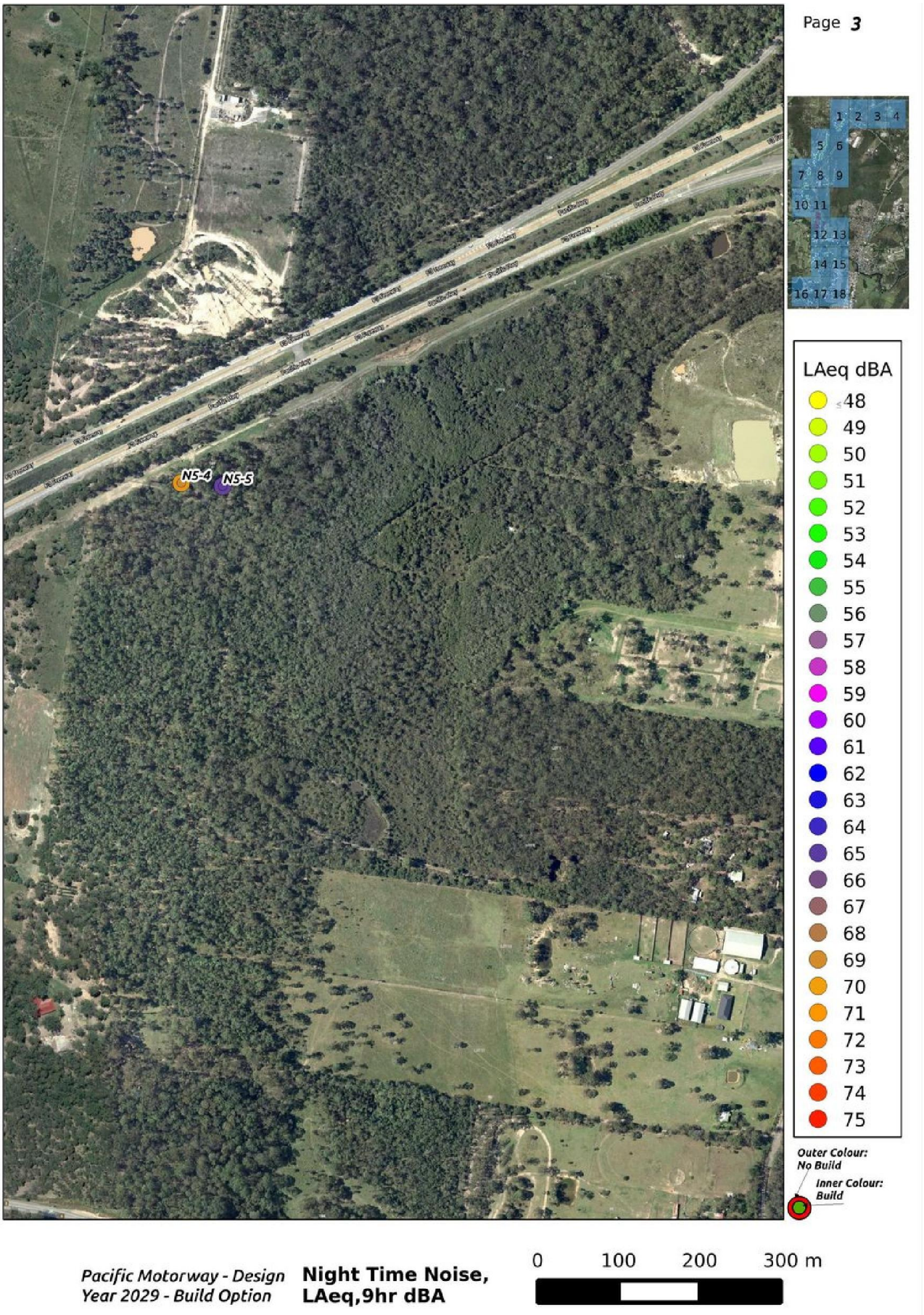
N5-3
Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
0 100 200 300 m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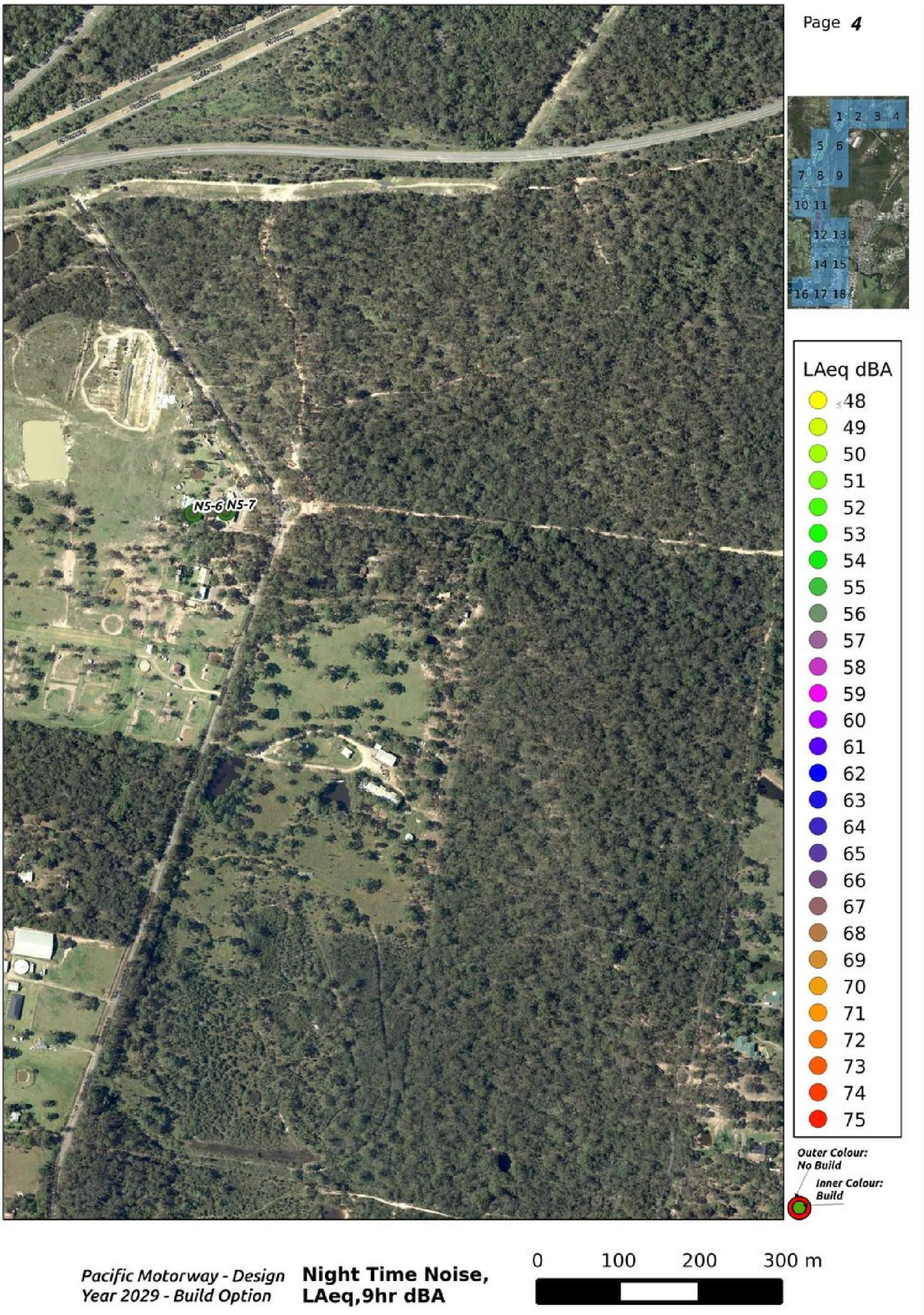
Outer Colour: No Build
Inner Colour: Build
Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
0 100 200 300 m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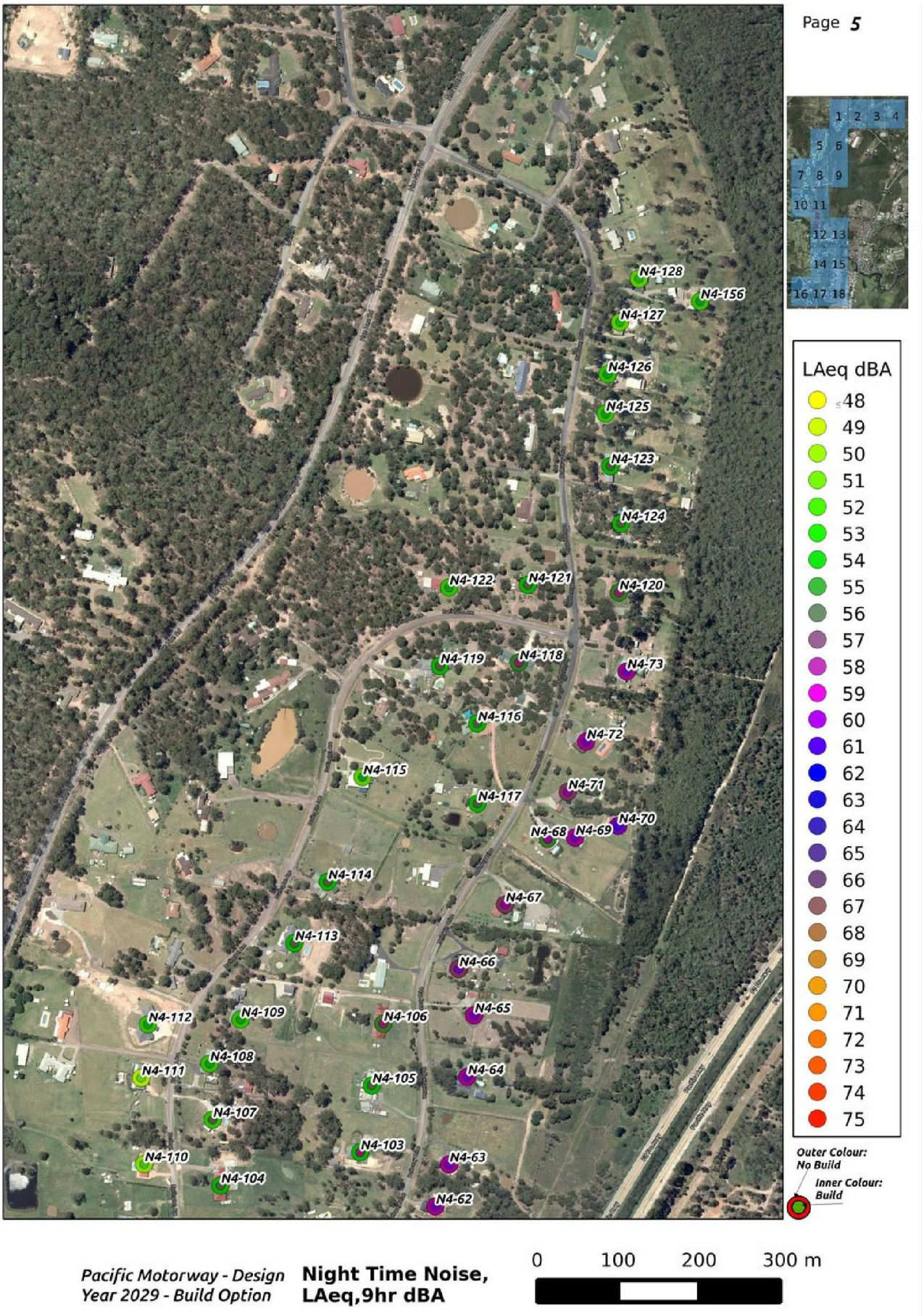
Outer Colour: No Build
Inner Colour: Build
Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
0 100 200 300 m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Outer Colour: No Build
Inner Colour: Build
Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
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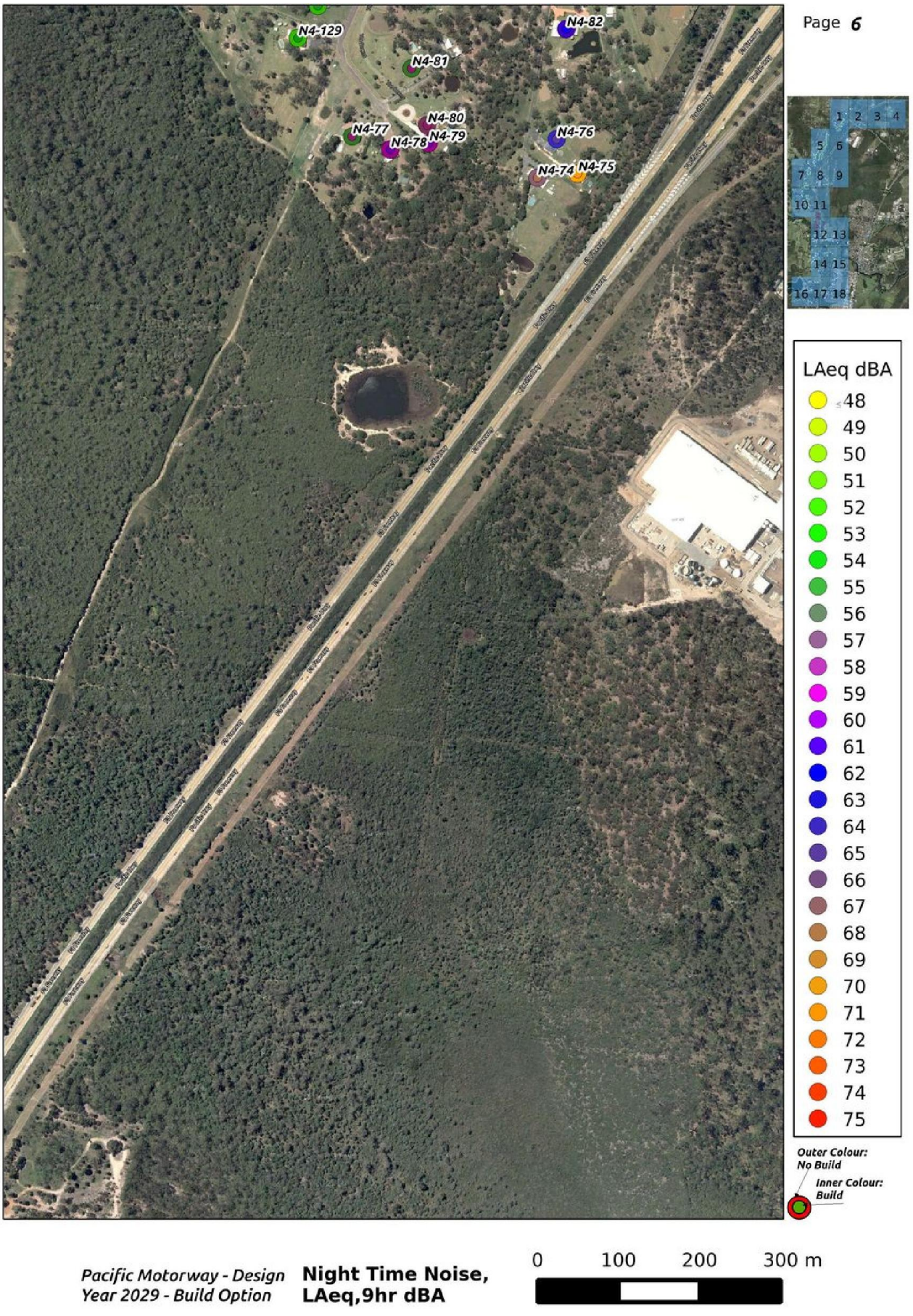
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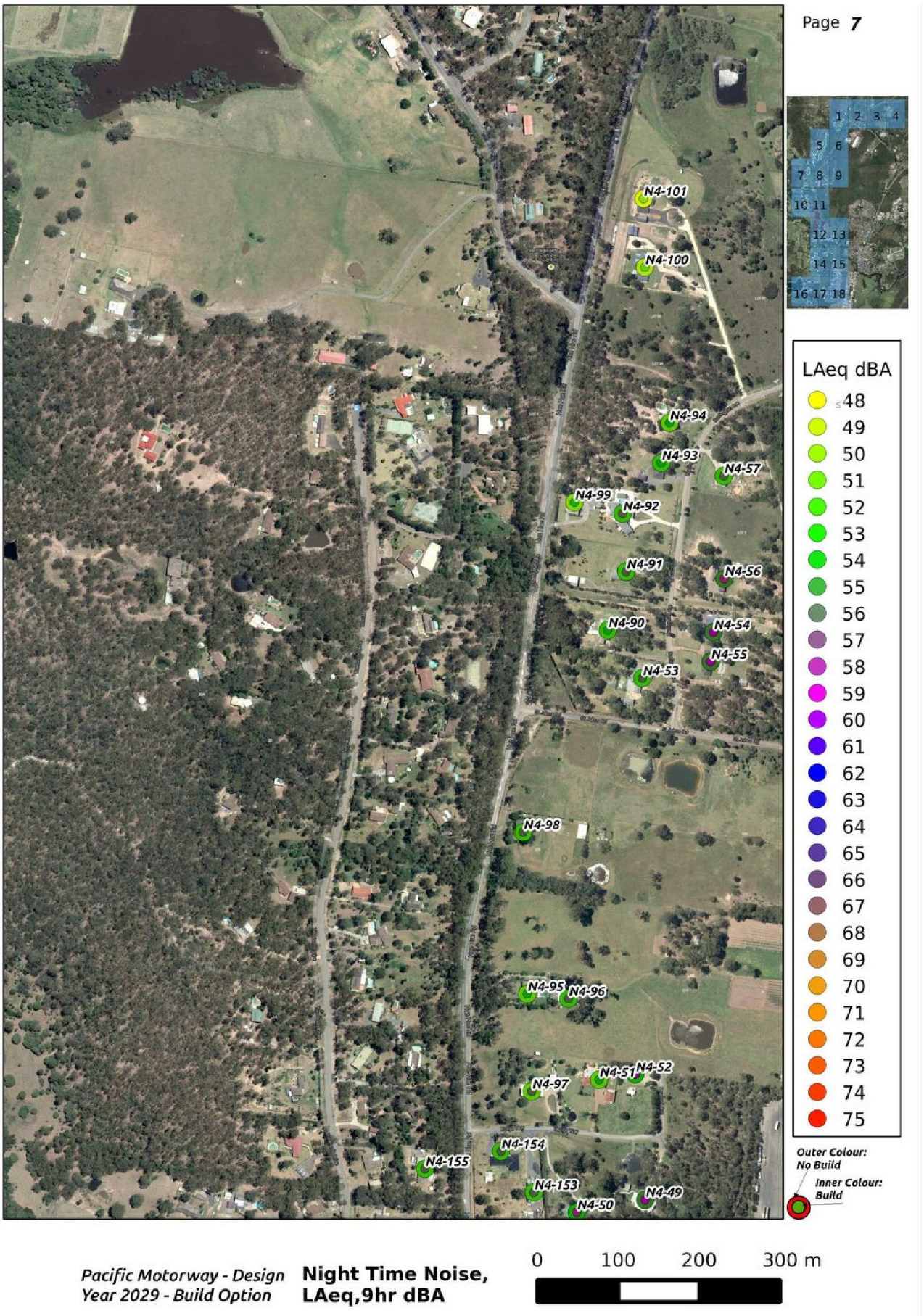
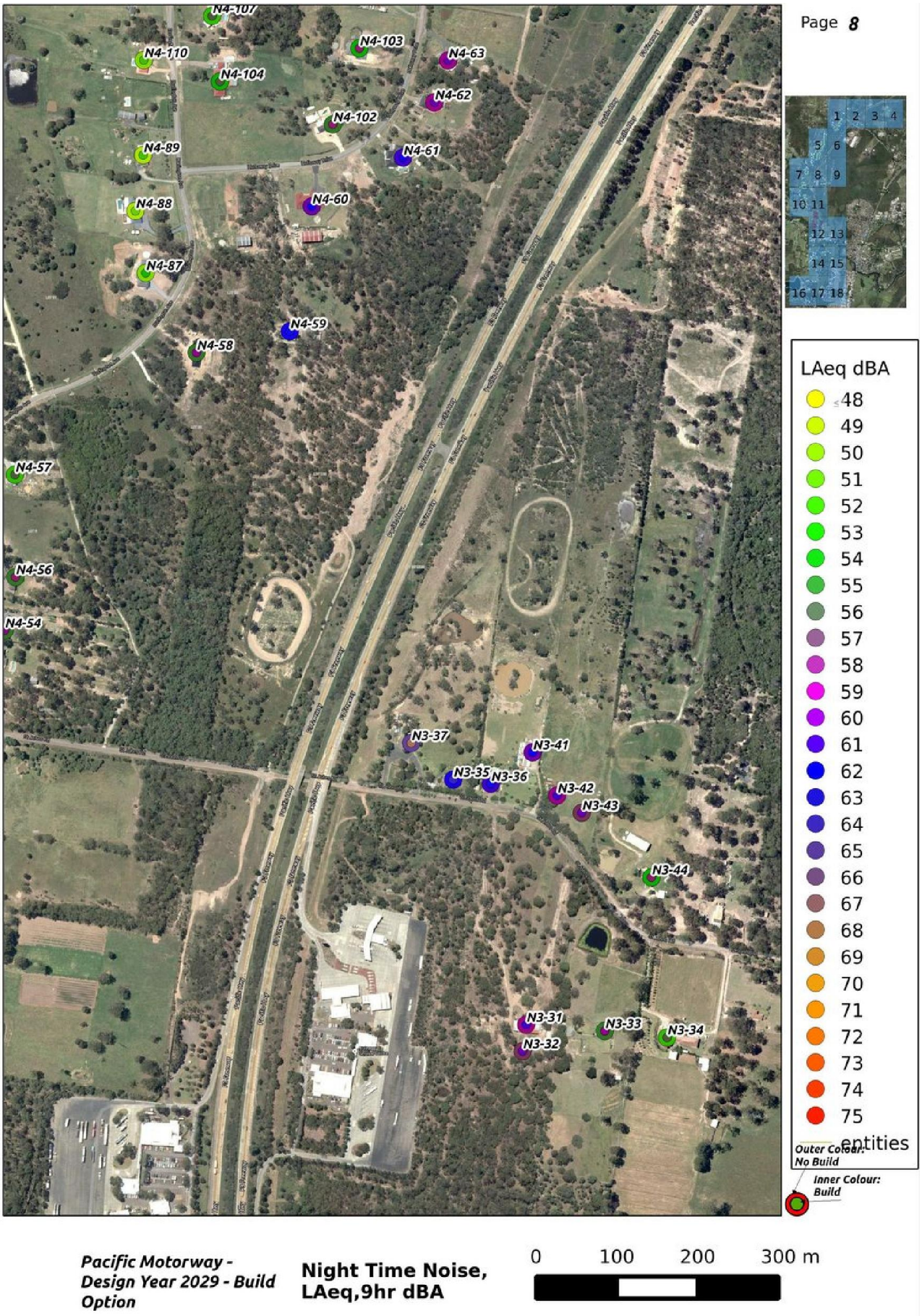
Outer Colour: No Build
Inner Colour: Build
Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
0 100 200 300 m



Pacific Motorway - Design Year 2029 - Build Option

Night Time Noise, LAeq,9hr dBA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entities
Outer Colour: No Build
Inner Colour: Build
Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
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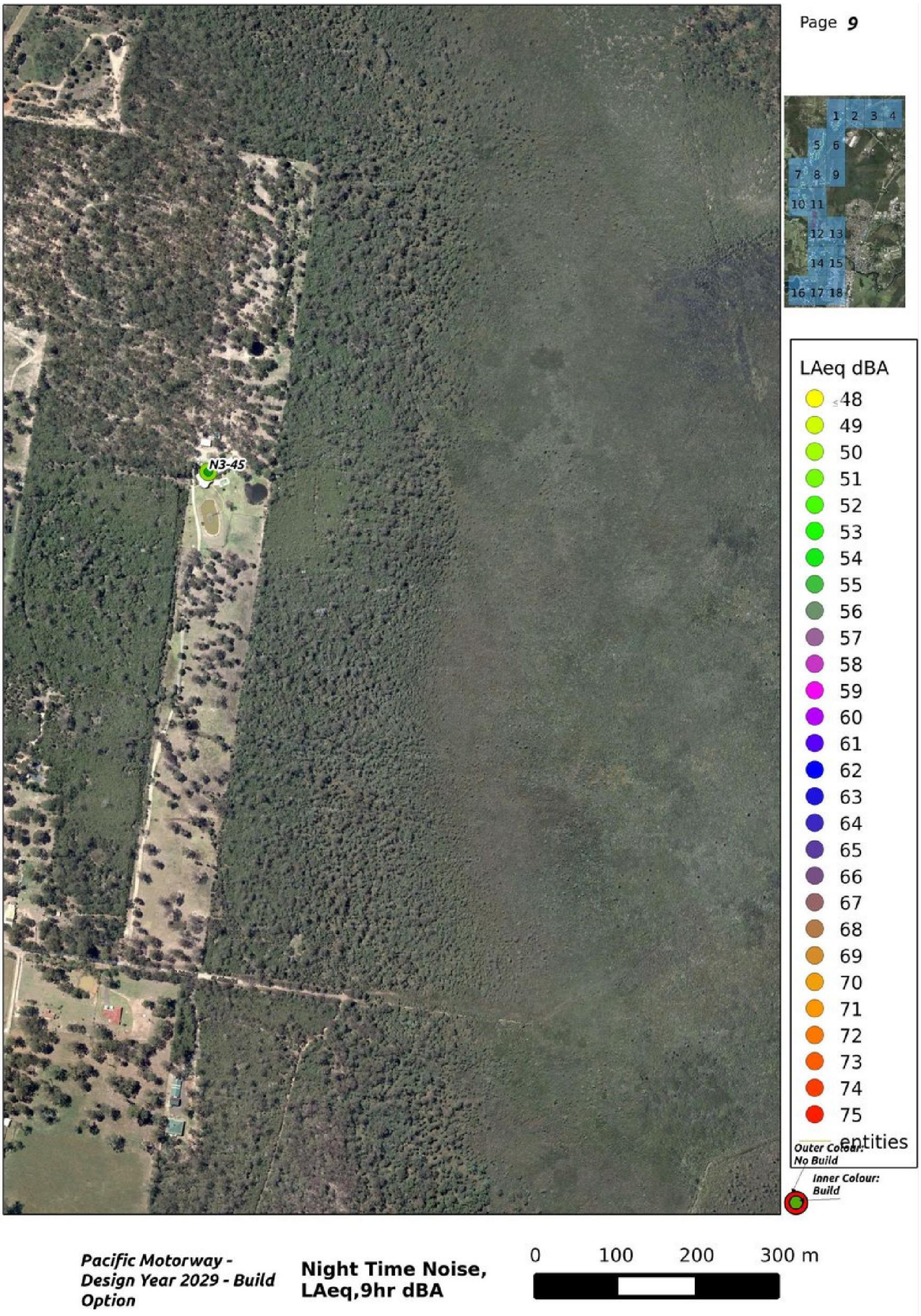
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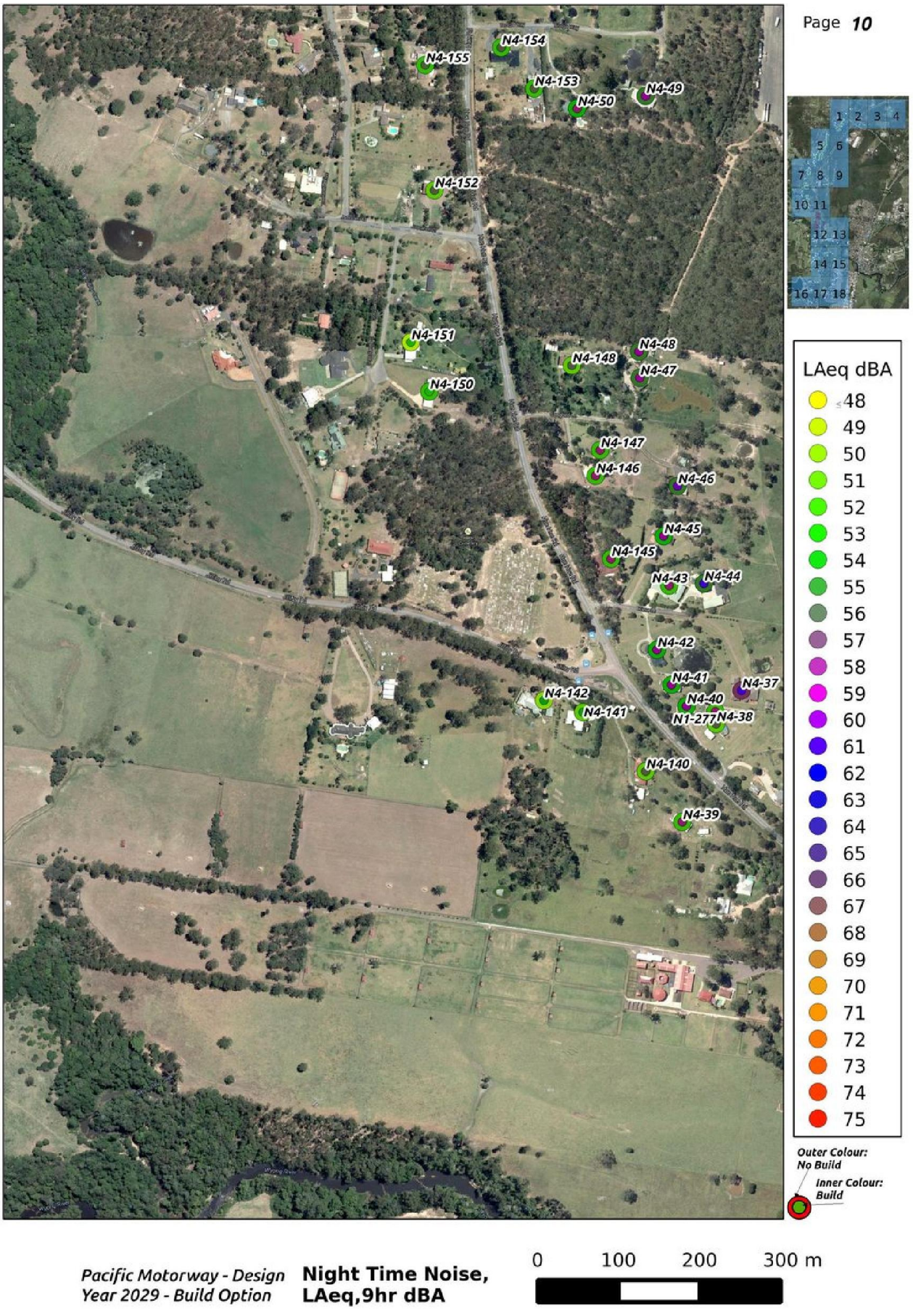
entities
Outer Colour: No Build
Inner Colour: Build
Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
0 100 200 300 m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Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
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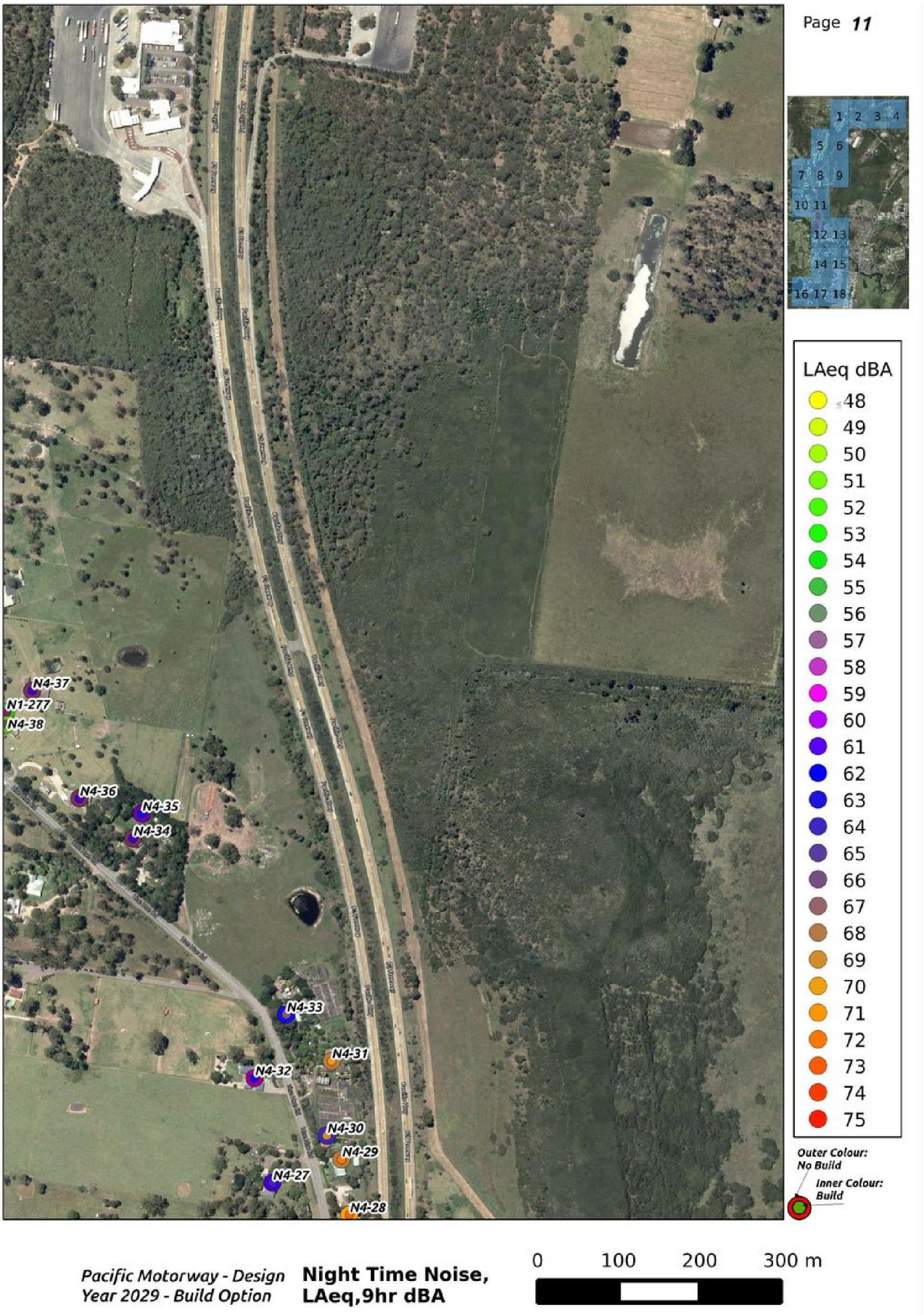
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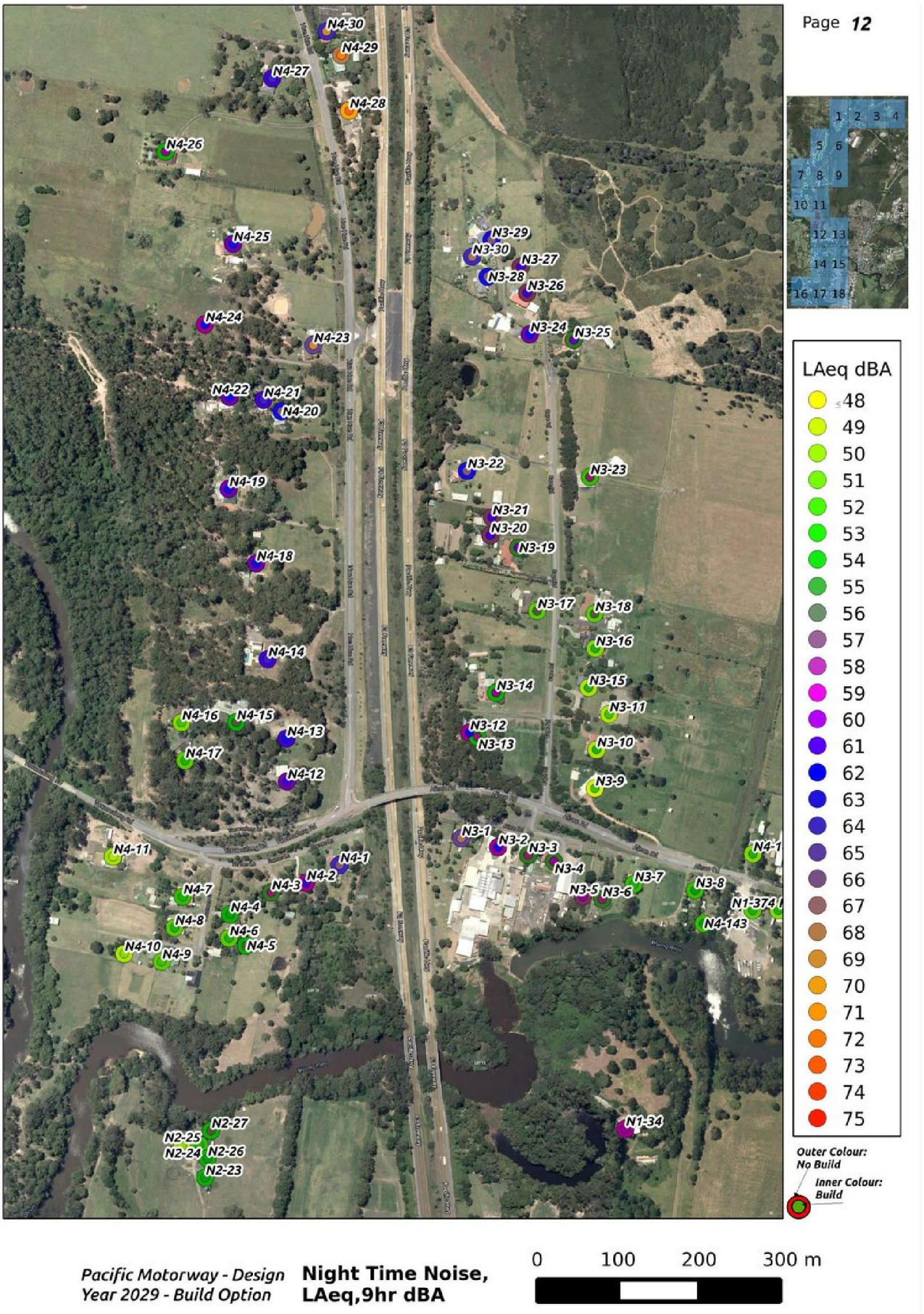
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Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
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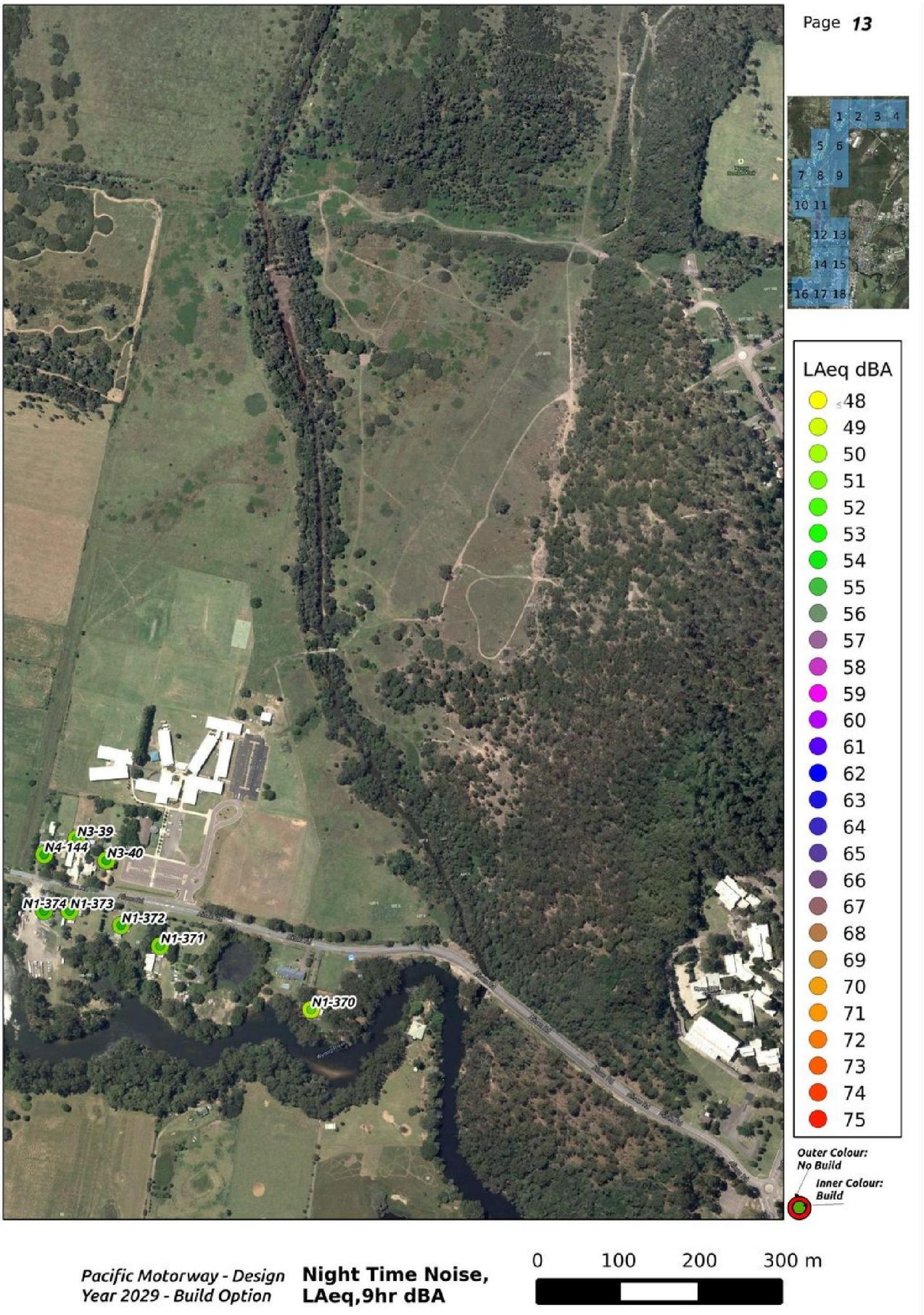
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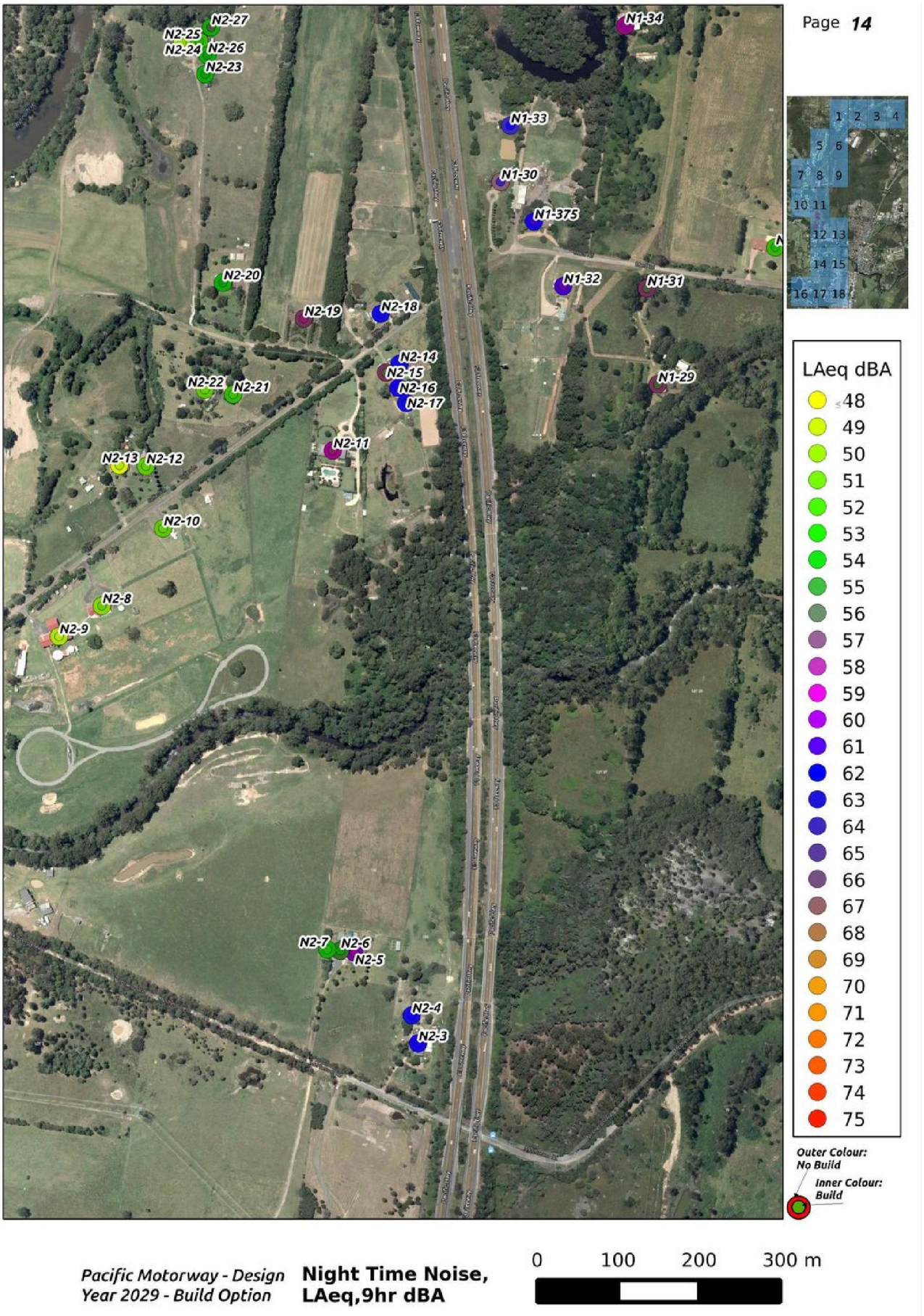
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Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
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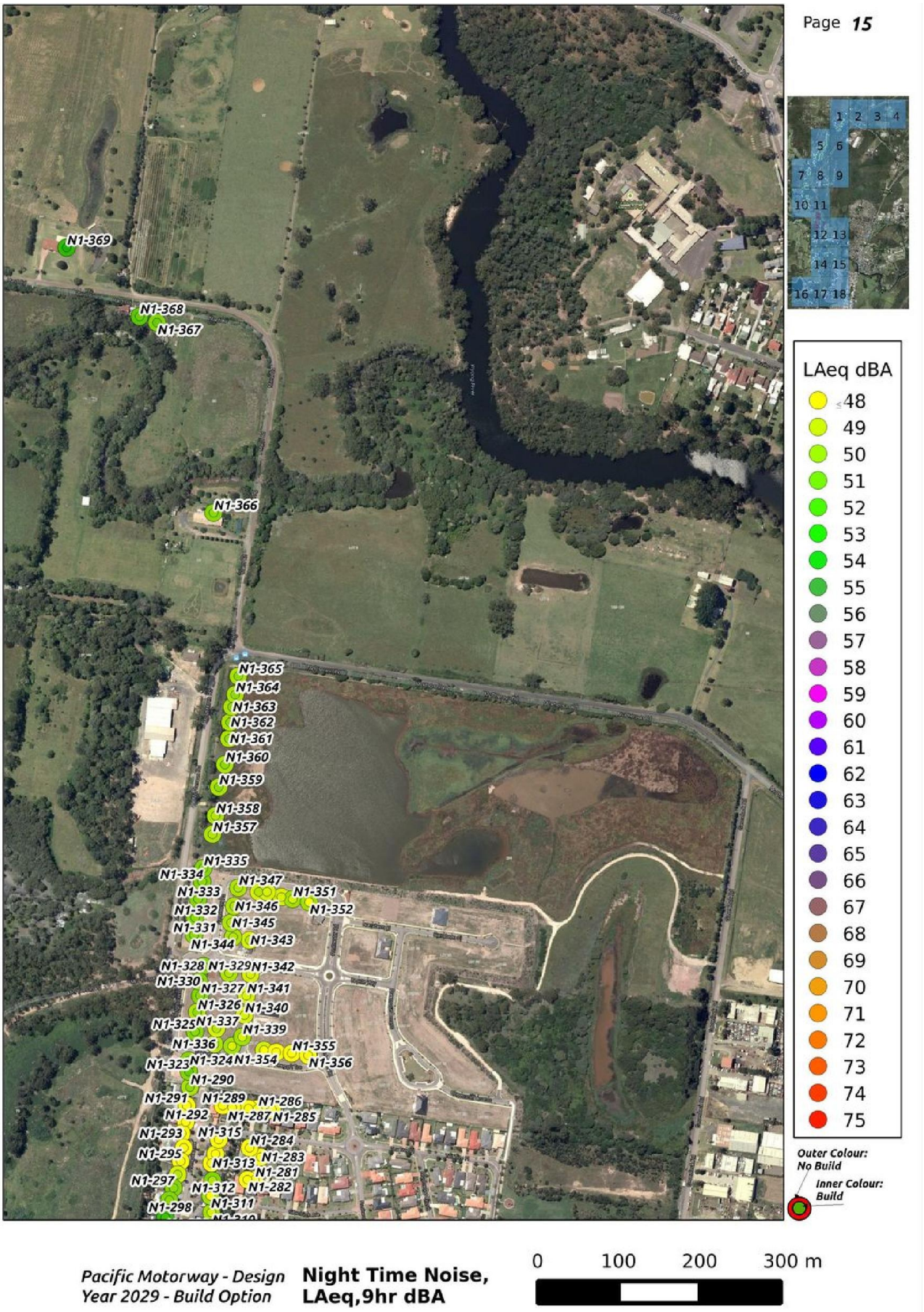
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Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
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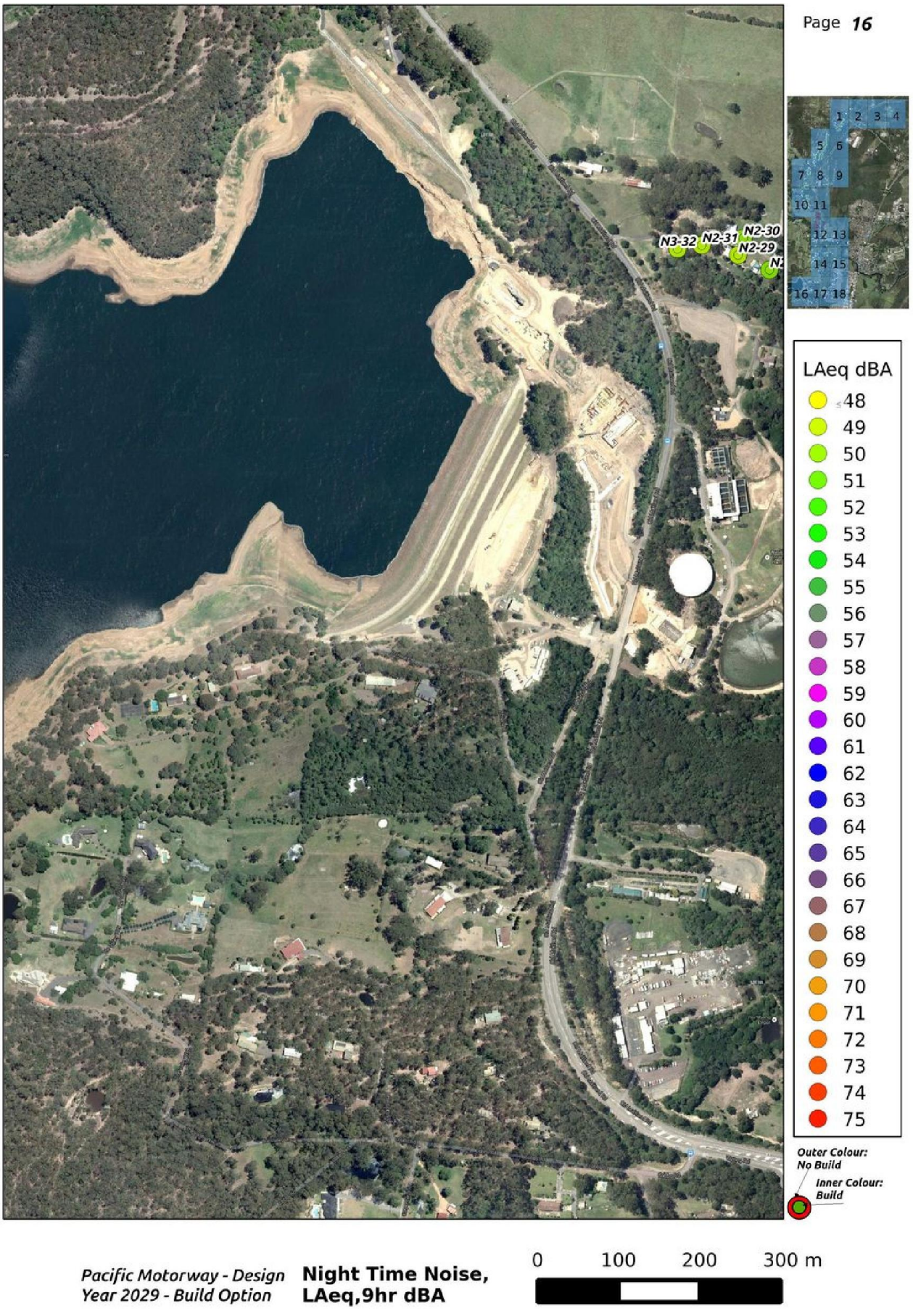
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Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
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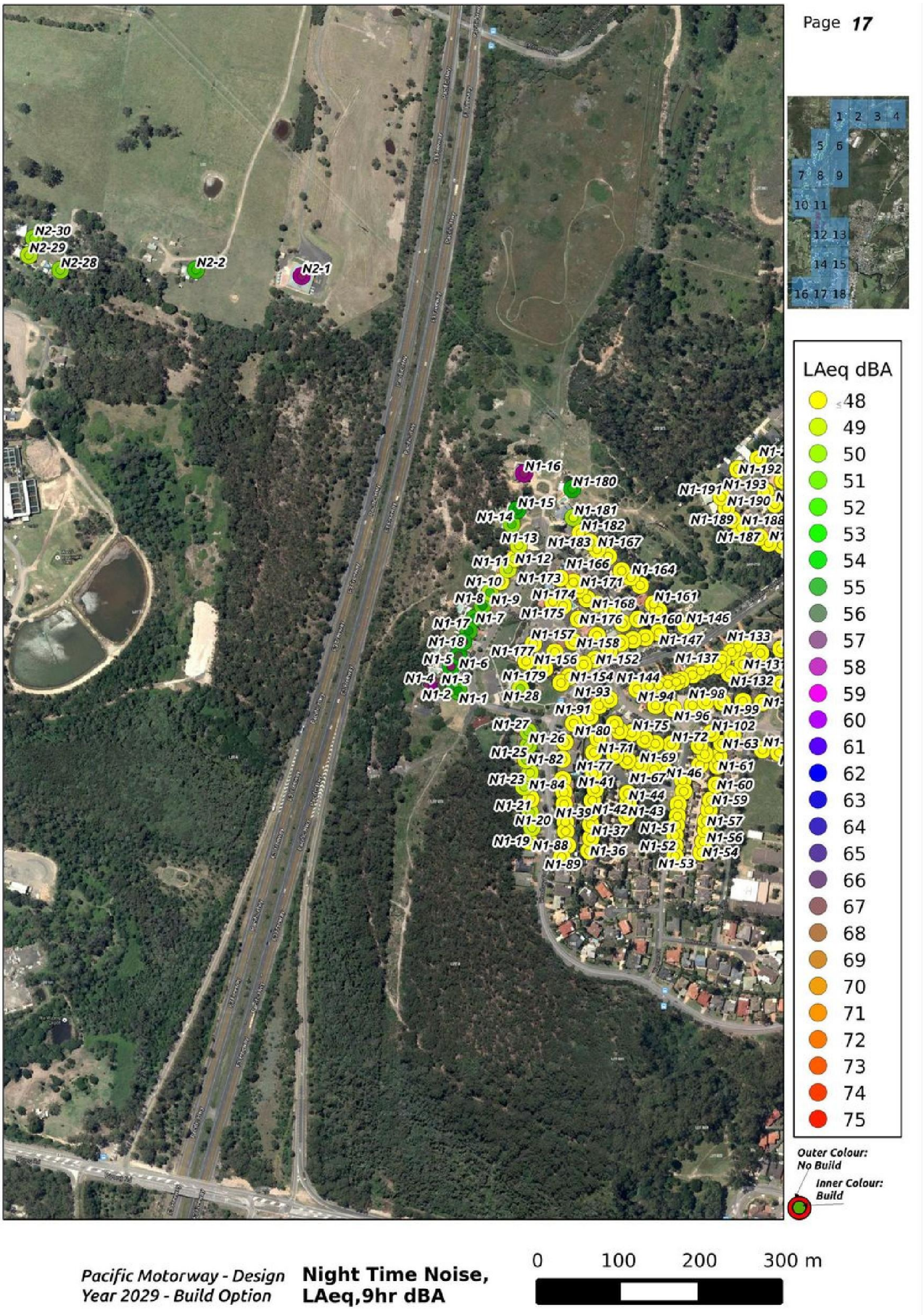
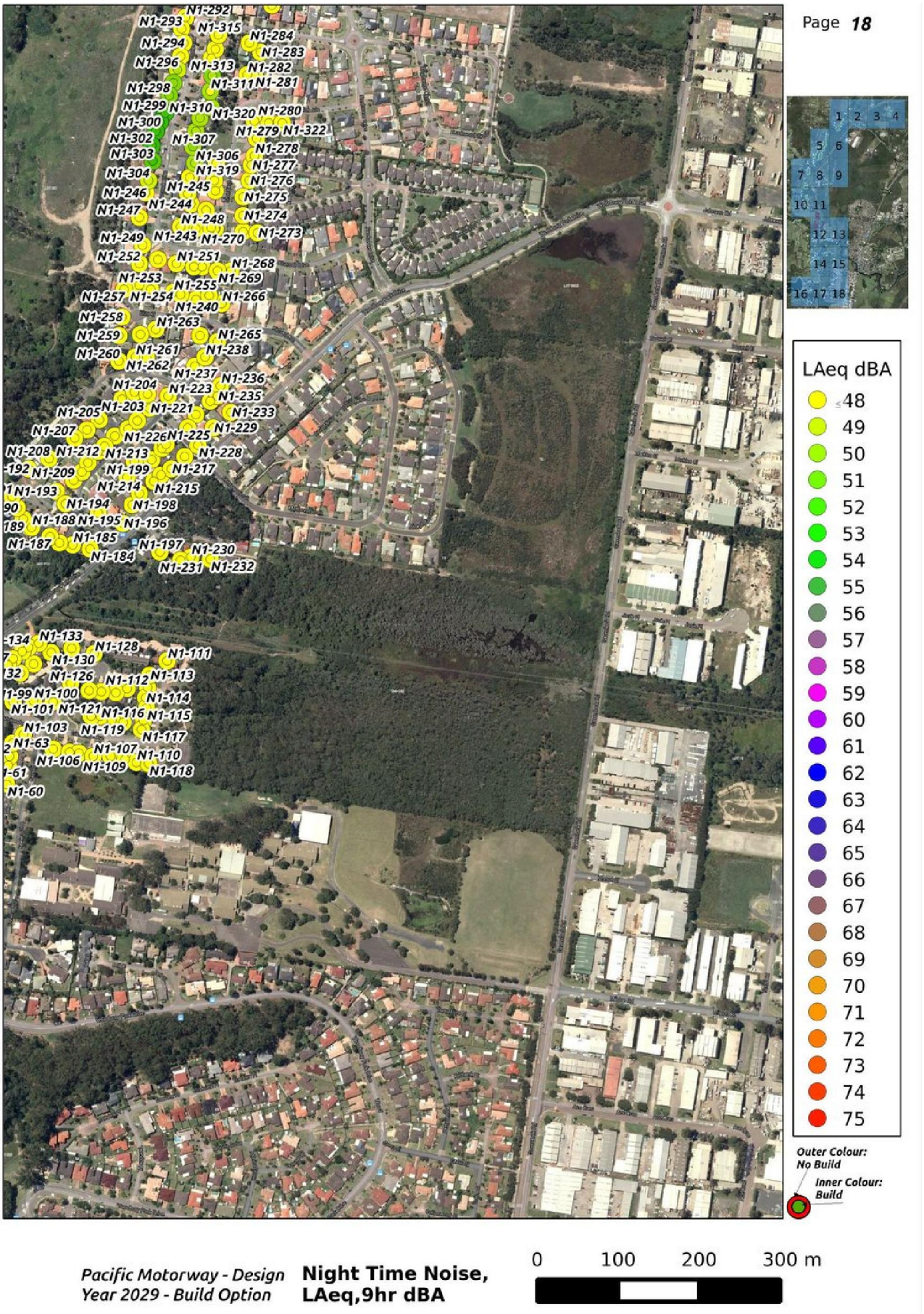


Pacific Motorway - Design Year 2029 - Build Option

Night Time Noise, LAeq,9hr dBA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Pacific Motorway - Design Year 2029 - Build Option
Night Time Noise, LAeq,9hr dBA
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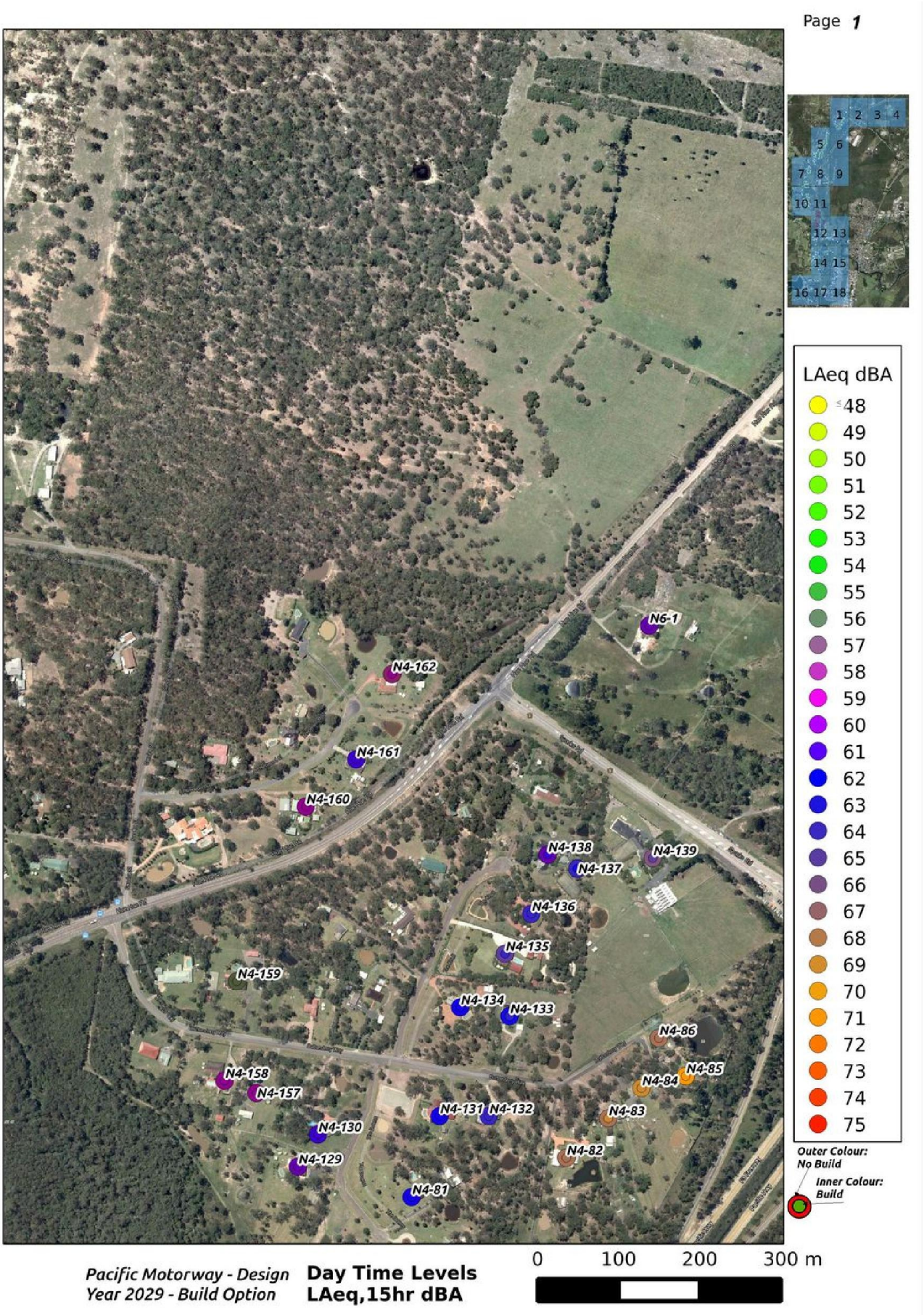
APPENDIX D

RECEIVER LOCATIONS & 2029 DAYTIME NOISE PREDICTIONS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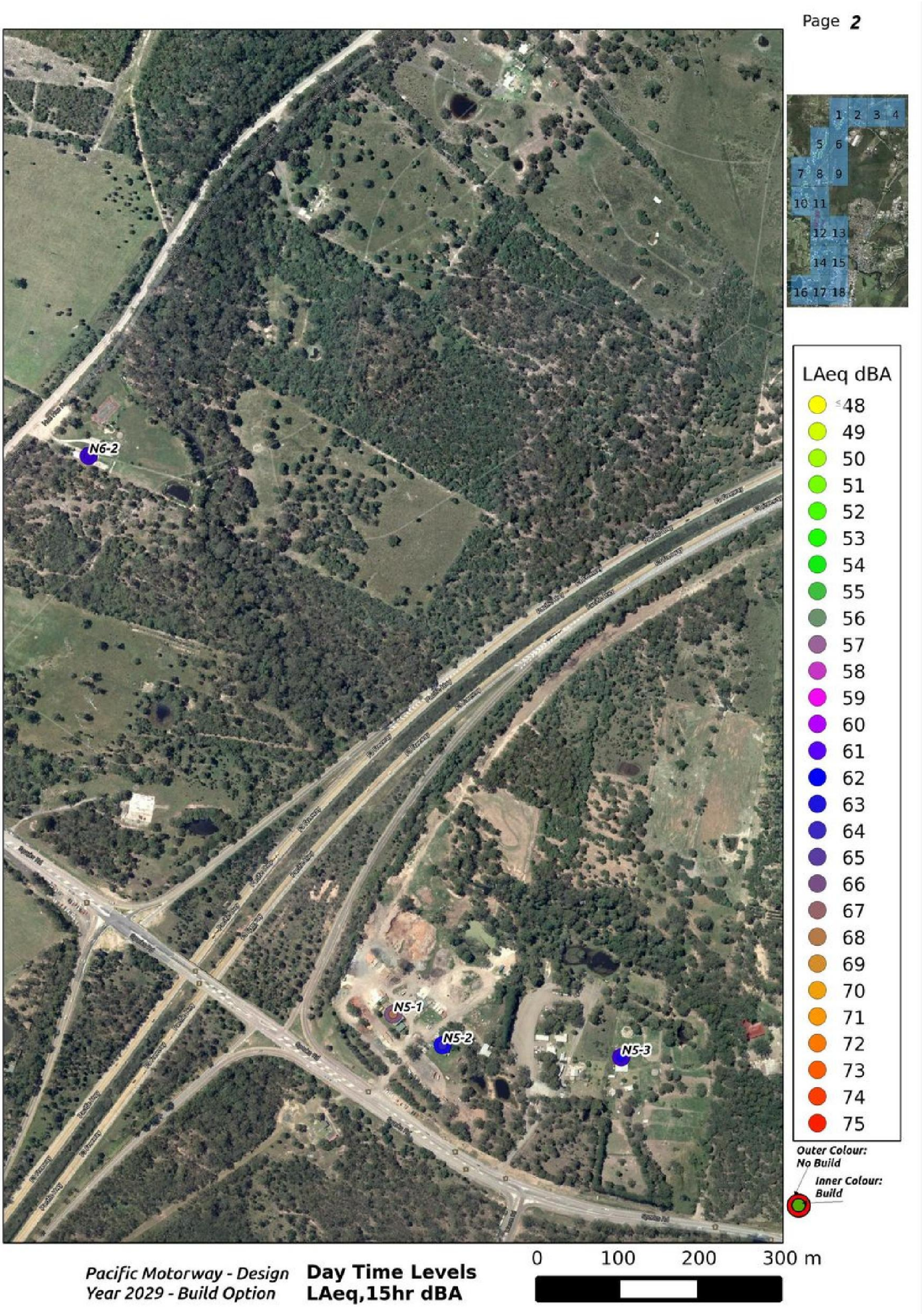
Pacific Motorway - Design
Year 2029 - Build Option
Day Time Levels
LAeq,15hr dBA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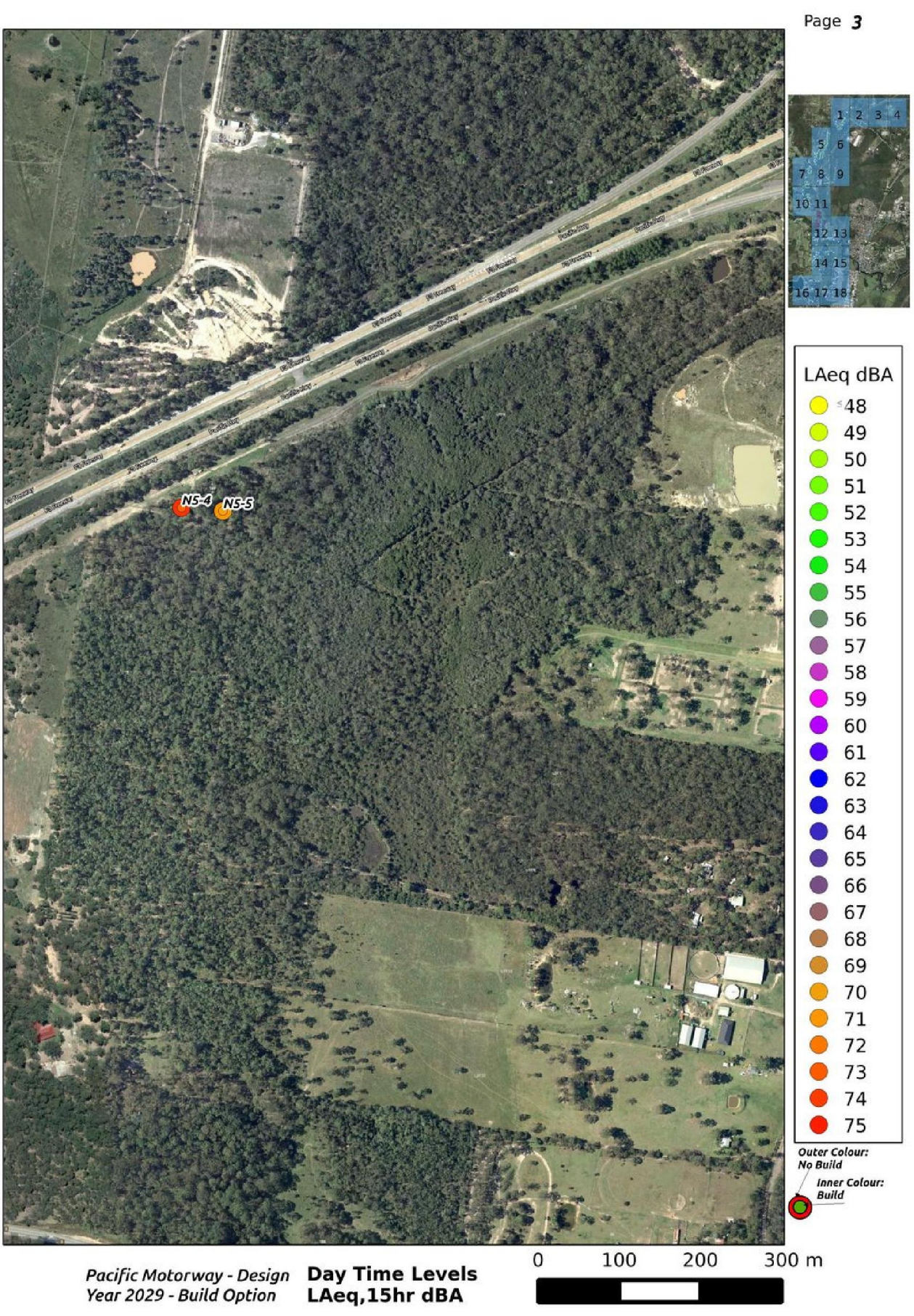
Pacific Motorway - Design Year 2029 - Build Option
Day Time Levels LAeq,15hr dBA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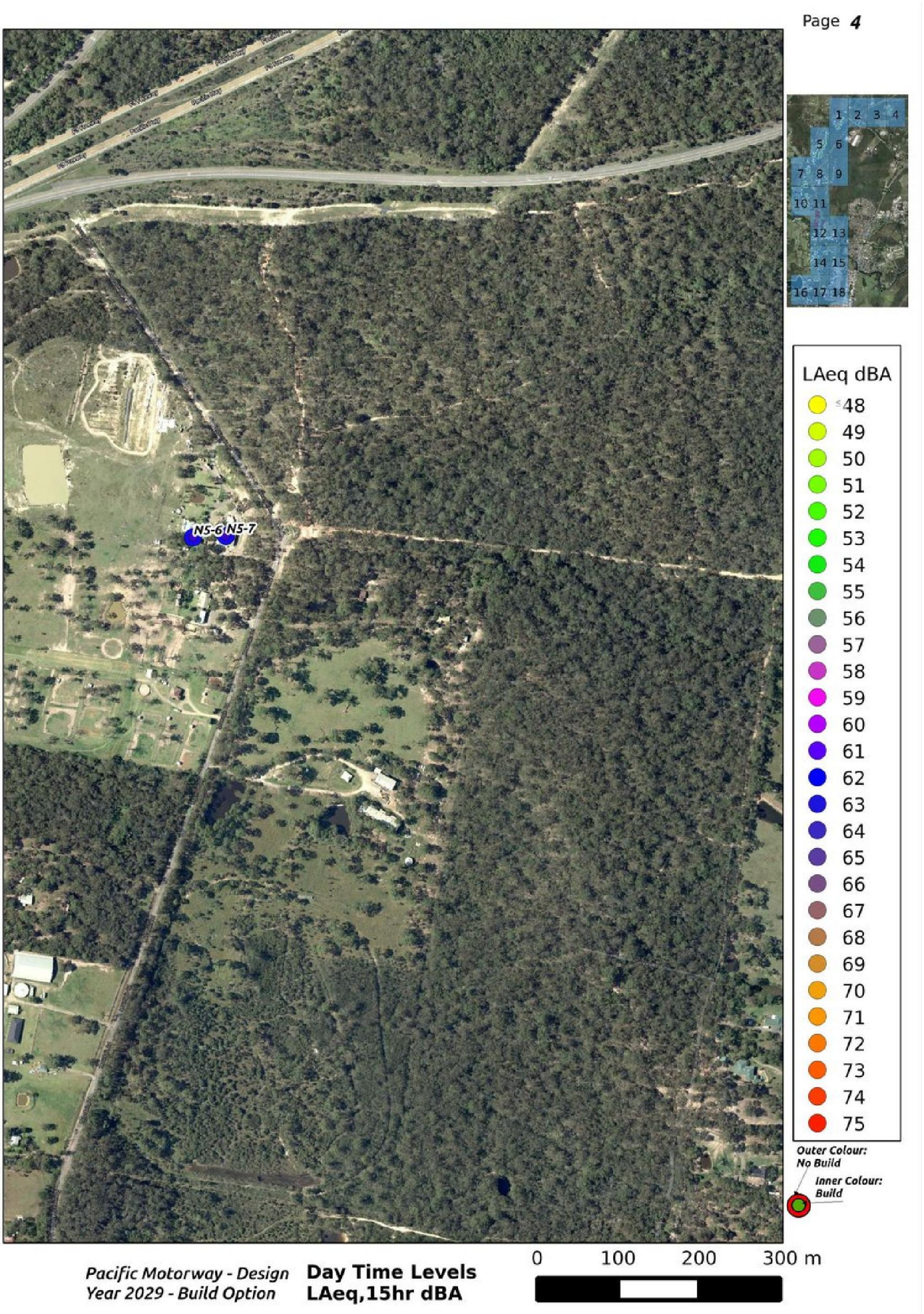
Pacific Motorway - Design Year 2029 - Build Option
Day Time Levels LAeq,15hr dBA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Pacific Motorway - Design
Year 2029 - Build Option
Day Time Levels
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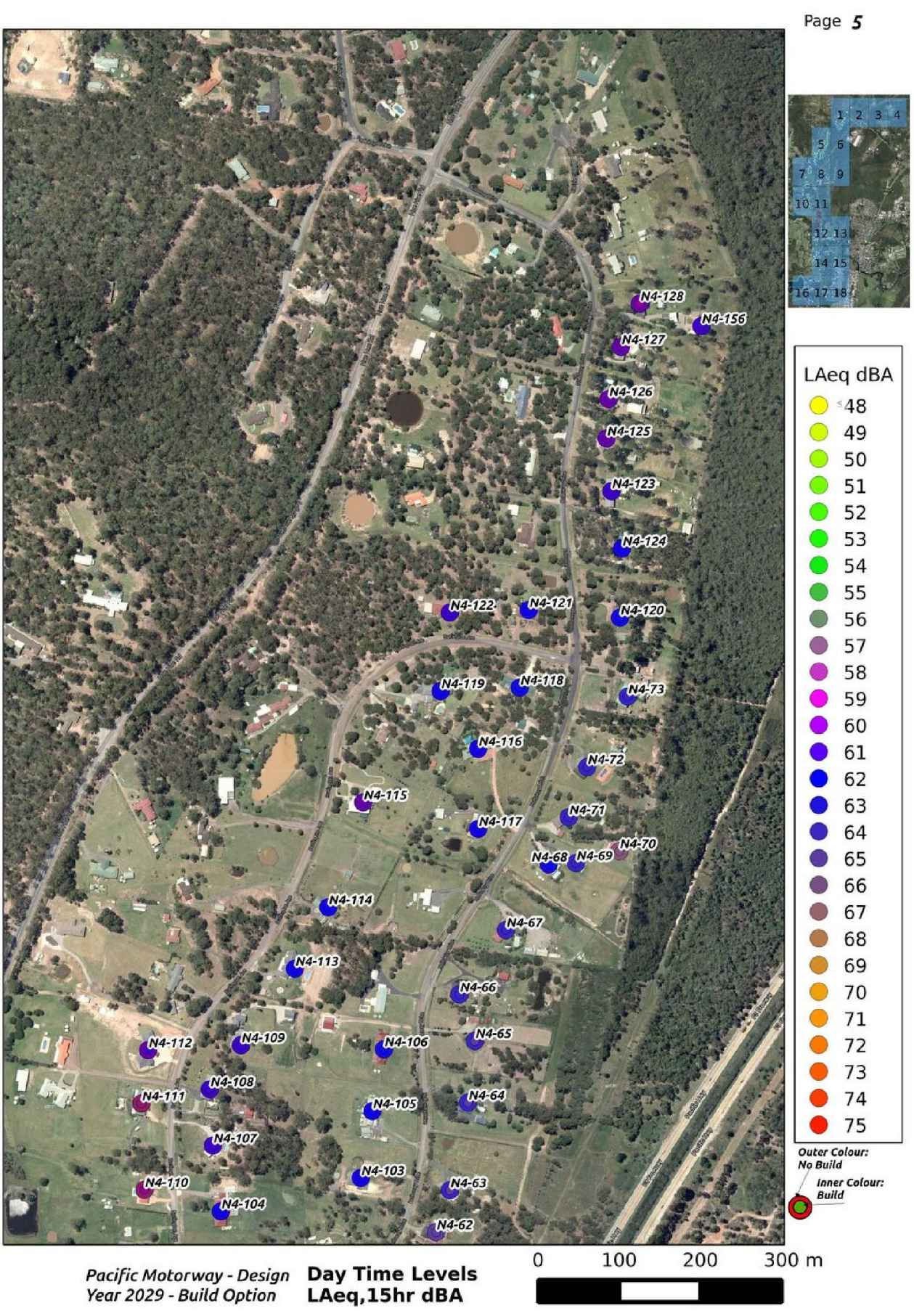
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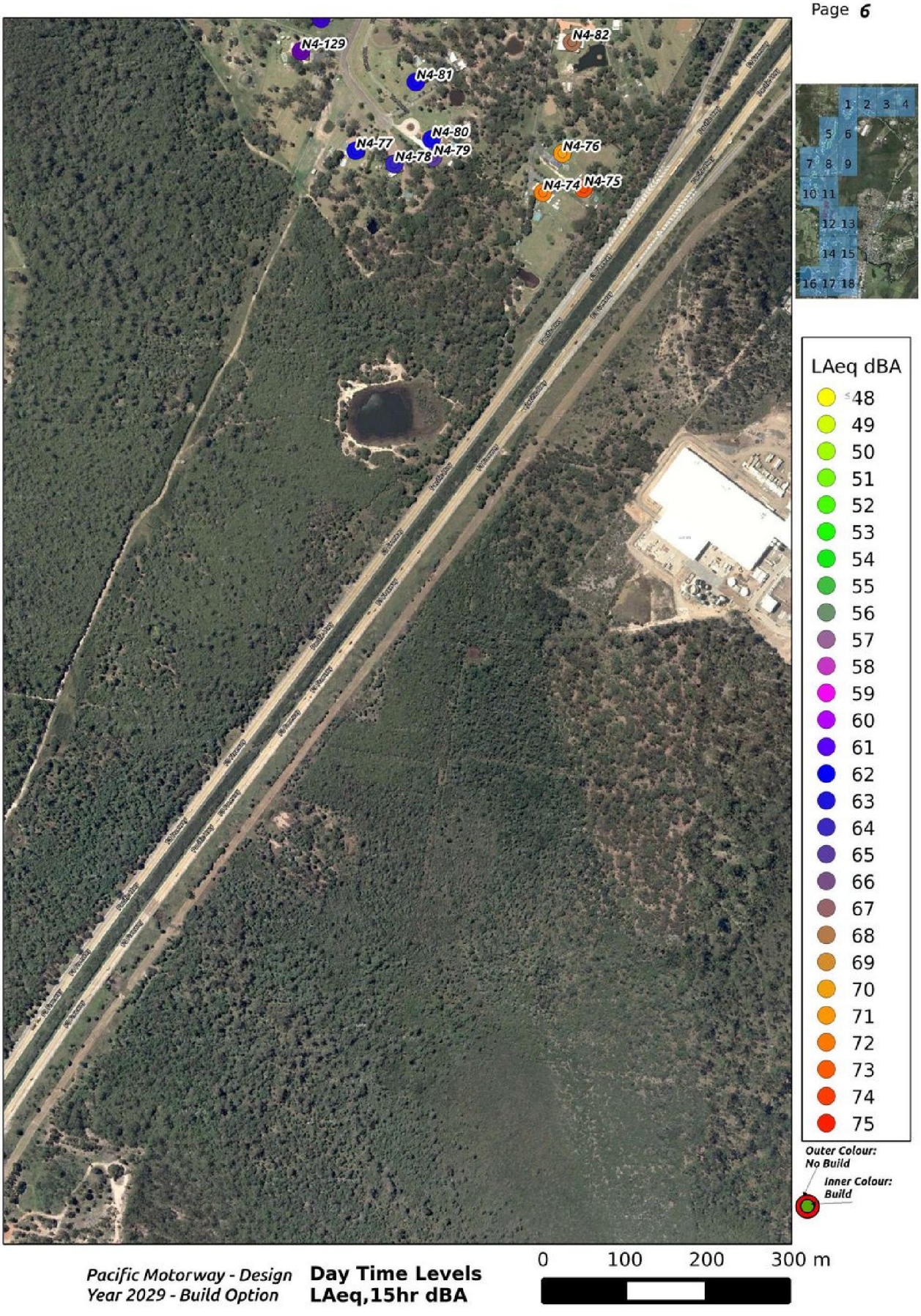
Pacific Motorway - Design Year 2029 - Build Option
Day Time Levels LAeq,15hr dBA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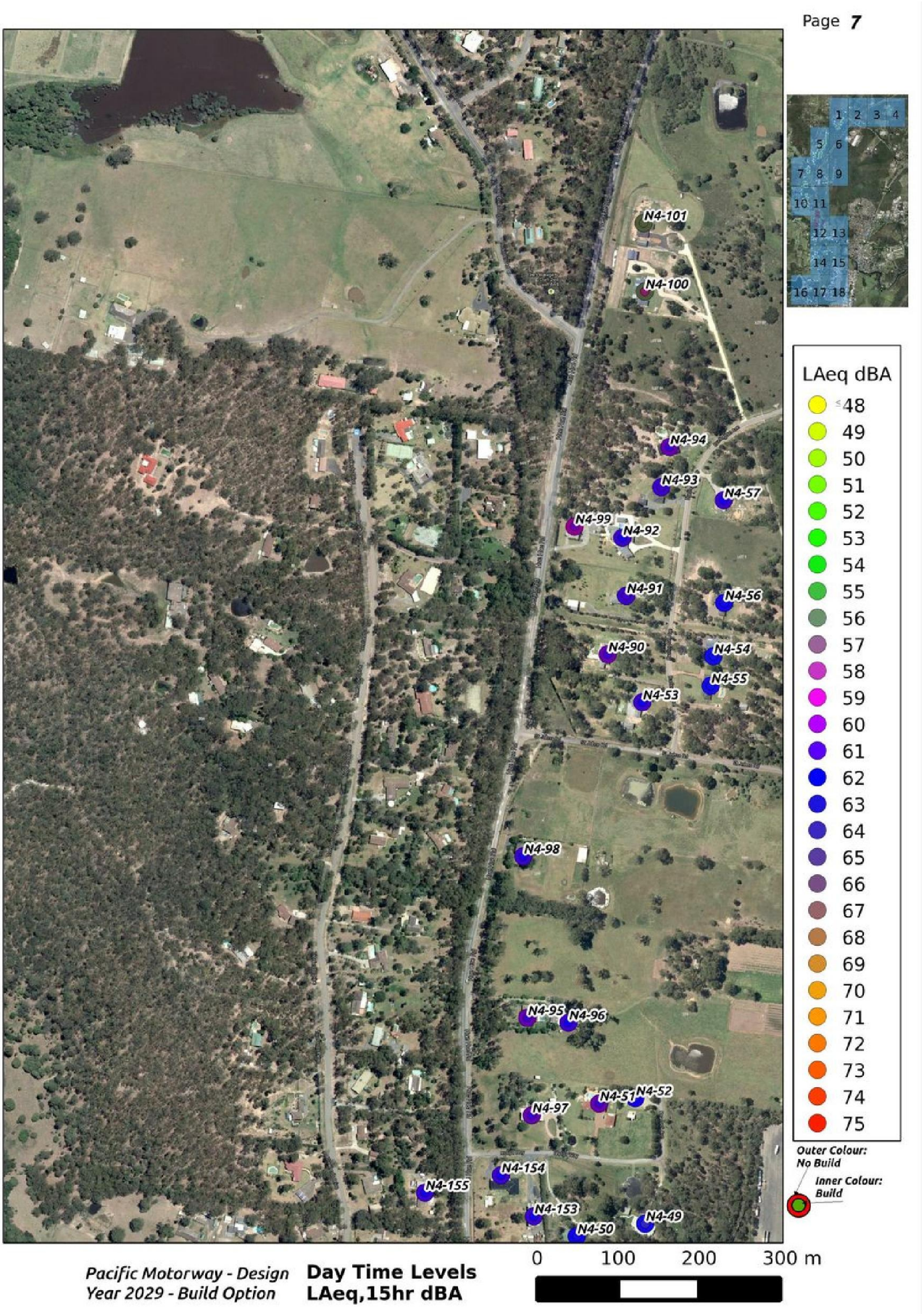
Pacific Motorway - Design Year 2029 - Build Option
Day Time Levels LAeq,15hr dBA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Pacific Motorway - Design
Year 2029 - Build Option
Day Time Levels
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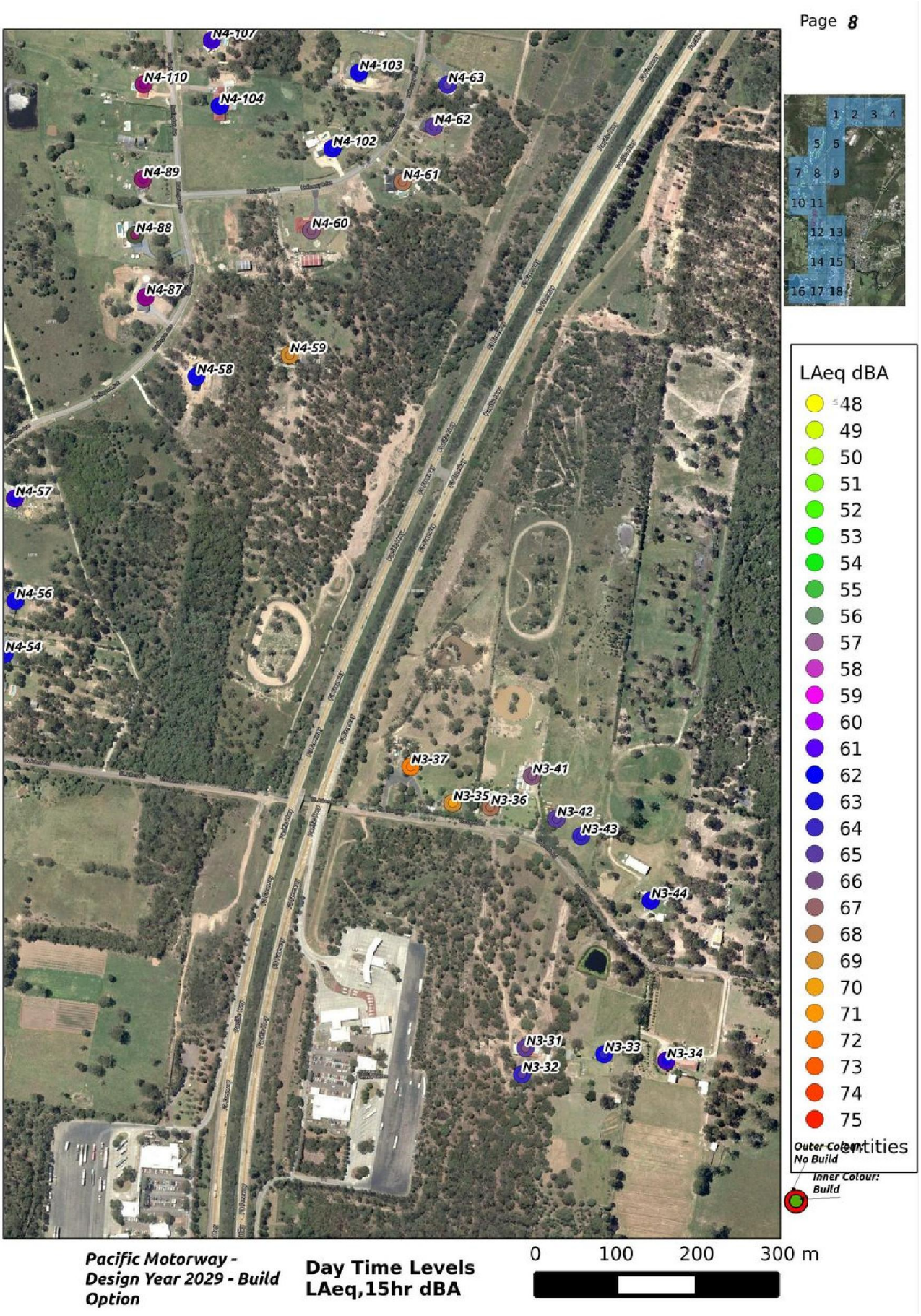
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Pacific Motorway - Design Year 2029 - Build Option
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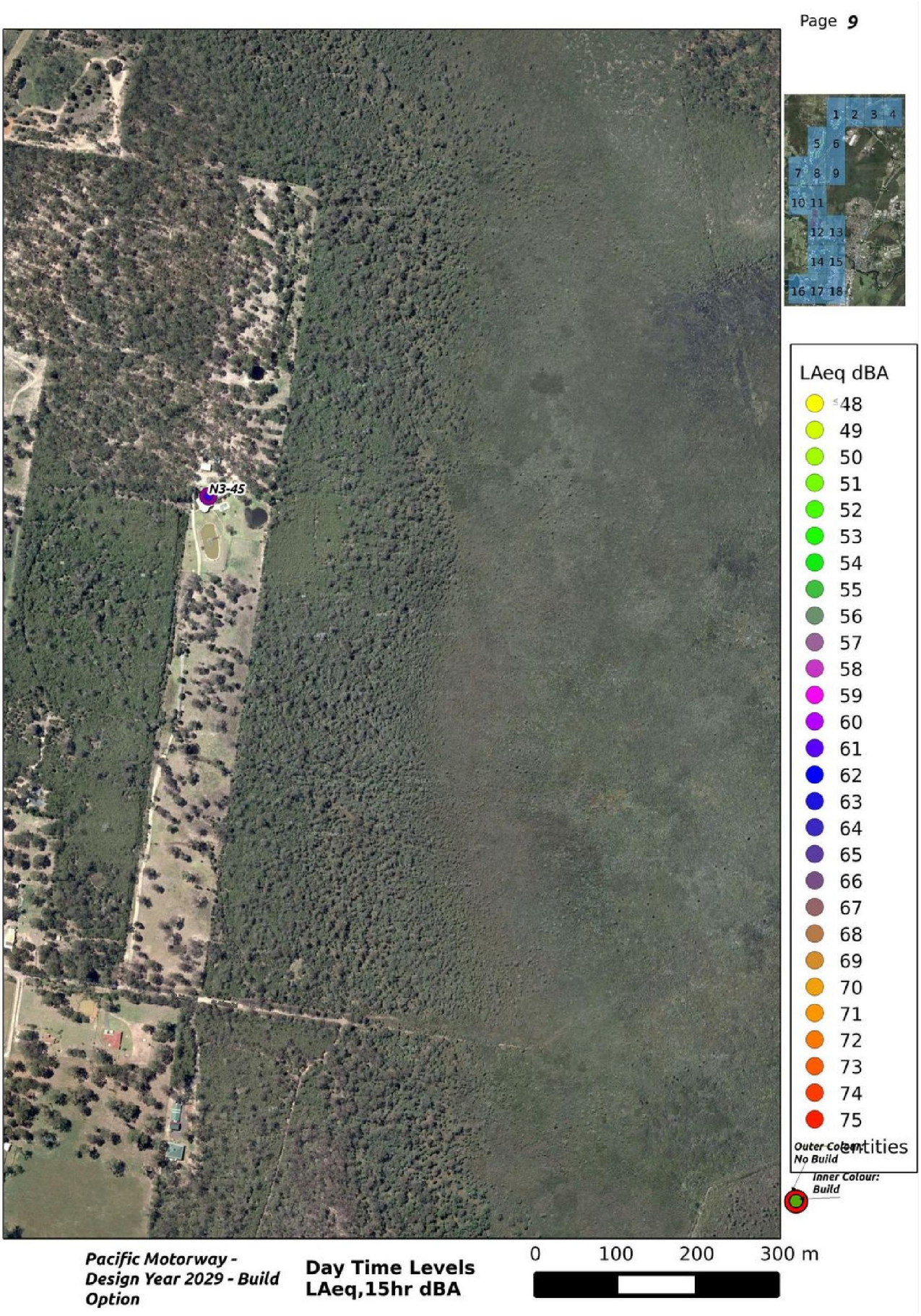
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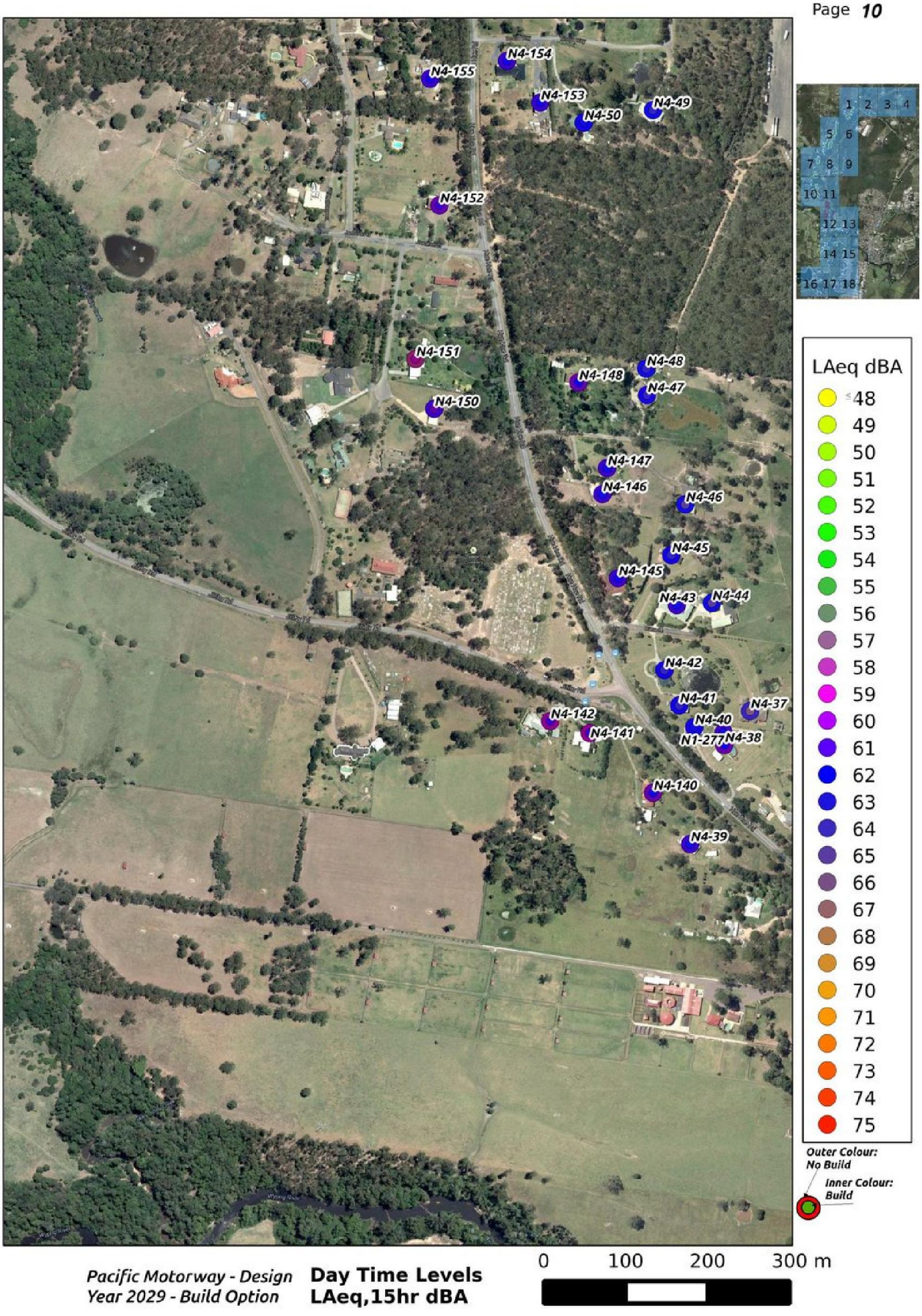
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Pacific Motorway - Design
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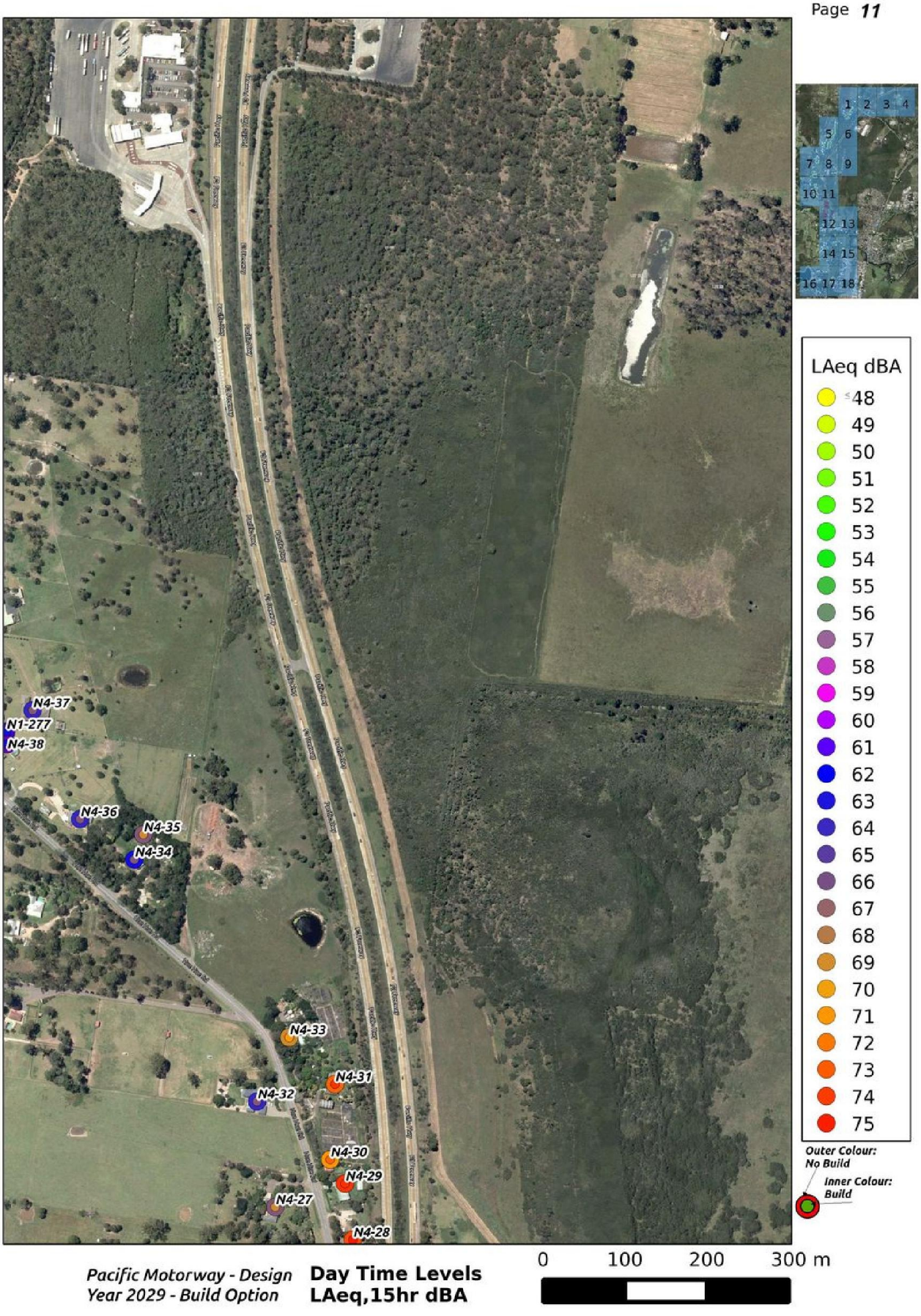
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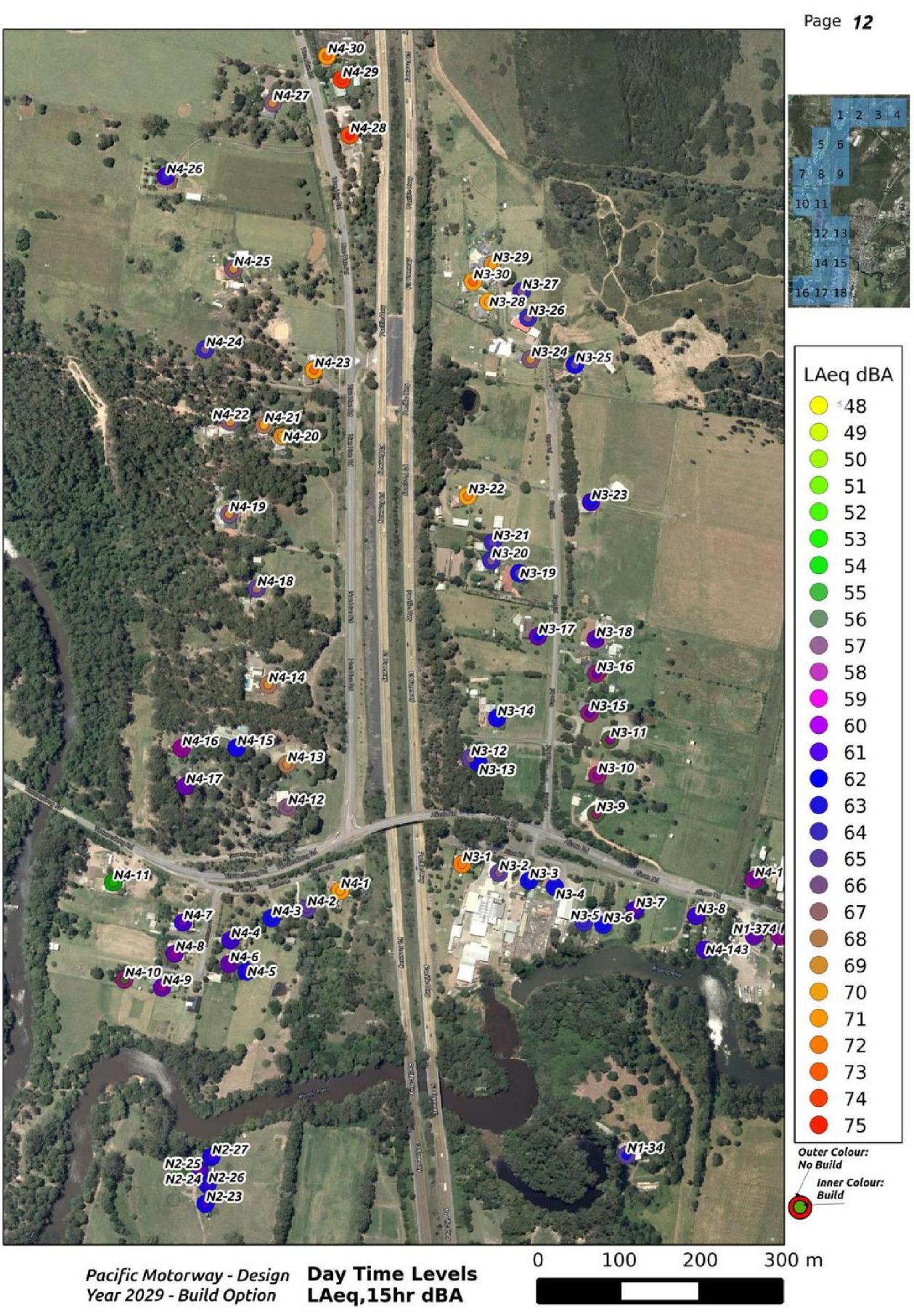
Pacific Motorway - Design Year 2029 - Build Option
Day Time Levels LAeq,15hr dBA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N3-6
N3-7
N3-8
N1-374
N4-143
N1-34
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5 6
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LAeq dBA
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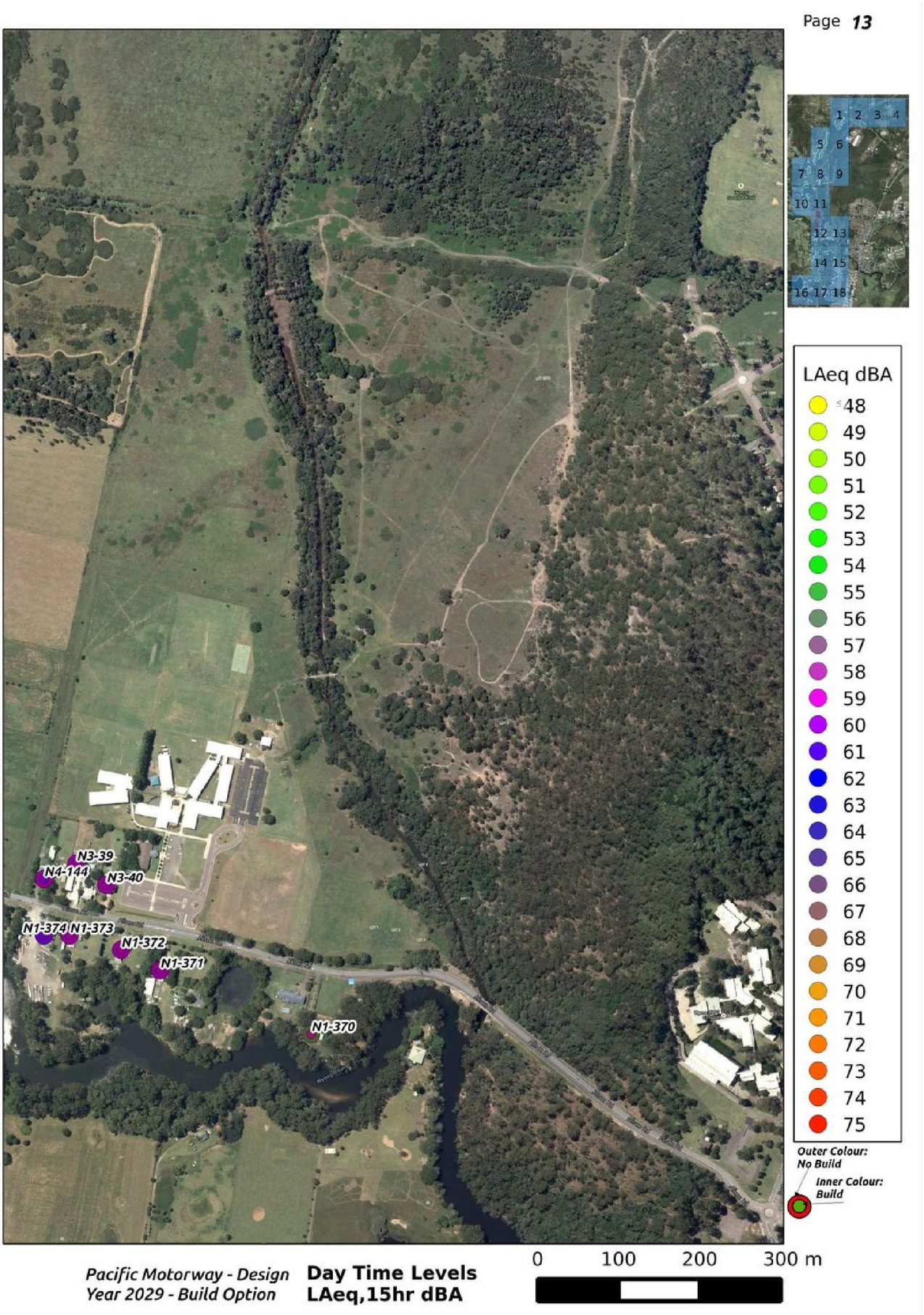
75
Outer Colour: No Build
Inner Colour: Build
0 100 200 300 m
Pacific Motorway - Design
Year 2029 - Build Option
Day Time Levels
LAeq,15hr dBA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Outer Colour: No Build
Inner Colour: Build
N3-39
N4-144
N3-40
N1-374
N1-373
N1-372
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N1-370
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100
200
300 m
Pacific Motorway - Design Year 2029 - Build Option
Day Time Levels LAeq,15hr dBA

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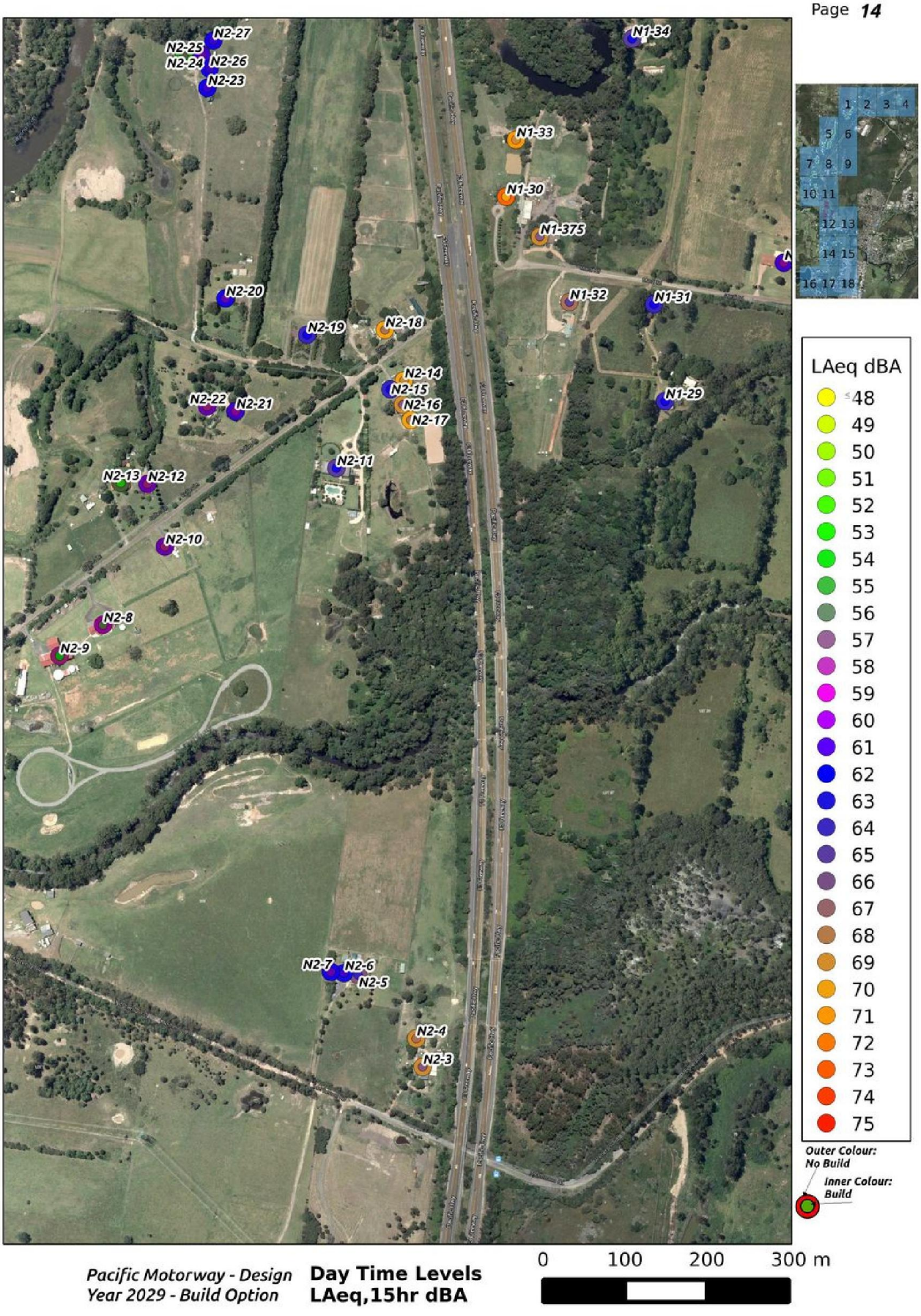
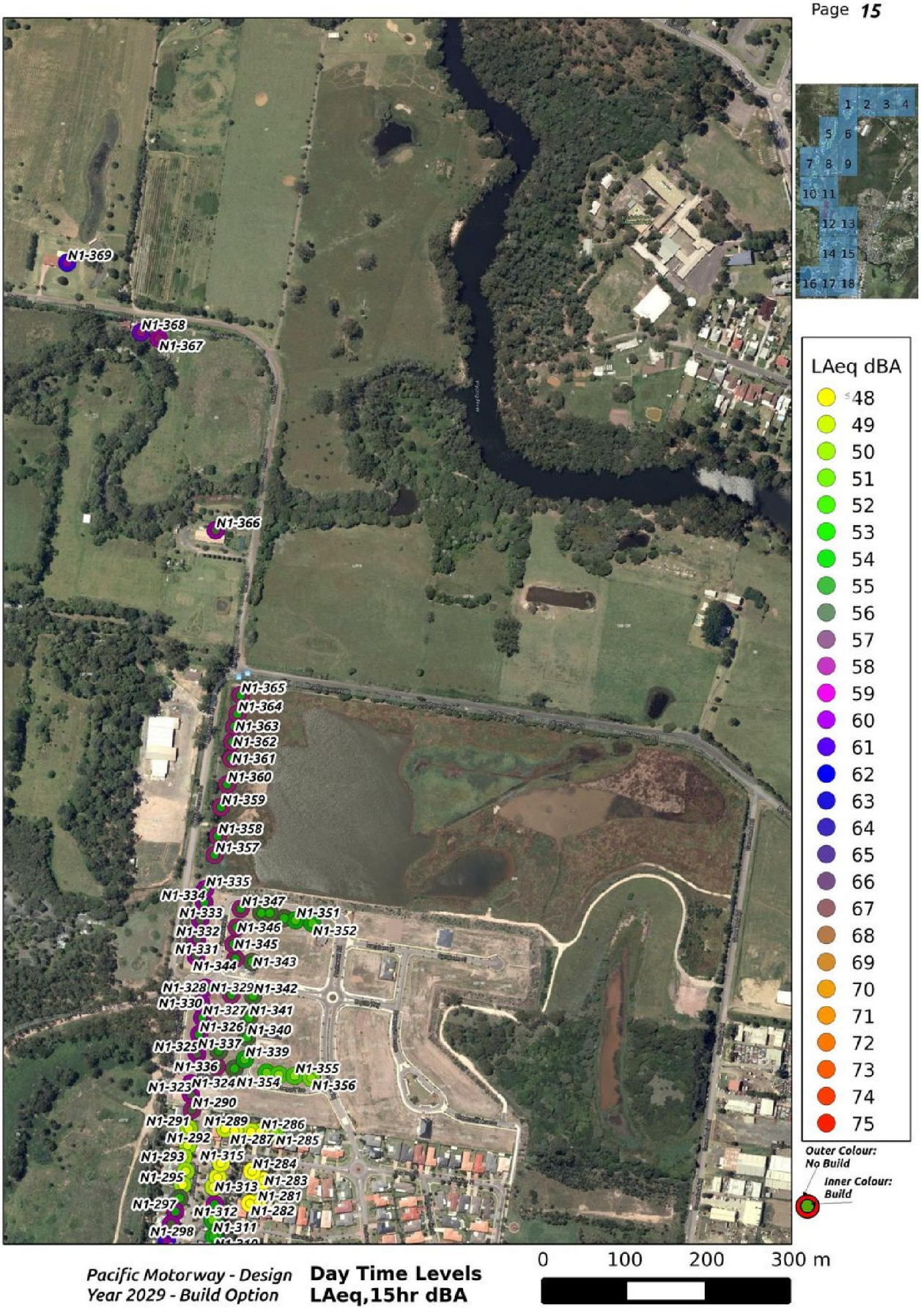


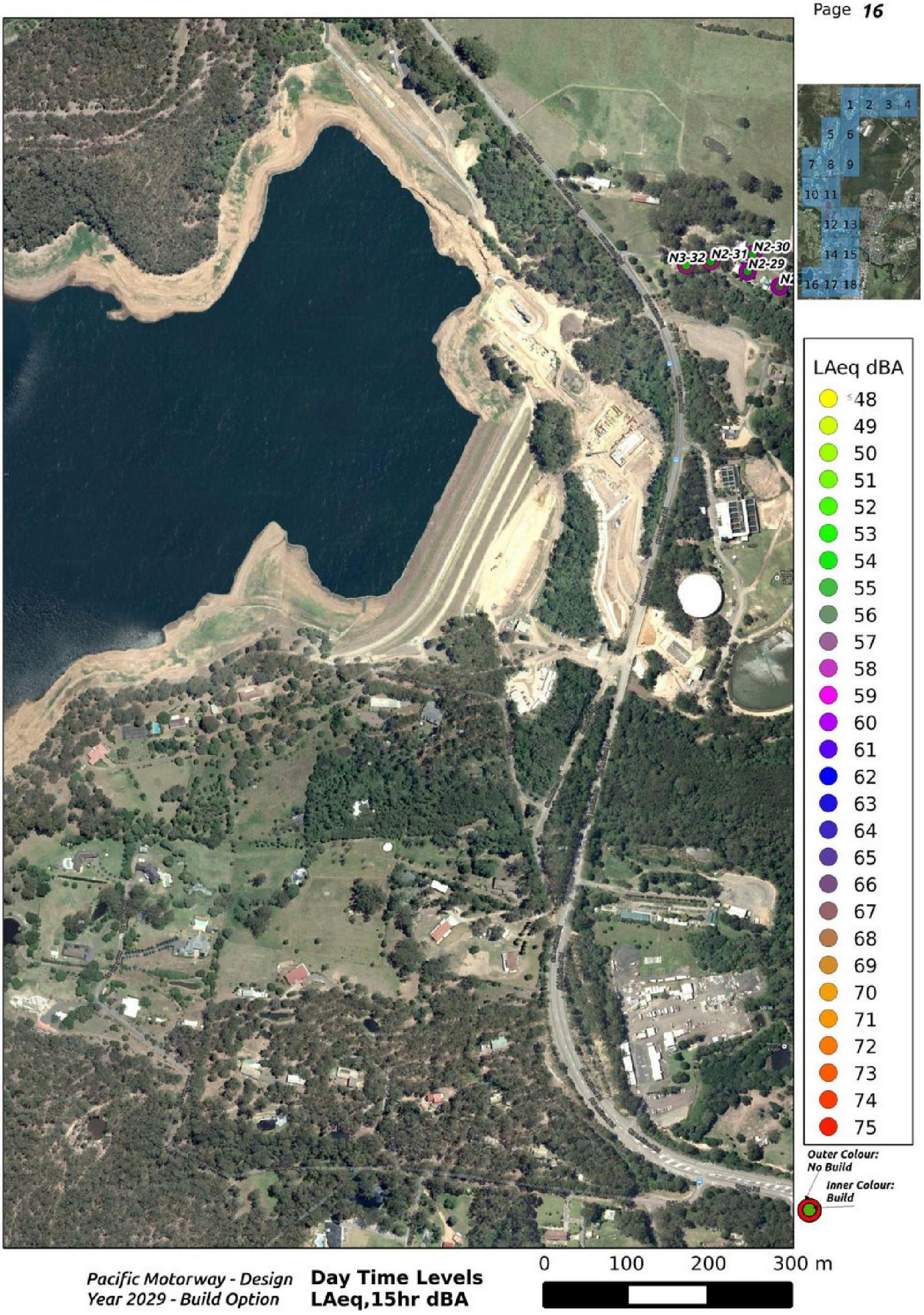
Pacific Motorway - Design Year 2029 - Build Option

Day Time Levels LAeq,15hr dBA



Pacific Motorway - Design Year 2029 - Build Option

Day Time Levels LAeq,15hr dBA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14 15
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LAeq dBA
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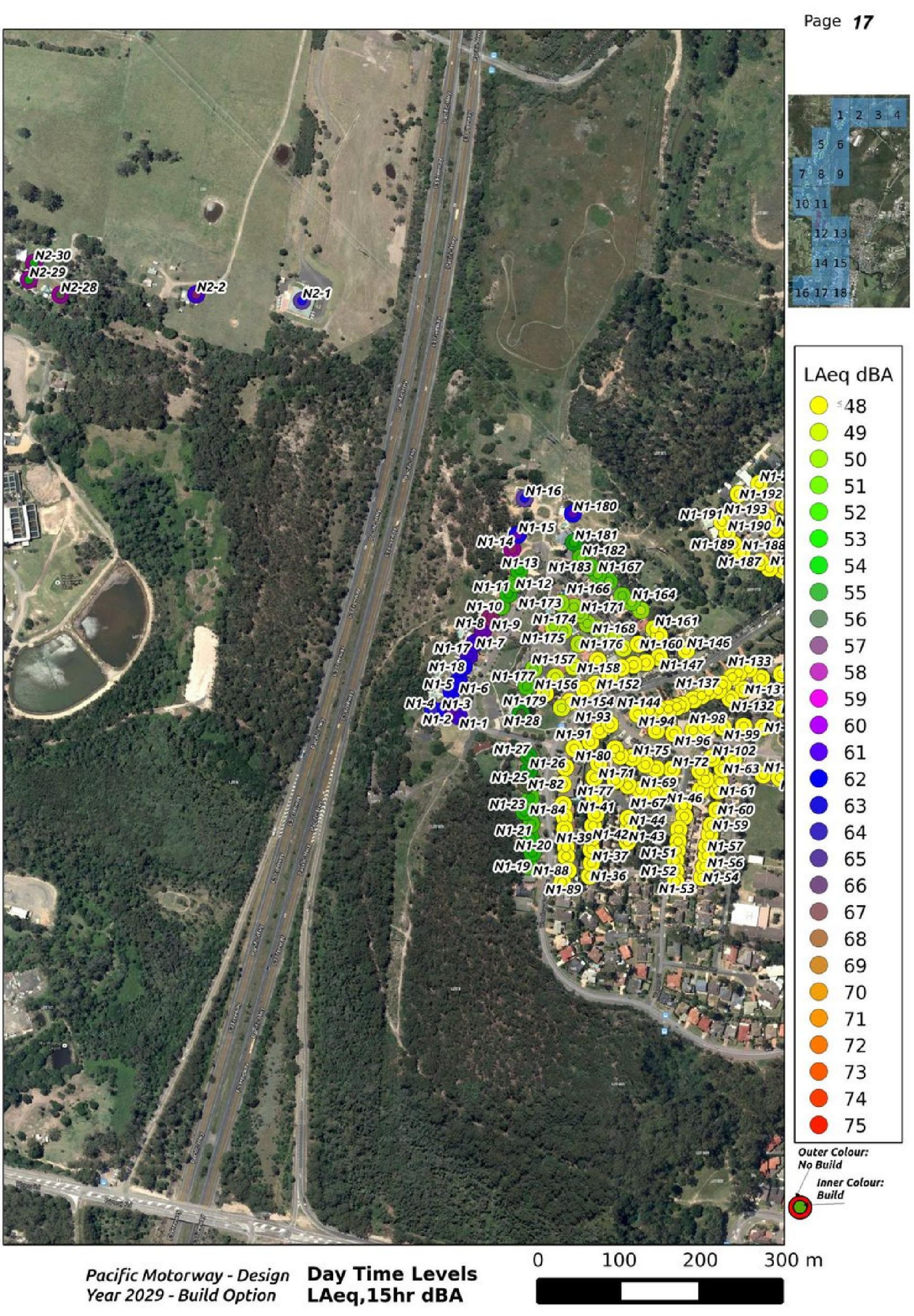
Outer Colour: No Build
Inner Colour: Build
0 100 200 300 m
Pacific Motorway - Design Year 2029 - Build Option
Day Time Levels LAeq,15hr dBA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12 13
14 15
16 17 18
N2-30
N2-29
N2-28
N2-2
N2-1
LAeq dBA
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Outer Colour: No Build
Inner Colour: Build
0 100 200 300 m
Pacific Motorway - Design Year 2029 - Build Option
Day Time Levels LAeq,15hr dBA

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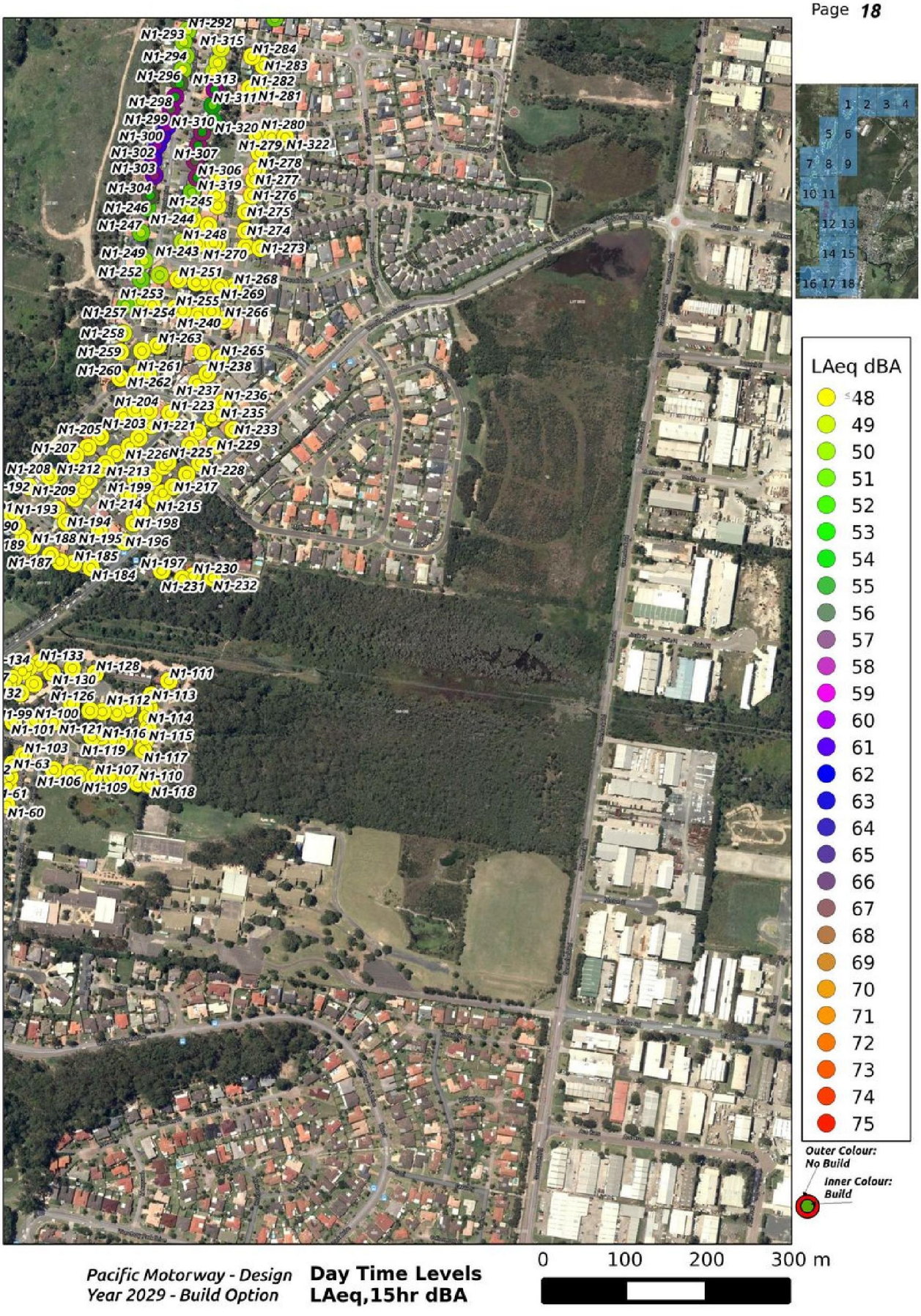
LAeq dBA
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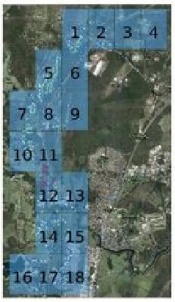
Outer Colour: No Build
Inner Colour: Build
0
100
200
300 m
Pacific Motorway - Design
Year 2029 - Build Option
Day Time Levels
LAeq,15hr dBA

APPENDIX E

RECEIVER LOCATIONS & 2029 PREDICTED NOISE IMPACT


Page 1
1 2 3 4
5 6
7 8 9
10 11
12 13
14 15
16 17 18
N6-1
N4-162
N4-161
N4-160
N4-138
N4-139
N4-137
N4-136
N4-135
N4-159
N4-134
N4-133
N4-86
N4-85
N4-84
N4-158
N4-157
N4-131
N4-132
N4-83
N4-130
N4-82
N4-129
N4-81
0 100 200 300 m
Pacific Motorway -
Design Year 2029 -
Build Option
Noise Impact
Exceeds RNP
Exceeds RNP and increase more than 2dBA
Complies
Acute
Acute, increase more than 2BA

Page 2

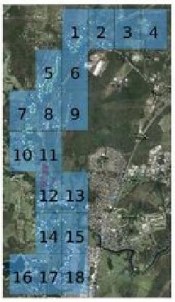


0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact
Complies
Exceeds RNP
Acute
Exceeds RNP and increase more than 2dBA
Acute, increase more than 2BA

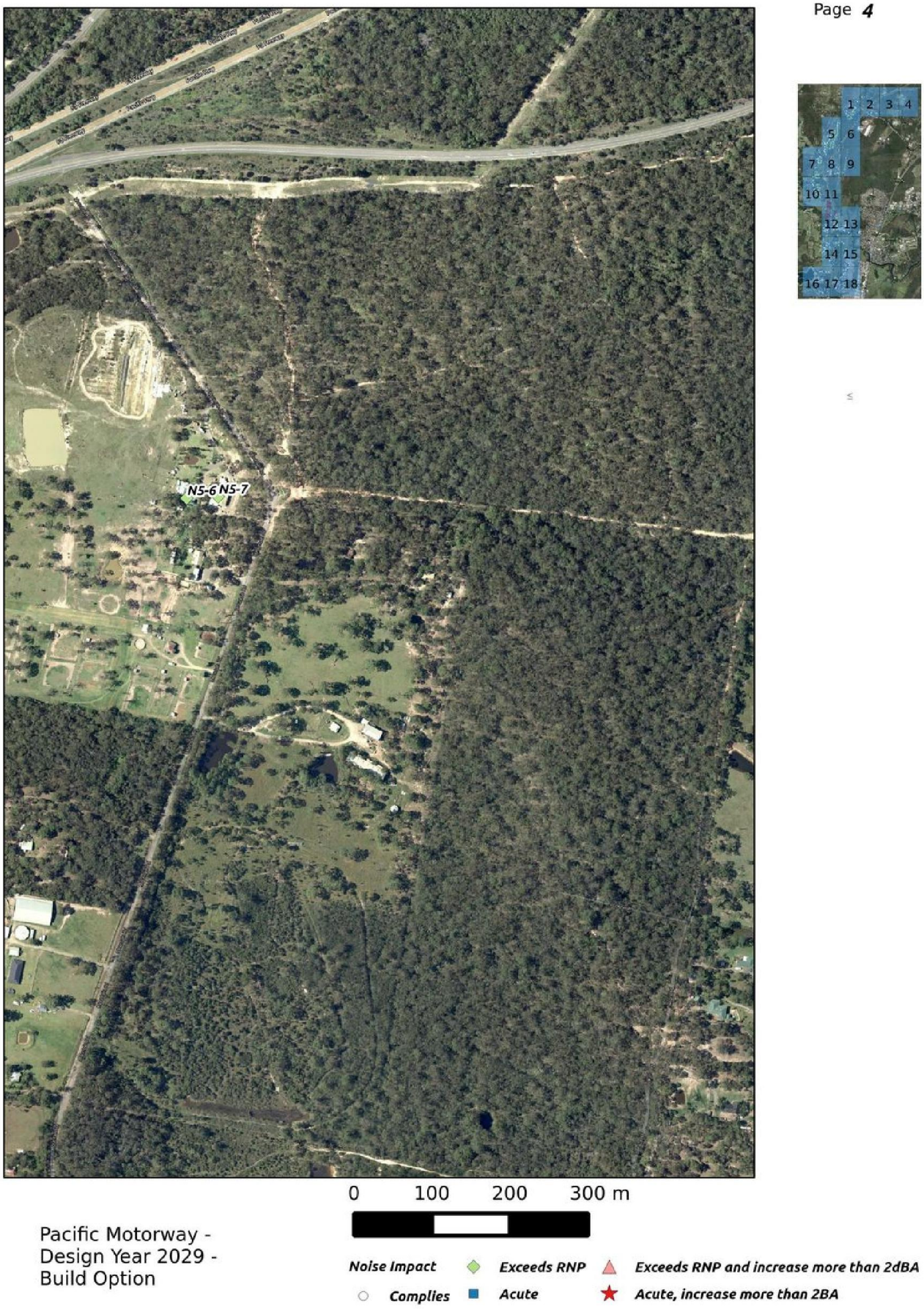
Page 3



0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact
Complies
Exceeds RNP
Acute
Exceeds RNP and increase more than 2dBA
Acute, increase more than 2BA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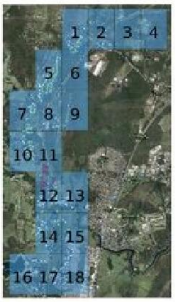
N5-6 N5-7
0 100 200 300 m
Pacific Motorway -
Design Year 2029 -
Build Option
Noise Impact
Exceeds RNP
Exceeds RNP and increase more than 2dBA
Complies
Acute
Acute, increase more than 2BA

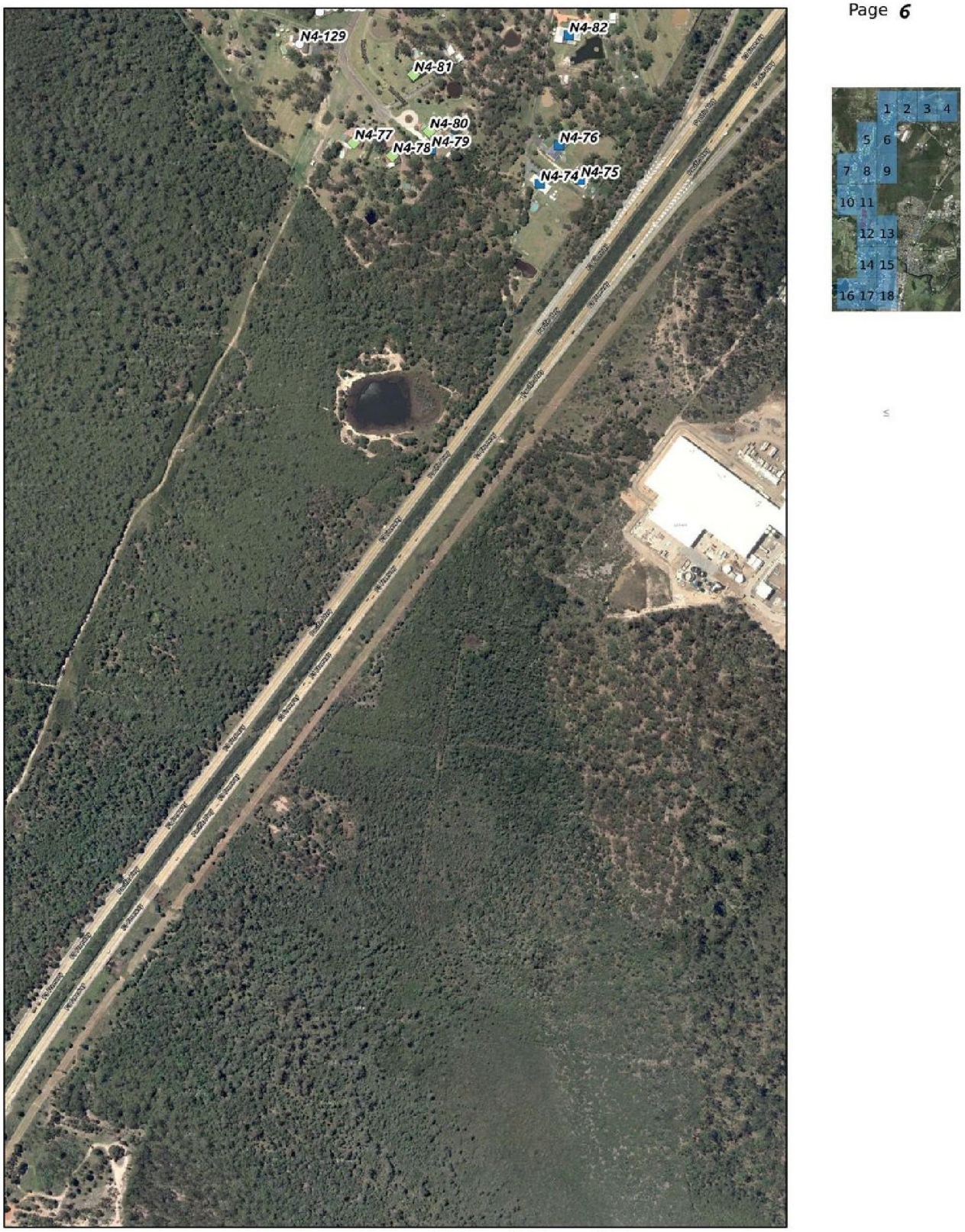
Page 5



0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact
Complies
Exceeds RNP
Acute
Exceeds RNP and increase more than 2dBA
Acute, increase more than 2BA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N4-76
N4-74
N4-75
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14 15
16 17 18
0 100 200 300 m
Pacific Motorway -
Design Year 2029 -
Build Option
Noise Impact
Exceeds RNP
Exceeds RNP and increase more than 2dBA
Complies
Acute
Acute, increase more than 2BA

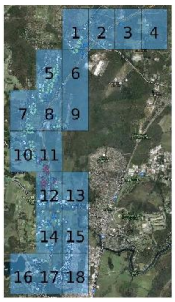
Page 7

0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact
Exceeds RNP
Exceeds RNP and increase more than 2dBA
Complies
Acute
Acute, increase more than 2BA

Page *8*

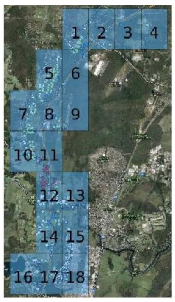


0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact *Exceeds RNP* *Exceeds RNP and increase more than 2dBA*
Complies *Acute* *Acute, increase more than 2BA*

Page **9**



0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact ◇ *Exceeds RNP* △ *Exceeds RNP and increase more than 2dBA*
○ *Complies* □ *Acute* ★ *Acute, increase more than 2BA*


Page 10
N4-154
N4-155
N4-153
N4-50
N4-49
N4-152
N4-151
N4-48
N4-148
N4-47
N4-150
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N4-41
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N4-142
N4-40
N4-141
N1-277
N4-38
N4-140
N4-39
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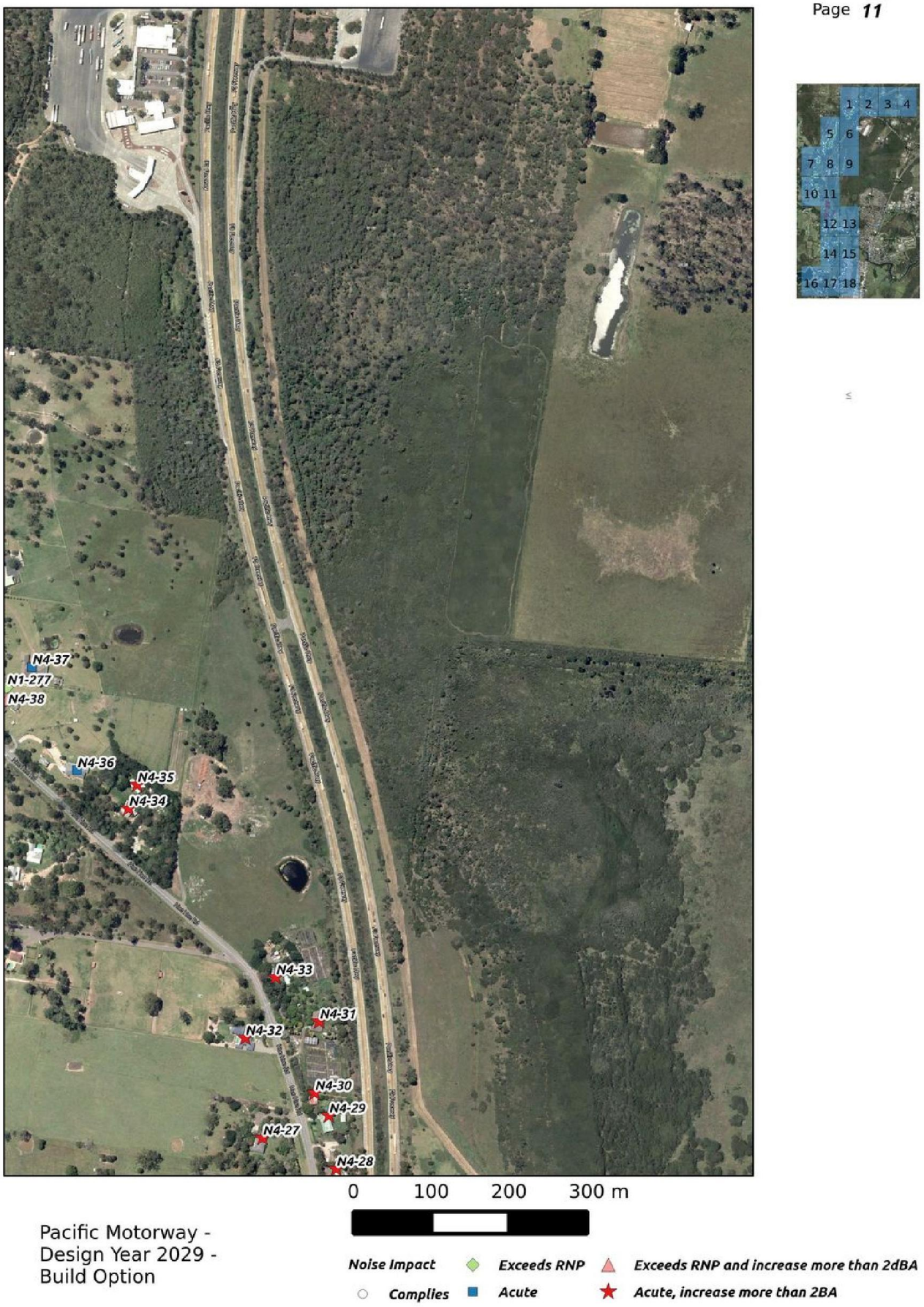
0 100 200 300 m
Pacific Motorway -
Design Year 2029 -
Build Option
Noise Impact
Exceeds RNP
Exceeds RNP and increase more than 2dBA
Complies
Acute
Acute, increase more than 2BA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N4-31
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N4-27
N4-28
0 100 200 300 m
Pacific Motorway - Design Year 2029 - Build Option
Noise Impact
Exceeds RNP
Exceeds RNP and increase more than 2dBA
Complies
Acute
Acute, increase more than 2BA


Page 12
N4-30
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14 15
16 17 18
0 100 200 300 m
Pacific Motorway -
Design Year 2029 -
Build Option
Noise Impact
Exceeds RNP
Exceeds RNP and increase more than 2dBA
Complies
Acute
Acute, increase more than 2BA

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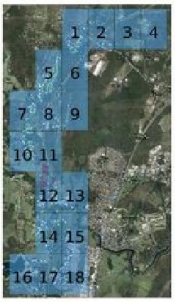

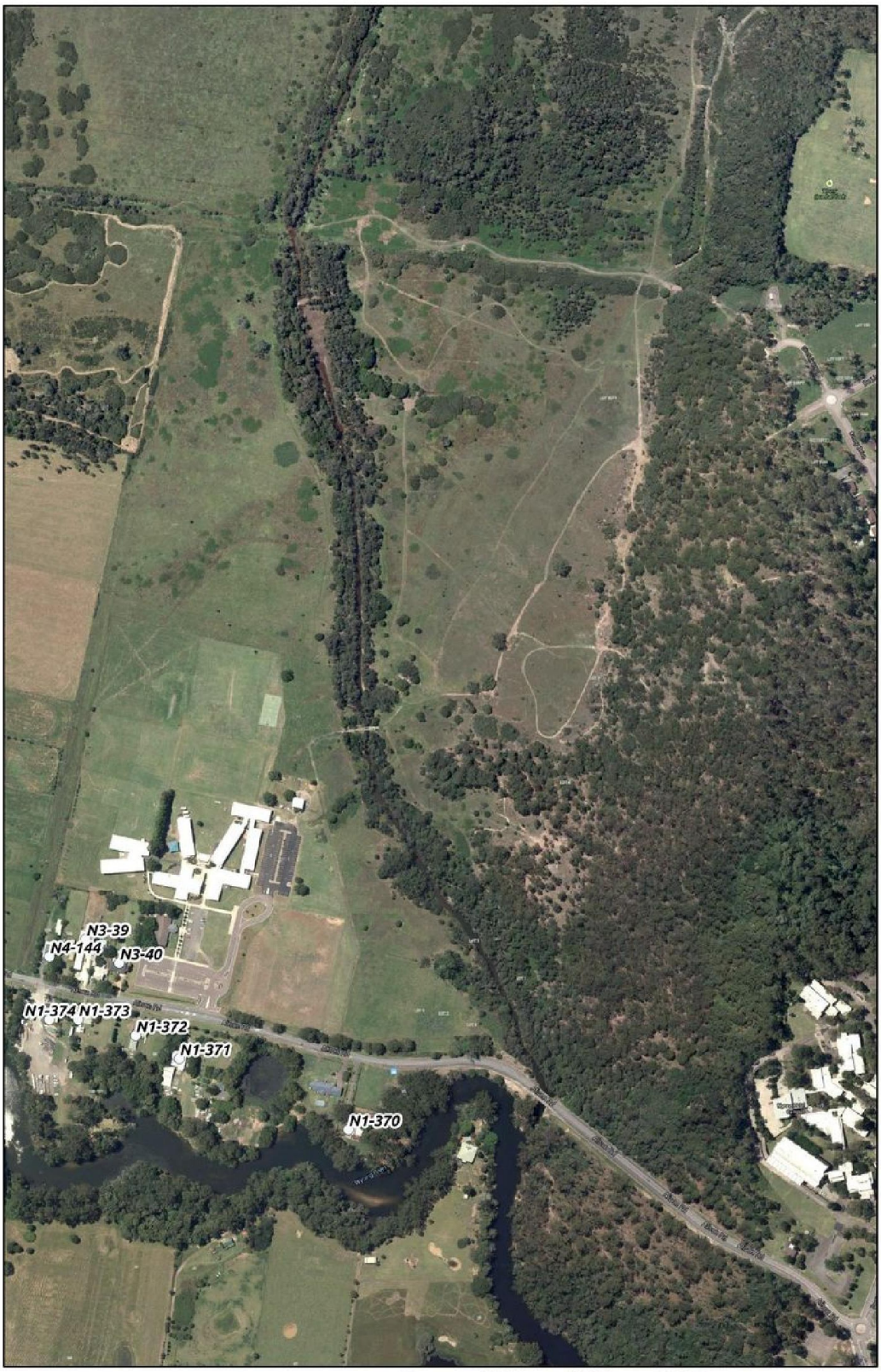

0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact
Complies
Exceeds RNP
Acute
Exceeds RNP and increase more than 2dBA
Acute, increase more than 2BA


Page 14
N2-27
N2-25
N2-24
N2-26
N2-23
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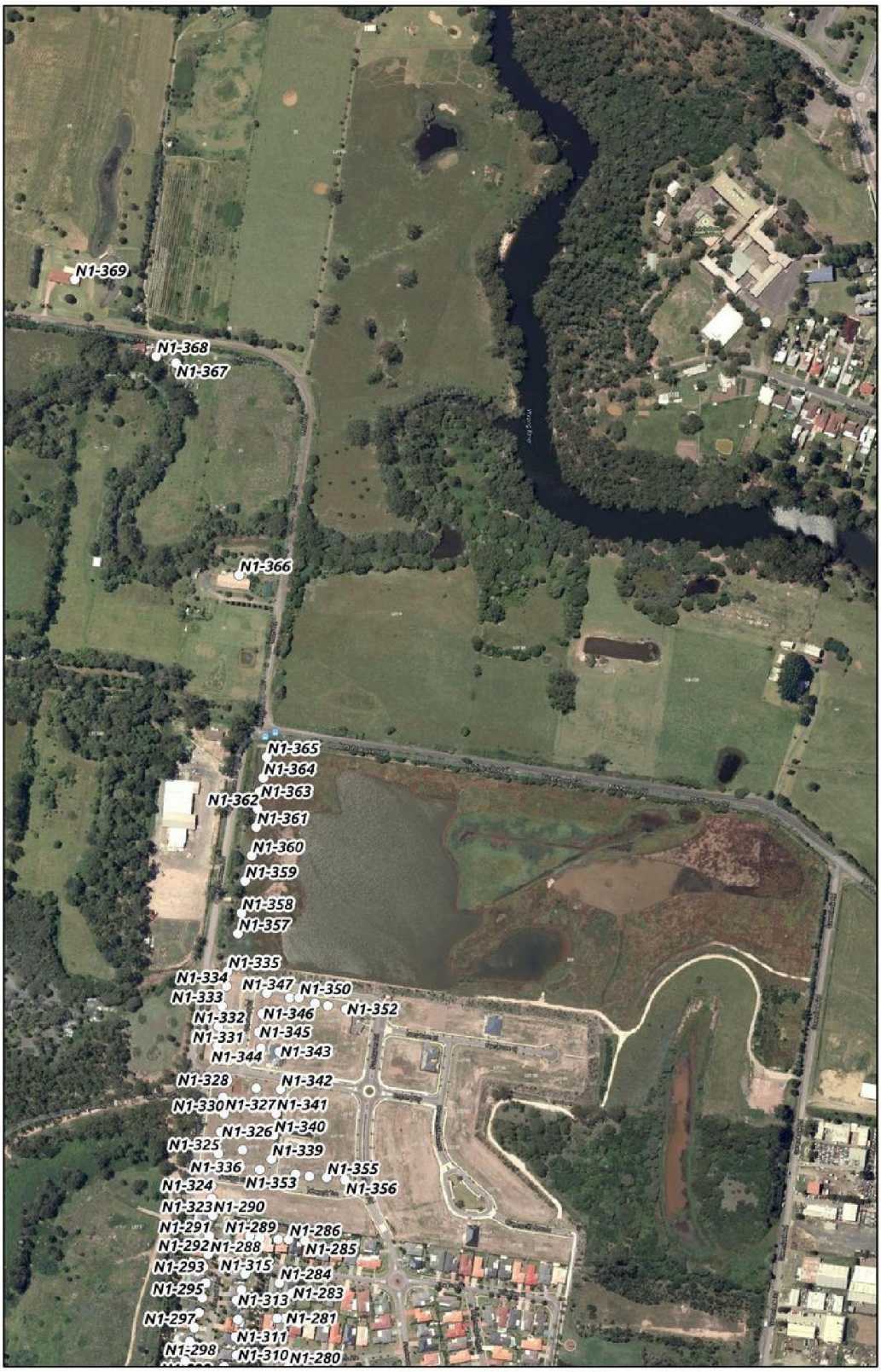
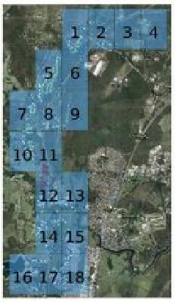
14 15
16 17 18
0 100 200 300 m
Pacific Motorway -
Design Year 2029 -
Build Option
Noise Impact
Exceeds RNP
Exceeds RNP and increase more than 2dBA
Complies
Acute
Acute, increase more than 2BA

Page 15



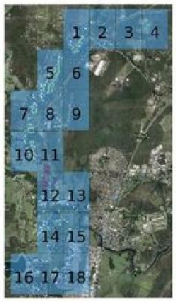


0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact
Complies
Exceeds RNP
Acute
Exceeds RNP and increase more than 2dBA
Acute, increase more than 2BA

Page **16**

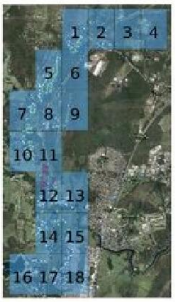


0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact ◇ *Exceeds RNP* △ *Exceeds RNP and increase more than 2dBA*
○ *Complies* ■ *Acute* ★ *Acute, increase more than 2BA*

Page 17



Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact
Complies
Exceeds RNP
Acute
Exceeds RNP and increase more than 2dBA
Acute, increase more than 2BA

Page **18**

0 100 200 300 m

Pacific Motorway -
Design Year 2029 -
Build Option

Noise Impact
Complies
Exceeds RNP
Acute
Exceeds RNP and increase more than 2dBA
Acute, increase more than 2BA

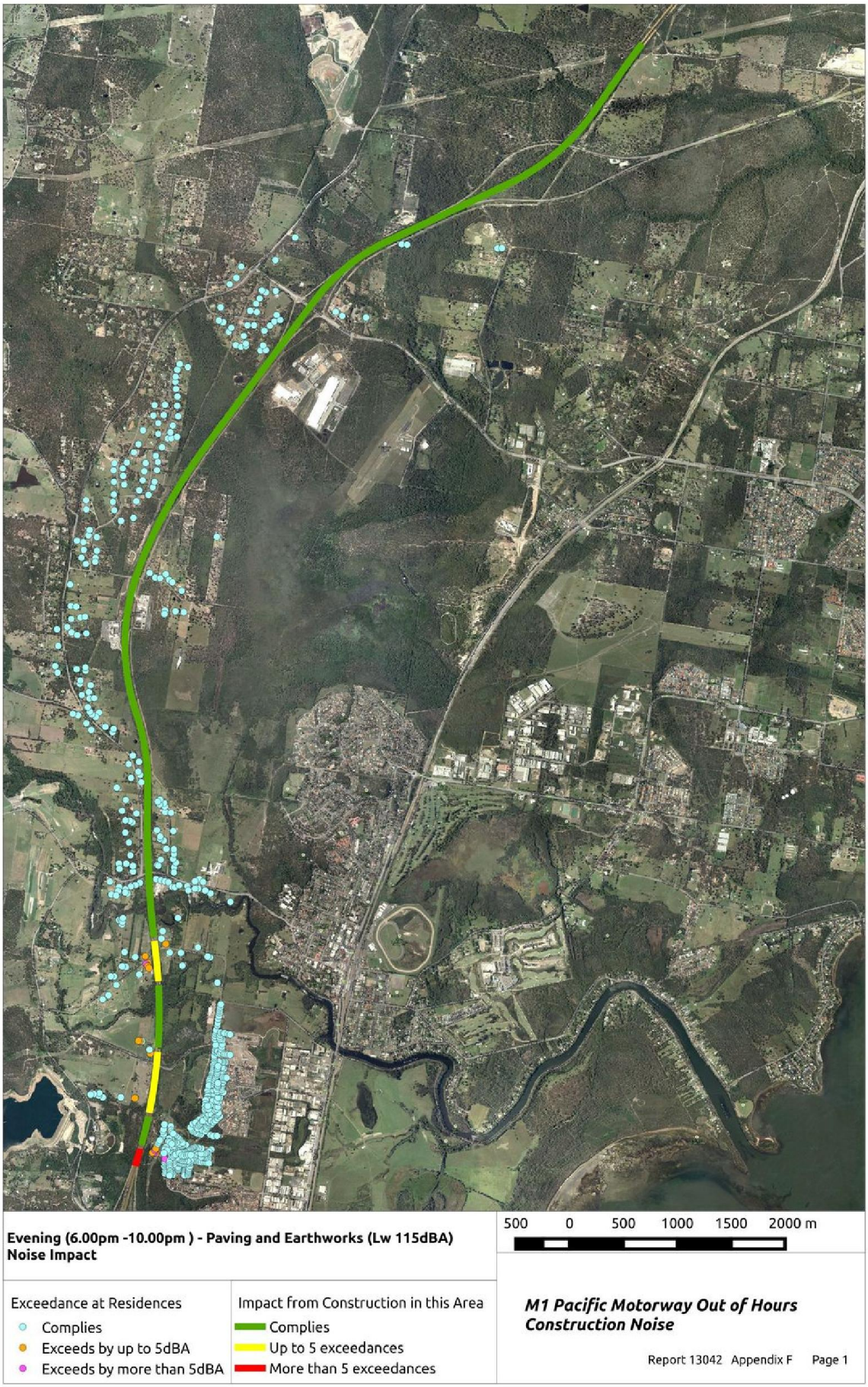
APPENDIX F

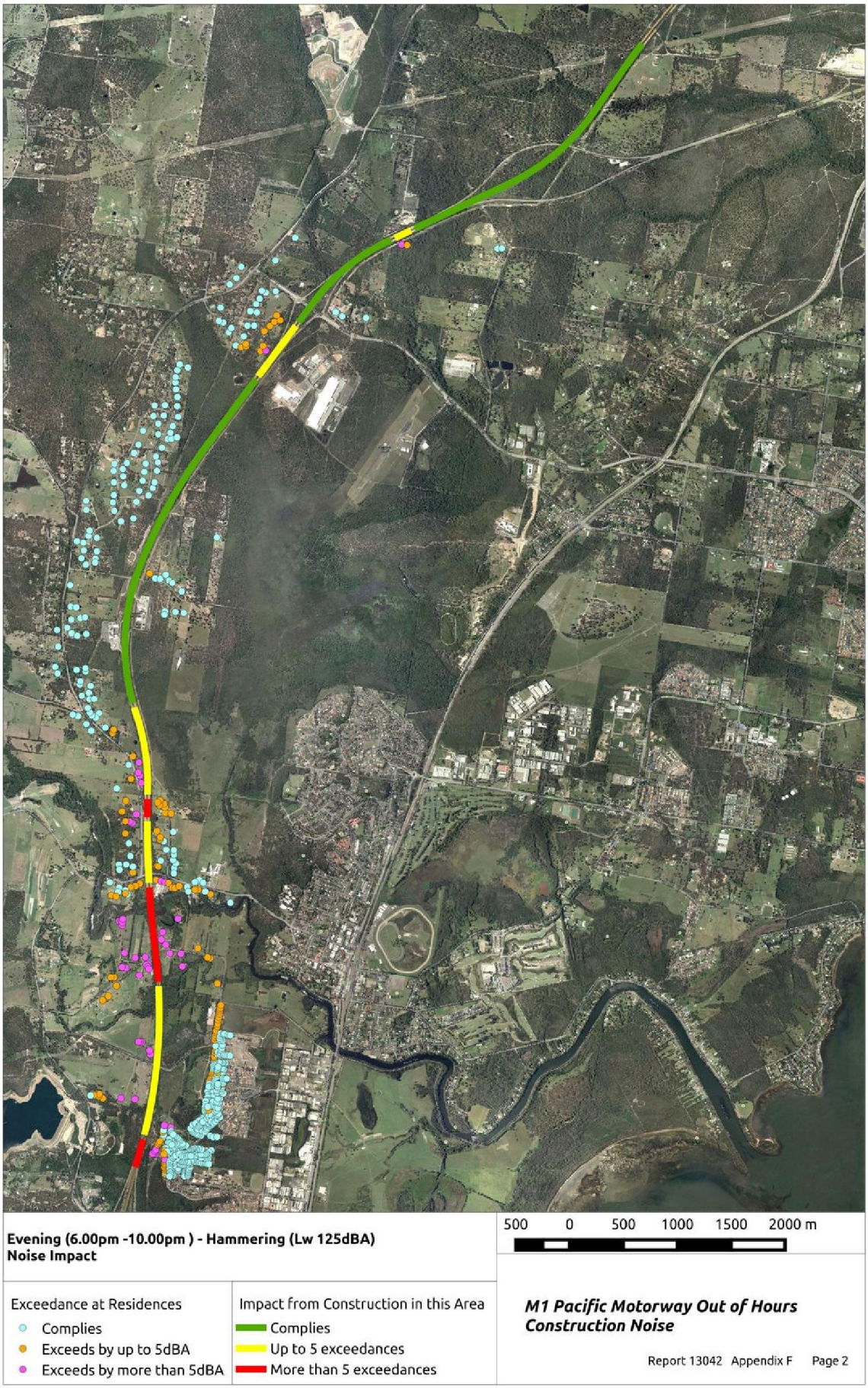
OUT-OF-HOURS CONSTRUCTION NOISE IMPACT

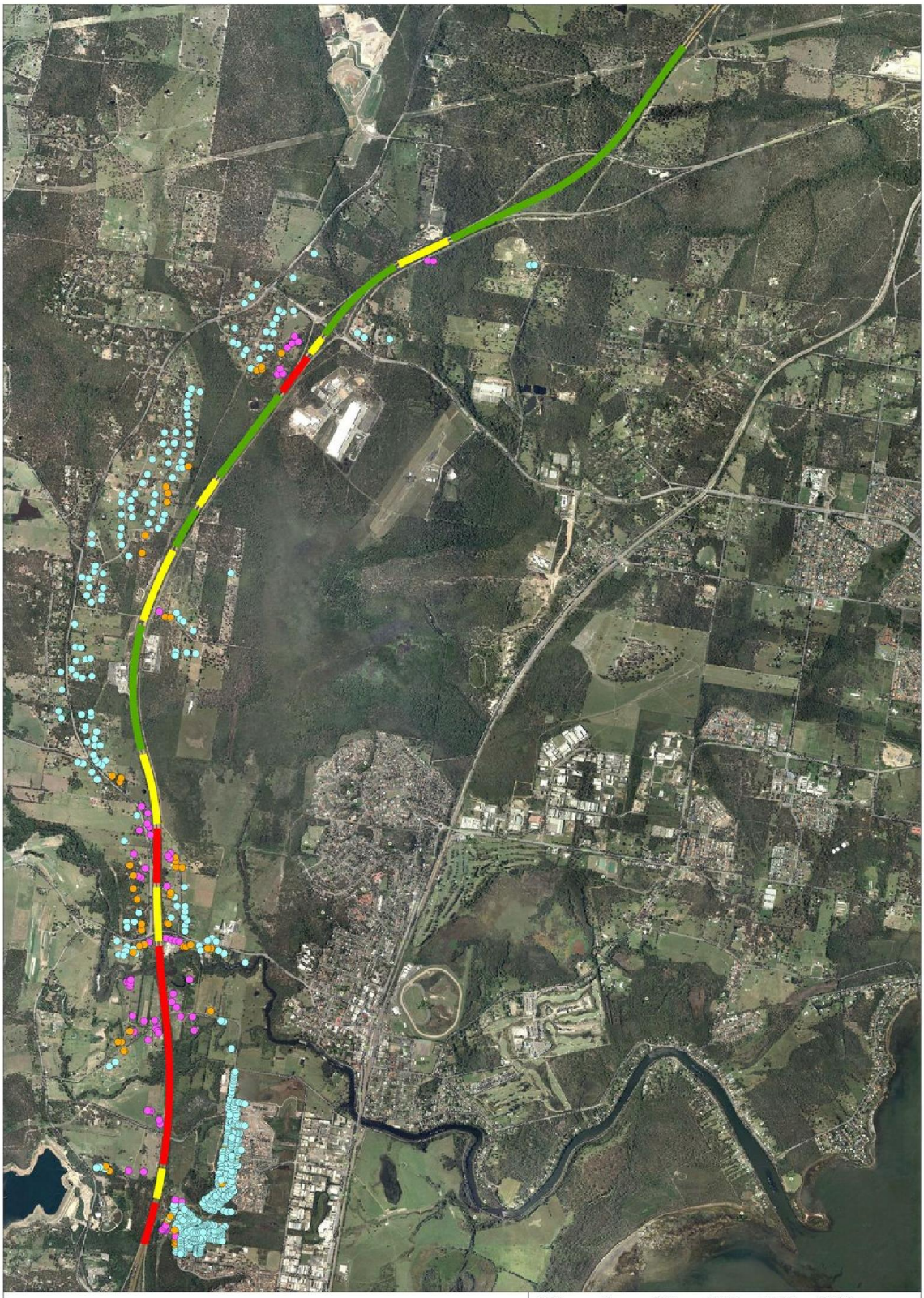
OUT—OF-HOURS CONSTRUCTION NOISE IMPACT

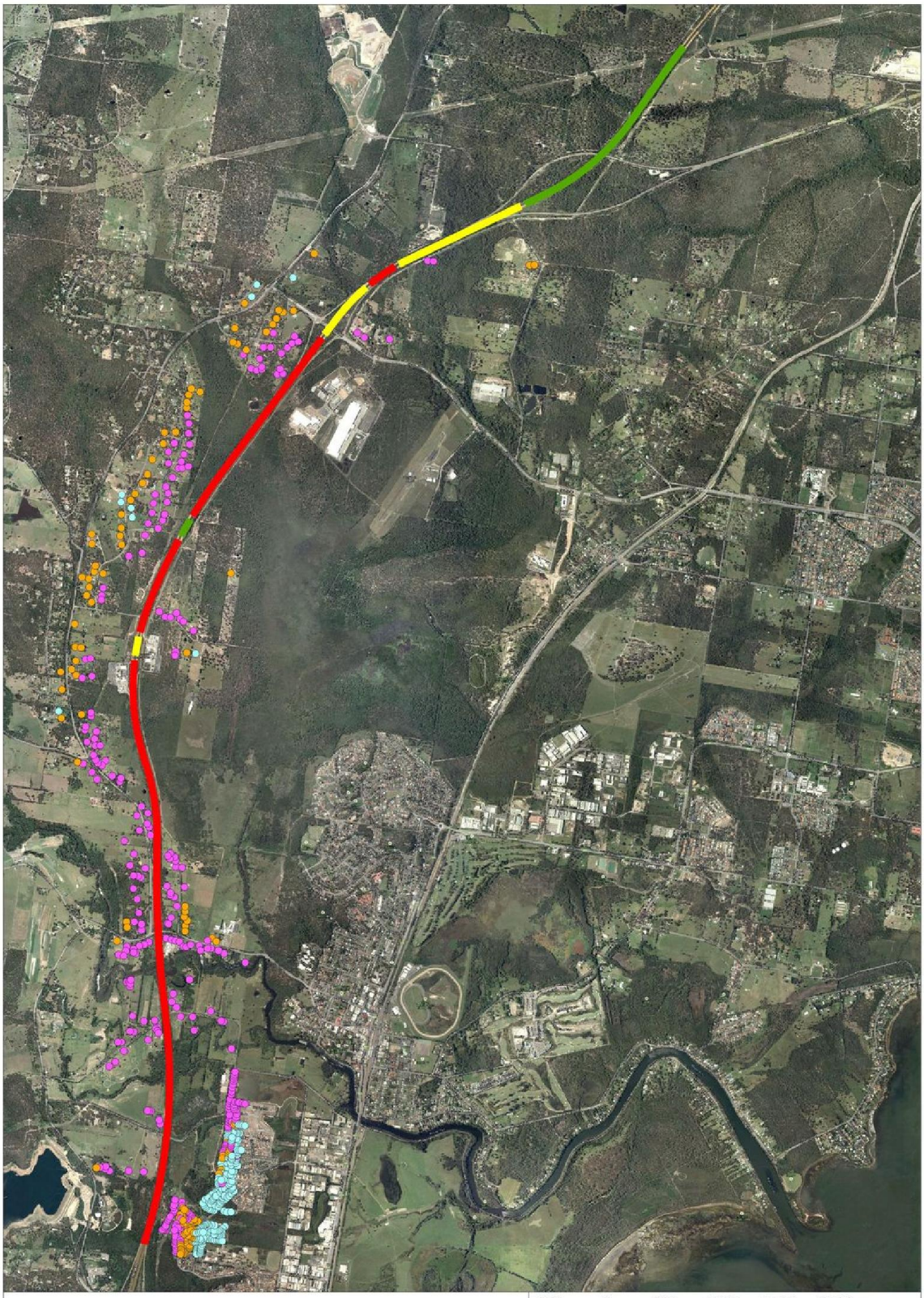
For out-of-hours works that could occur when noise emission is negligible or manageable, the work day has been broken into the following hours to allow maximum flexibility in scheduling:

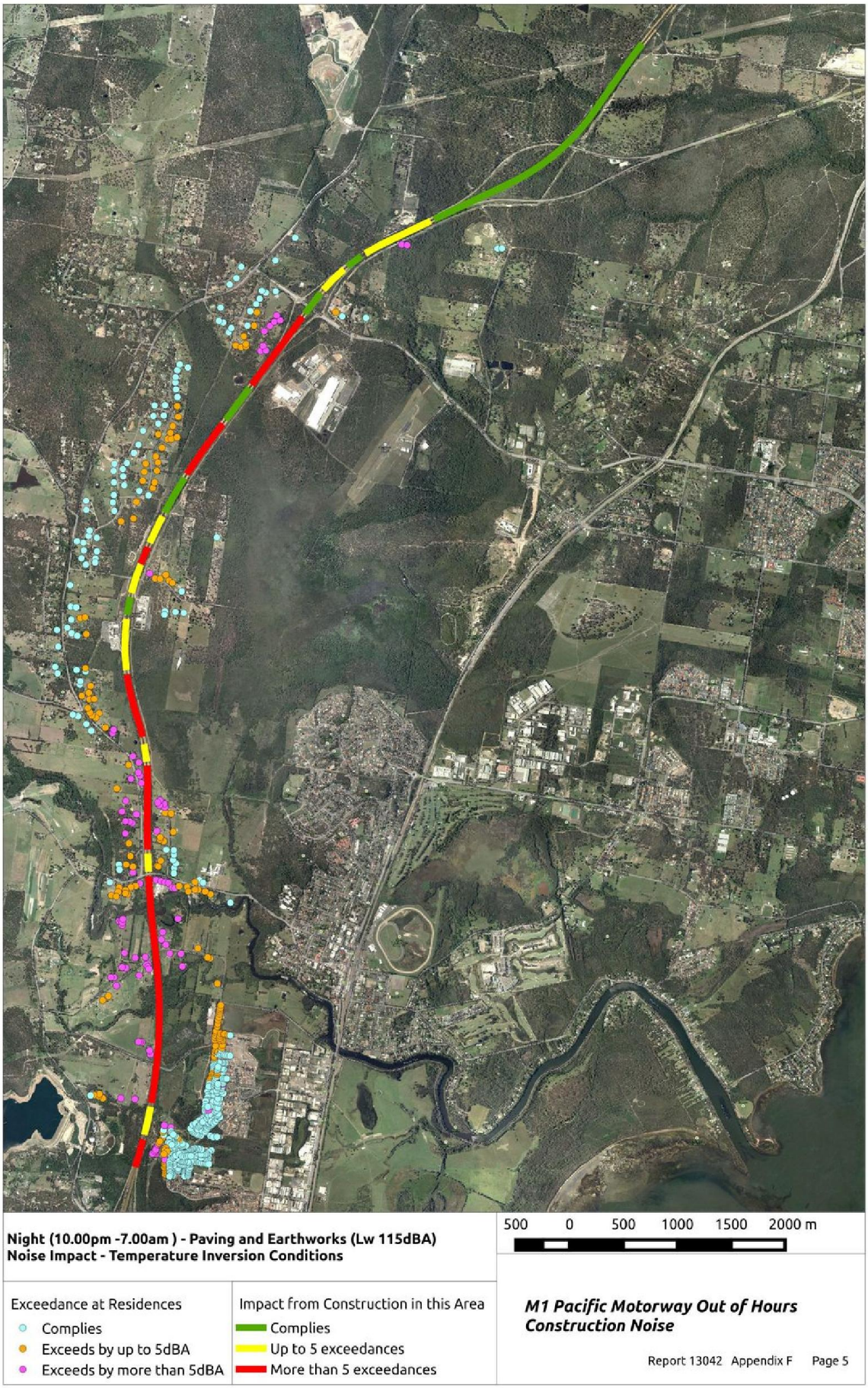
- Evening (6.00pm-10.00pm) – Pages 1 and 2;
- Night time (10.00pm-7.00am) – Pages 3 and 4 (Isothermal Conditions) and Pages 5 and 6 (Temperature Inversion Conditions);
- Early Morning (6.00am-7.00am) – Pages 7 and 8;
- Early Evening (6.00pm-8.00pm) – Pages 9 and 10.

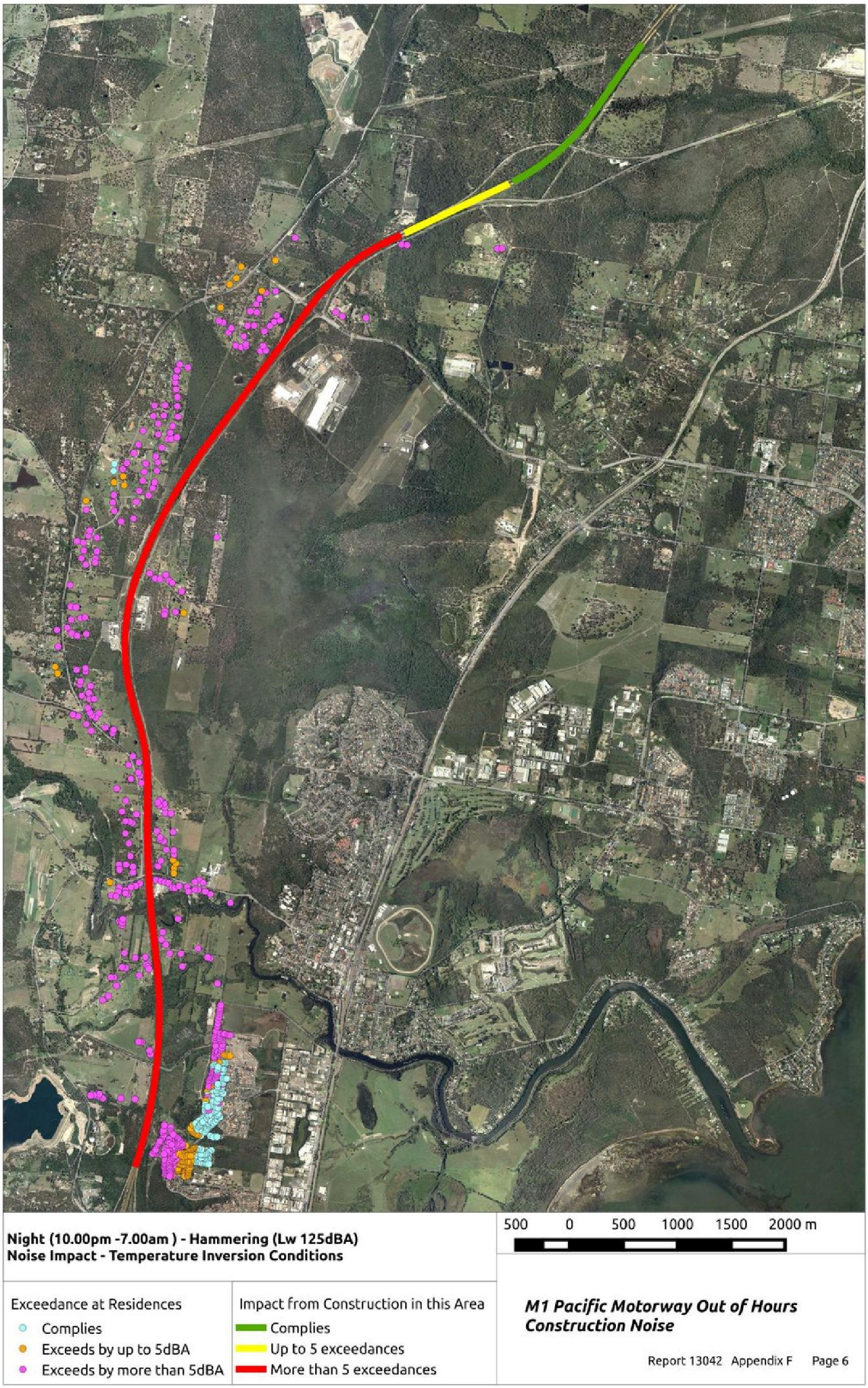

Evening (6.00pm -10.00pm) - Paving and Earthworks (Lw 115dBA)
Noise Impact
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 1

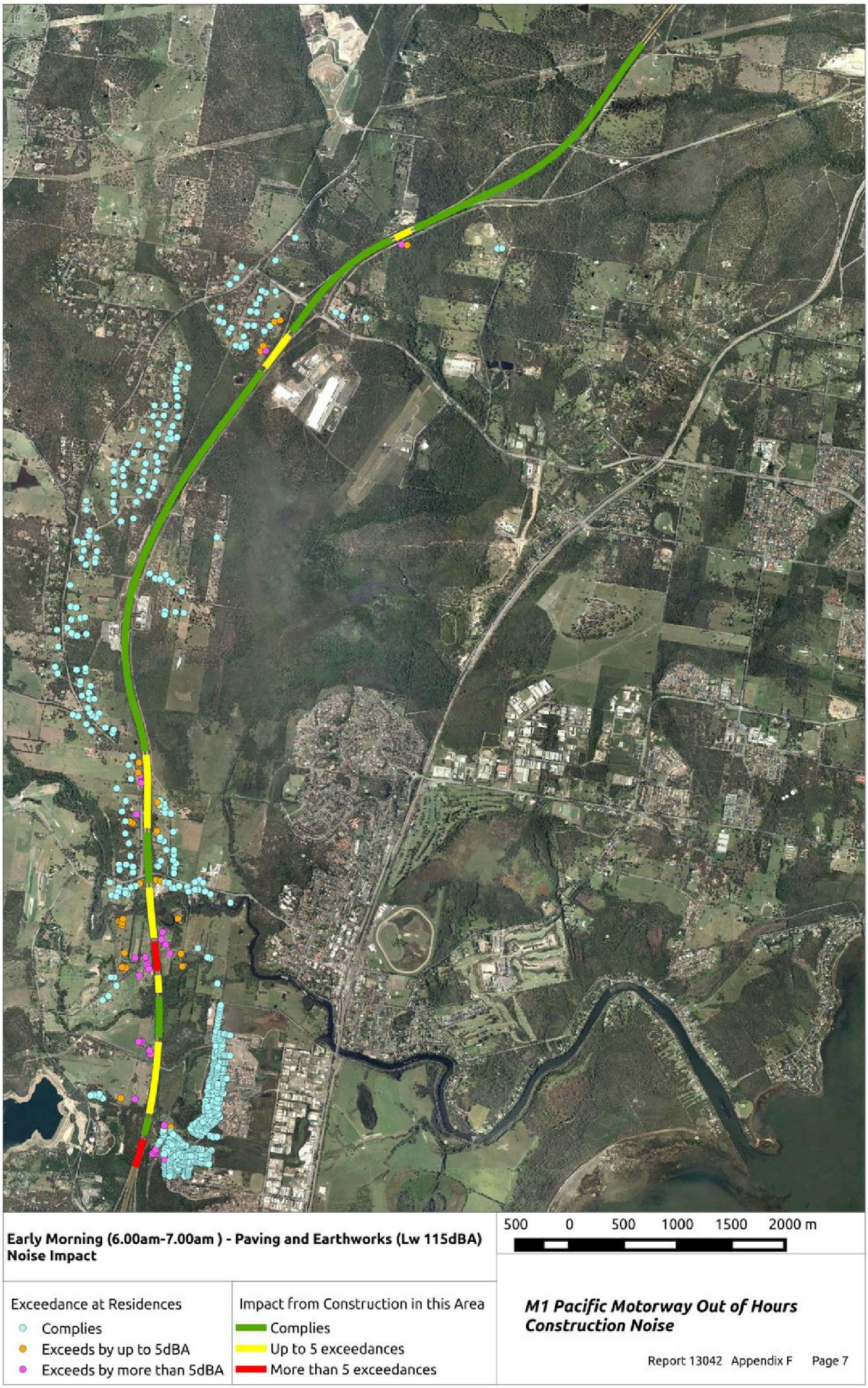

Evening (6.00pm -10.00pm) - Hammering (Lw 125dBA)
Noise Impact
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 2

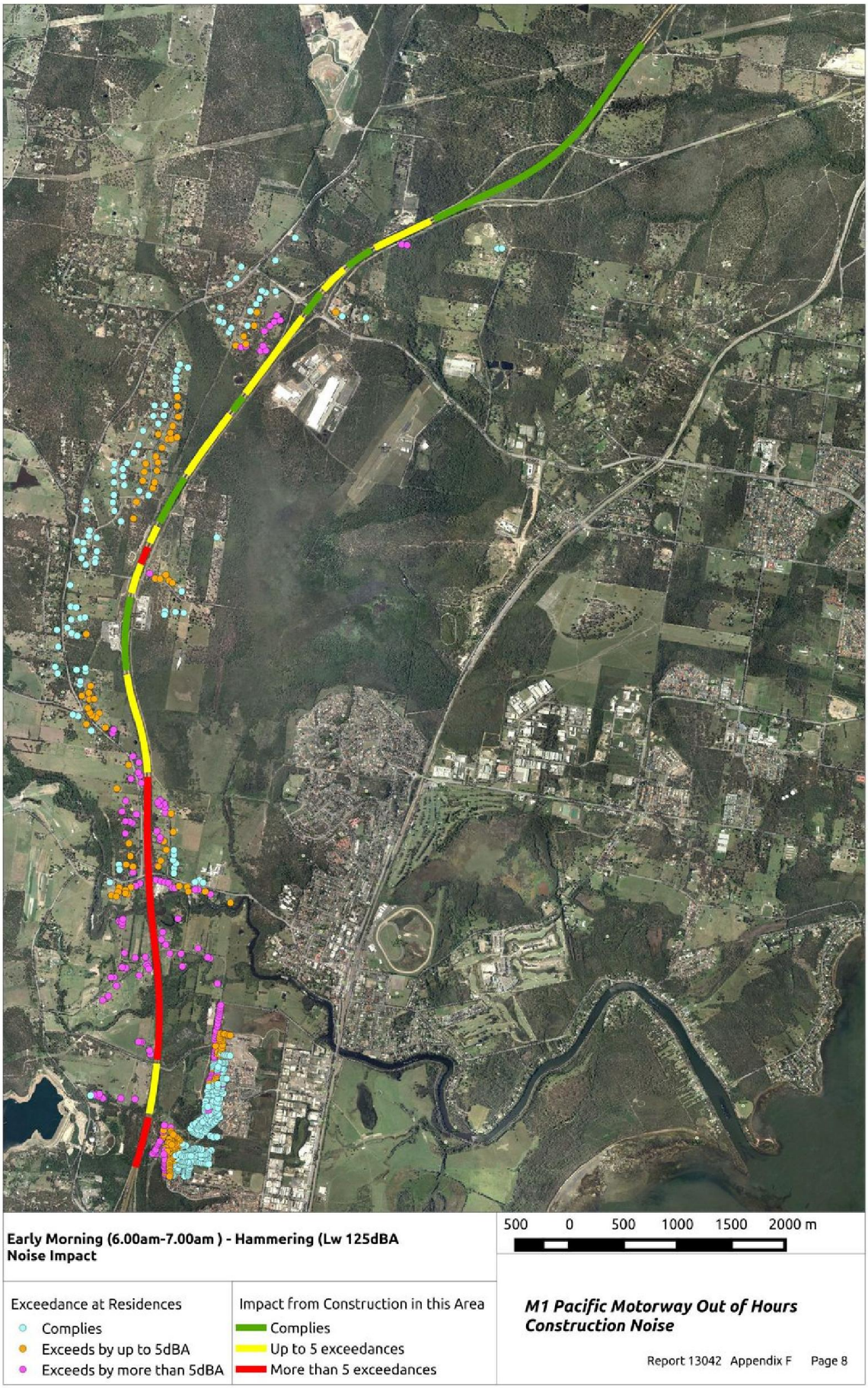

Night (10.00pm-7.00am)Paving and Earthworks (Lw 115dBA)
Noise Impact - Isothermal Conditions
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 3

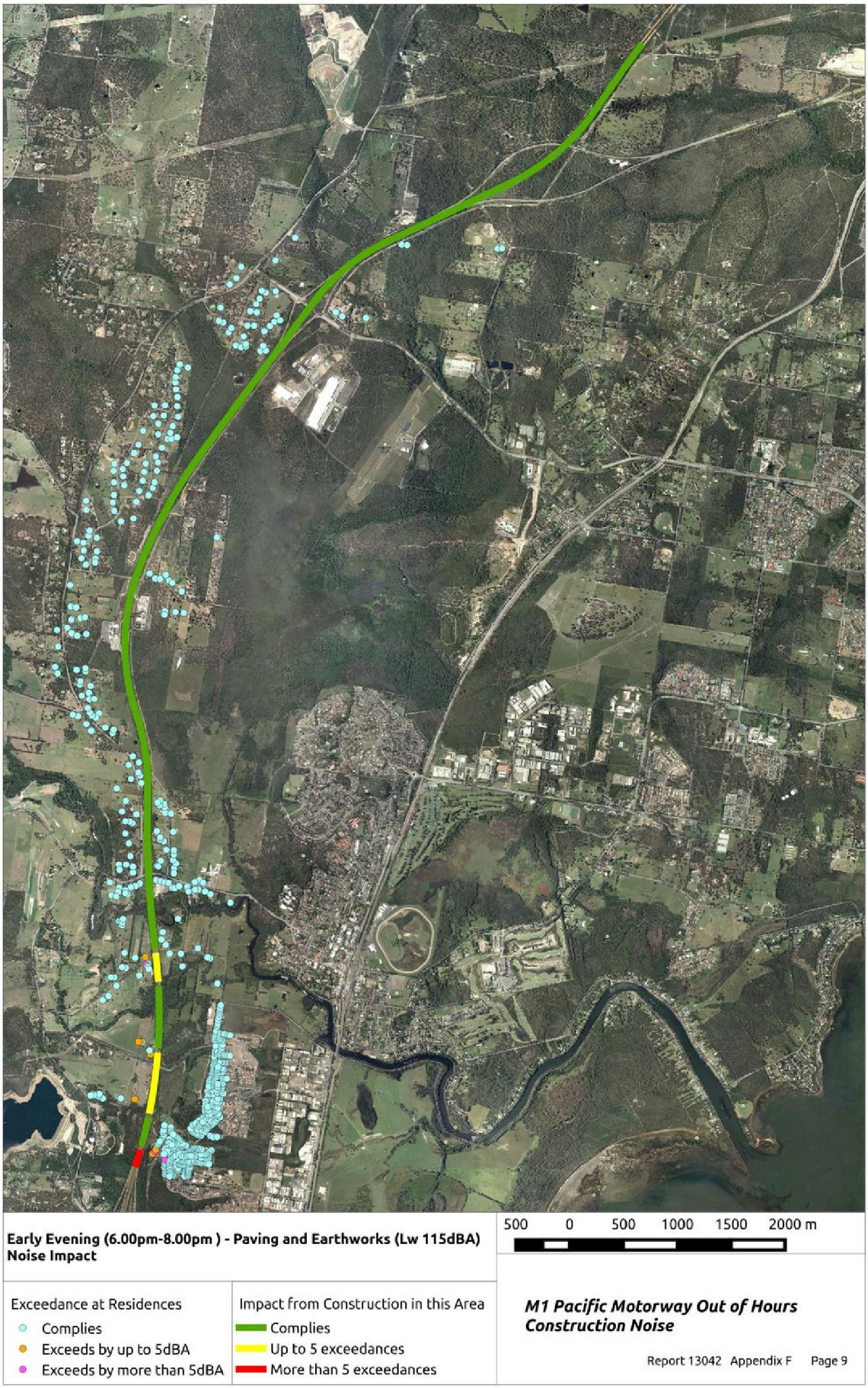

Night (10.00pm-7.00am) - Hammering (Lw 125dBA)
Noise Impact - Isothermal Conditions
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 4

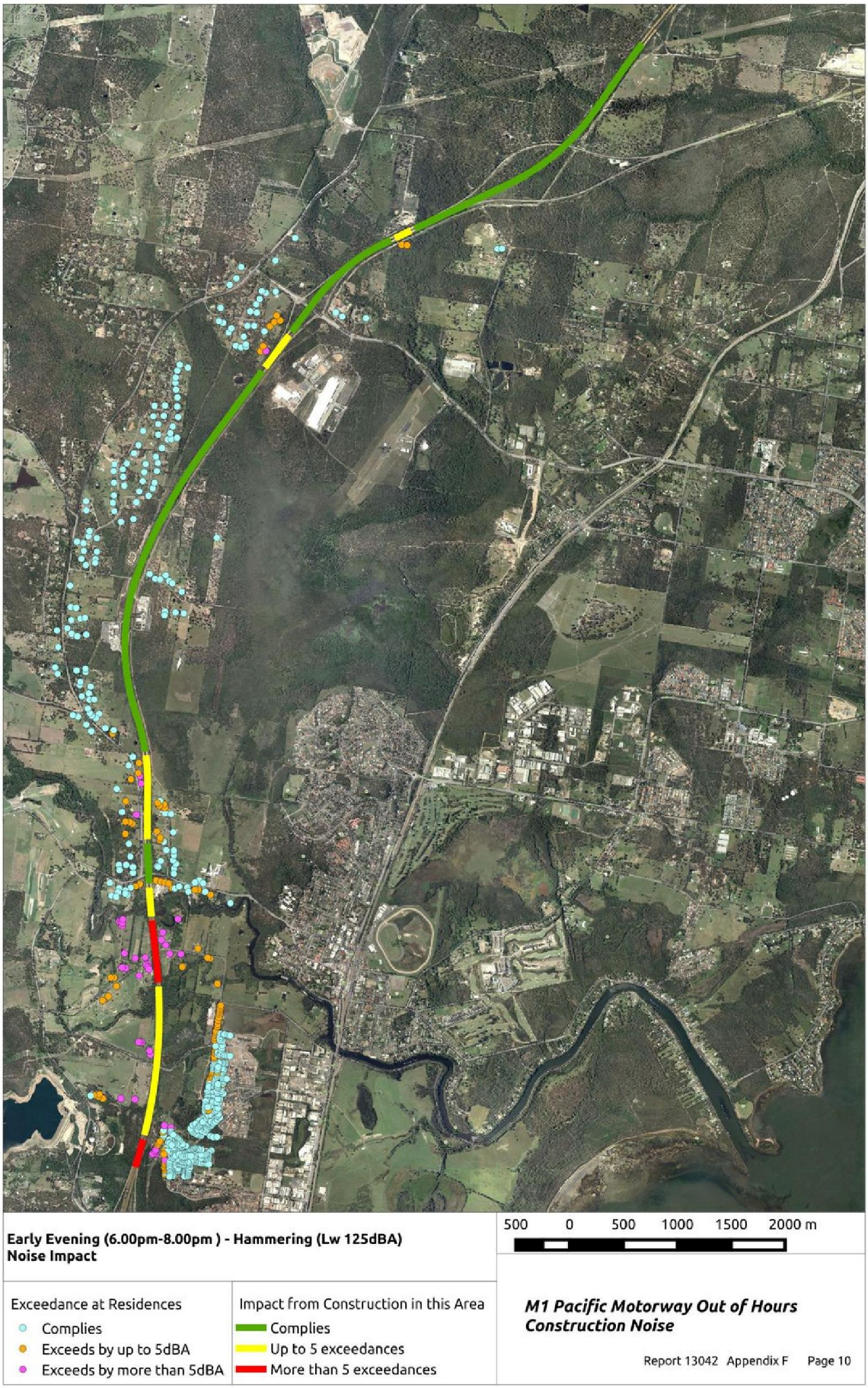

Night (10.00pm -7.00am) - Paving and Earthworks (Lw 115dBA)
Noise Impact - Temperature Inversion Conditions
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 5


Night (10.00pm -7.00am) - Hammering (Lw 125dBA)
Noise Impact - Temperature Inversion Conditions
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 6


Early Morning (6.00am-7.00am) - Paving and Earthworks (Lw 115dBA) Noise Impact
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 7


Early Morning (6.00am-7.00am) - Hammering (Lw 125dBA
Noise Impact
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours
Construction Noise
Report 13042 Appendix F Page 8


Early Evening (6.00pm-8.00pm) - Paving and Earthworks (Lw 115dBA) Noise Impact
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 9


Early Evening (6.00pm-8.00pm) - Hammering (Lw 125dBA)
Noise Impact
500 0 500 1000 1500 2000 m
Exceedance at Residences
Complies
Exceeds by up to 5dBA
Exceeds by more than 5dBA
Impact from Construction in this Area
Complies
Up to 5 exceedances
More than 5 exceedances
M1 Pacific Motorway Out of Hours Construction Noise
Report 13042 Appendix F Page 10