Lend Lease

Operational Noise Management Report

Final Design Documentation

PACIFIC HIGHWAY UPGRADE
NAMBUCCA HEADS TO URUNGA

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1.0 Introduction

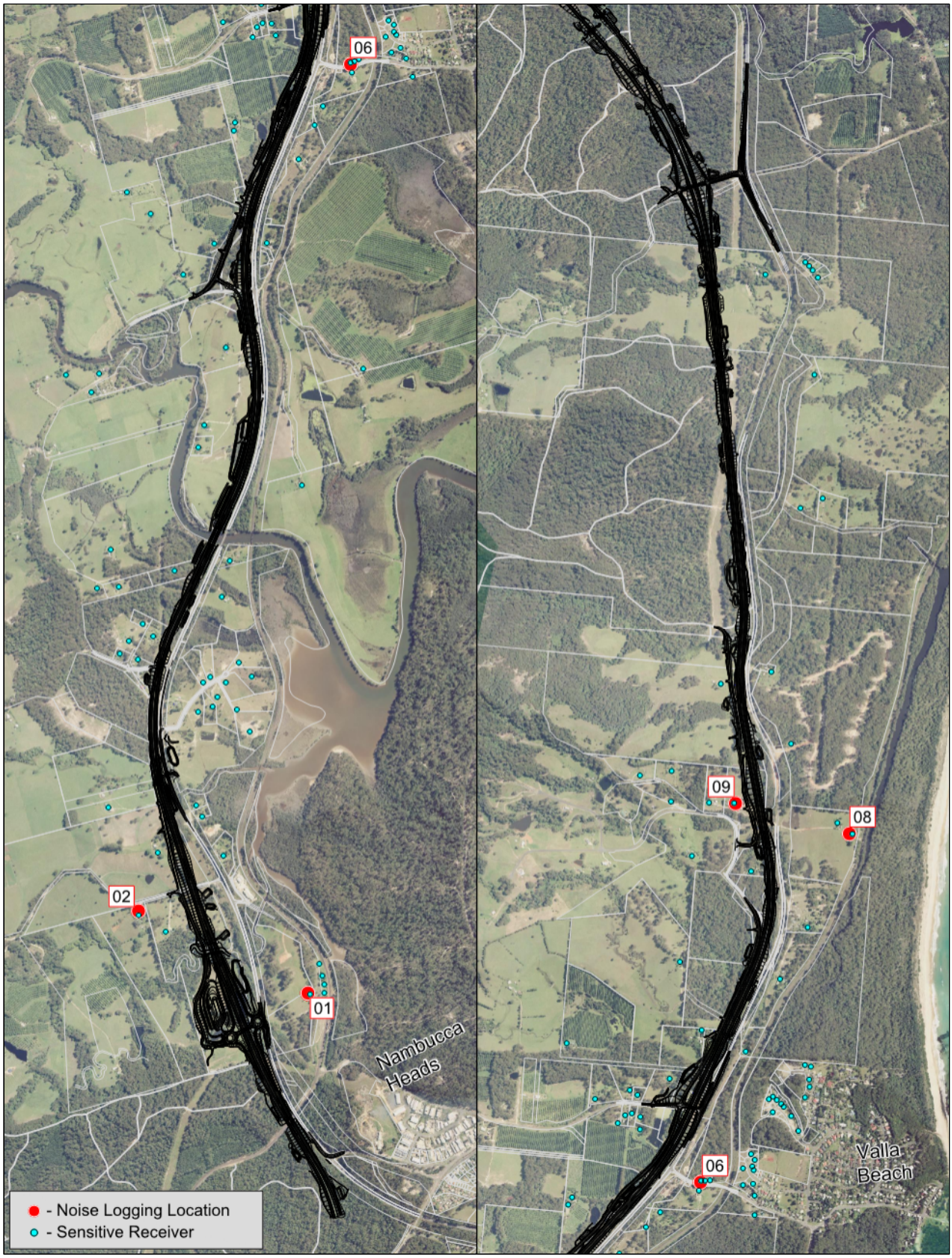
The Warrell Creek to Urunga highway upgrade received project approval in July 2011. The 42 km upgrade is to be delivered in two sections – Warrell Creek to Nambucca Heads and Nambucca Heads to Urunga.

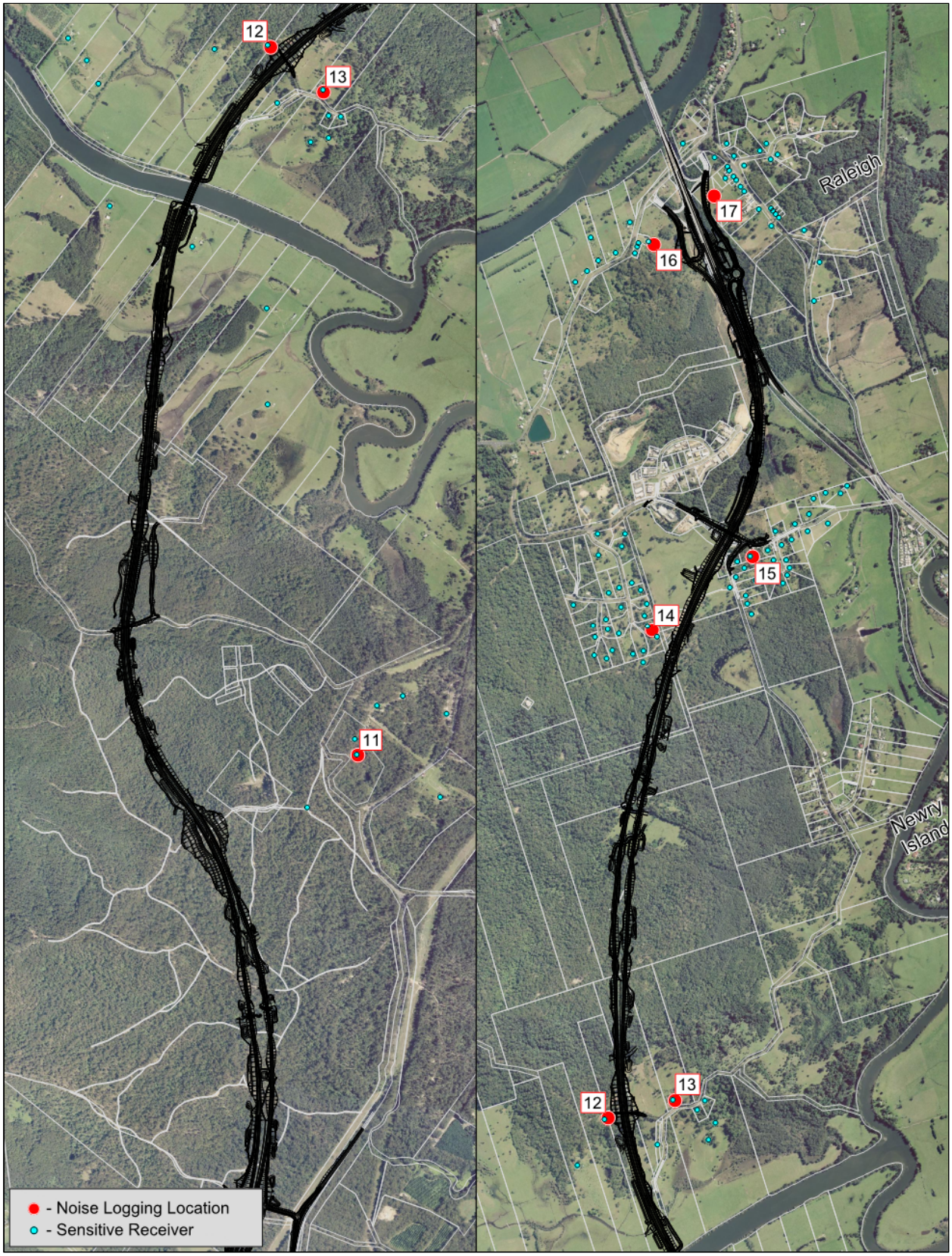
The Nambucca Heads to Urunga project (NH2U) comprises the construction of 22 km of new dual-carriageway highway including three grade separated interchanges at Nambucca Heads, Ballards Road and Waterfall Way. Major creek crossings at Deep Creek, Kalang River and the North Coast Railway also form significant parts of the project. The project will connect to the existing Pacific Highway at the Waterfall Way Interchange north of Urunga and near Link Road, west of Nambucca Heads. **Figure 1** illustrates the NH2U project area.

Development of the detailed design and construction of the project is being delivered through Lend Lease. Construction of the project commenced in 2013.

SLR Consulting Pty Ltd (SLR) has been commissioned by Lend Lease to provide a review of the operational noise mitigation measures for the detailed design of the project in accordance with Conditions 4.24 (Noise Mitigation) and 4.25 (Operational Noise Management Report) of the Scope of Works and Technical Criteria (SWTC) for the project.

Figure 1 NH2U Project Area





Note: Locations measured during previous noise logging surveys have been removed from the above data set. Therefore noise logging location numbers shown in **Figure 1** are not always consecutive.

2.0 Project Conditions of Approval

The Minister's Conditions of Approval (MCoA) for NH2U are mandatory requirements for the project. Condition 4.25 of the SWTC references condition C12 of the MCoA, which is provided below:

> ***C12. Operational Noise Mitigation Review***
>
> *Unless otherwise agreed to by the Director General, within six months of commencing construction, the Proponent shall in consultation with OEH prepare and submit for the approval of the Director General, a review of the operational noise mitigation measures proposed to be implemented for the project. The review shall:*
>
> *(a) confirm the operational noise predictions of the project based on detailed design. This operational noise assessment shall be based on an appropriately calibrated noise model (which has incorporated additional noise monitoring, where necessary for calibration purposes). The assessment shall specifically include verification of noise levels at Nambucca Heads Rest Area, based on additional noise monitoring undertaken at this location;*
>
> *(b) review the suitability of the operational noise mitigations measures identified in the documents listed under condition A1 to achieve the criteria outlined in the Environmental Criteria for Road Traffic Noise (EPA, 1999) and the Industrial noise Policy (EPA, 2000) in relation to the Nambucca Heads Rest Area, based on the operational noise performance of the project predicted under (a) above; and*
>
> *(c) where, necessary, investigate additional feasible and reasonable noise mitigation measures to achieve the criteria outlined in the Environmental Criteria for Road Traffic Noise (EPA, 1999) and the Industrial noise Policy (EPA, 2000) in relation to the Nambucca Heads Rest Area including the applicability of noise walls in the vicinity of River Road in Macksville.*

This report constitutes the required review addressing Condition of Approval C12.

3.0 Assessment Terminology

3.1 Noise and Vibration Terminology

A detailed description of the acoustic terminology used within this report is presented in **Appendix A**.

3.2 Operational Assessment Years

Throughout this Operational Noise Management Report, reference is made to two assessment situations: the Future Existing and the Future Design scenarios.

These are used to assess the noise impact of new and redeveloped road projects in accordance with the requirements of:

- *Environmental Criteria for Road Traffic Noise* (ECRTN) (NSW EPA, 1999)
- *Environmental Noise Management Manual* (ENMM) (RMS, 2001) -

The two ECRTN-related assessment years are described as follows: -

- The Future Existing scenario represents the 'baseline' scenario and is used to determine the level of road noise, in the absence of the NH2U Project, predicted at the year of opening of the proposed upgrade project. This scenario makes use of the road alignment in its existing geometry, with traffic volumes extrapolated to the project opening year by applying an incremental factor to measured existing flows.

  - The Future EXISTING year is 2016.

- The Future Design scenario represents the 'assessment' scenario for the NH2U and includes the proposed new alignment for the project, together with future traffic volumes predicted to 10 years after the scheduled project opening year.

  - The Future DESIGN year is 2026.

A third base line scenario was also modelled for the purposes of validating the SoundPLAN noise model developed for the project against the ambient noise survey data.

- The Model VALIDATION year is 2013.

4.0 Operational Noise Criteria

4.1 Environmental Criteria for Road Traffic Noise (ECRTN)

In May 1999, the NSW EPA issued the *Environmental Criteria for Road Traffic Noise* (ECRTN). This document provides guidance for assessing traffic noise impacts through setting design objectives for a range of development types and provides procedures for determining noise mitigation in situations where exceedances of the objectives occur.

The ECRTN embodies a non-mandatory performance-based approach. The proposed criteria are to be applied as targets, applicable to the future volumes of traffic projected to occur 10 years after project opening.

4.2 Environmental Noise Management Manual (ENMM)

The RMS's *Environmental Noise Management Manual* (ENMM) was issued in December 2001 and provides guidance in managing and controlling road traffic generated noise.

The ENMM recognises that the base criteria recommended by the ECRTN are not always practicable and that it is not always feasible or reasonable to expect that they should be achieved.

The ENMM notes that the most effective way of minimising noise from vehicles and traffic is to control vehicle noise at the source. Where source measures are not practical, or do not provide sufficient noise reduction, additional methods are required to reduce levels to within an acceptable range. Such additional methods may include the use of noise walls and/or consideration for architectural treatment of residences.

The ENMM also uses the term 'acute'. This refers to properties which are exposed to higher levels of road traffic generated noise (specifically at least 65 dBA LAeq(15hr) or 60 dBA LAeq(9hr)). In operational road traffic noise assessments, consideration for noise mitigation treatment is typically given to properties within the project area that experience acute levels of noise at the project design year even when there is no change in noise level due to the project.

4.3 Classification of the NH2U Project

The ENMM defines a 'new road traffic noise source' as being:

- A new road where a road of the same category (i.e. arterial, collector or local road) did not previously exist.
- A new road within an existing but previously undeveloped road corridor.
- An alignment or realignment producing noise at a receptor from a different direction which makes a 'significant contribution to noise exposure'[1].

To determine whether the noise contribution attributable to the new emission direction is 'significant', it is necessary to subtract the road traffic noise contribution generated from the existing alignment (after any road redevelopment or upgrade on this alignment) from the combined noise exposure. If the new noise emission direction is found to produce a 'significant' contribution, the new alignment or realignment is a new noise road traffic noise source.

When considering noise from a new direction, in instances where the most exposed facade of a residence does not have an existing road traffic noise exposure[2] then the 'new road' criteria are applicable.

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[1] A "significant contribution to road traffic noise exposure" from a road development or upgrading proposal is defined as an increase in road traffic noise at any exposed facade of more than 2 dB compared to the road traffic noise level from the existing road.

[2] A site is defined as having an "existing road traffic noise exposure" if the prevailing noise level from the existing road alignment(s) under consideration is equal to or greater than 55 dBA LAeq(15hr) or 50 dBA LAeq(9hr).

The ENMM notes that at locations where there is a transition between road development types (ie at the intersection of a new road or realignment with an existing or redeveloped road), it is necessary to assess each noise-sensitive receiver separately, facade by facade, relative to the road traffic noise source(s) under consideration and their noise contribution in order to determine whether the 'new road' or 'redeveloped road' criteria apply.

The result of this process is that different criteria can be applicable to different facades of the same residence, depending on their orientation to the existing and new sources of road traffic noise.

In situations where the existing ambient noise levels already exceed the baseline ECRTN criteria an 'allowance' criterion is applicable. For redeveloped roads this allowance criterion limits the noise increase from the project under consideration to no more than 2 dB. For a new road the allowance criterion is 0.5 dB. These allowances are however only applicable after all reasonable and feasible noise mitigation measures have been considered and implemented.

The applicable criteria for the NH2U project for residential receivers are provided in **Table 1**.

Table 1: ECRTN Daytime and Night-time Criteria for Residential Receivers

Type of Development	Criteria (dBA)		
	Daytime 7am to 10pm	Night time 10pm to 7am	Where Criteria are Already Exceeded
New freeway or arterial road corridor	LAeq(15hour) 55 dBA (external)	LAeq(9hour) 50 dBA (external)	The new road should be designed so as not to increase existing noise levels by more than 0.5 dBA.
Redevelopment of existing freeway / arterial road	LAeq(15hour) 60 dBA (external)	LAeq(9hour) 55 dBA (external)	In all cases, the redevelopment should be designed so as not to increase existing noise levels by more than 2.0 dBA.

4.4 Scope of Works and Technical Criteria (SWTC)

4.4.1 SWTC Assessment Requirements

Noise mitigation measures for the project are to be designed such that the noise outcomes meet or better the noise contours and sensitive receiver noise levels presented in Appendix 4 and Appendix 9 of the SWTC. Specifically, the following clauses from Appendix 4.24 - 'Noise Mitigation' of the SWTC are to be complied with:

4.24(e)(ii) - to maintain operational noise levels of 60 dB(A) / 55 dB(A) LAeq15hr (day) or less and 55 dB(A) / 50 dB (A) LAeq9hr (night) or less, for the years 2016 (at opening) and 2026 (ten years after opening) for redeveloped / new roads respectively as appropriate at the locations identified by the respective noise contour lines described in Figures 9.19 and 9.20 of Appendix 9 of the Scope of Works and Technical Criteria.

4.24(h)(i) - maintain operational day and night noise levels at noise-sensitive receiver locations for the year 2026 to no greater than those identified in the electronic file Appendix 4.6_RFT1.pdf, titled Noise Levels at Noise Sensitive Receivers; and

4.24(h)(ii) - comply with the NSW Government's ECRTN and ENMM for the year 2026 at all noise-sensitive receivers (where the term 'noise-sensitive receiver' is as defined in ENMM) including those that have been constructed or have been granted development approval by the relevant Authority under the provisions of the Environmental Protection Act 1979 prior to 29 January 2010.

4.24(h)(iii) - ensure that noise impacts do not result in additional at house treatments being required to those identified in Appendix 4.6_RFT1.pdf when assessed in accordnace [sic] with ECRTN and ENMM.

4.4.2 SWTC Noise Mitigation

Appendix 4.24 of the SWTC notes that at-residence noise mitigation treatments will be undertaken by RMS and that the Contractor must not undertake any at-residence treatments to address the operational noise mitigation requirements. The SWTC defines the RMS's and Contractor's responsibilities with regard to noise mitigation for the project in Appendix 4.24 - 'Noise Mitigation'. The relevant sections are reproduced below:

4.24(a) - RMS will consult with the owners of noise affected receivers and noise sensitive land uses, to determine, in consultation with the owners, the scope and extent of noise mitigation and treatments to be applied to residences.

4.24 (b) - The at-residence noise mitigation treatments will be undertaken by RMS. The Contractor must not undertake any at-residence treatments to address the operational noise mitigation requirements of the Environmental Documents.

4.24 (c) - The Contractor must comply with the operational noise mitigation requirements of the Environmental Documents using noise mitigation and treatments other than at-residence treatments.

4.24 (d) - Notwithstanding the requirements of Practice Note ii of ENMM noise mitigation measures are not required at commercial or industrial premises.

4.24 (e) - Further to any other requirements of the Environmental Documents and the Environmental Assessment in relation to noise mitigation measures, the Contractor must design and provide at-road operational noise mitigation measures:

(i) - notwithstanding and so as not to be constrained by any financial, costing, feasibility or other constraints on types of mitigation identified in the ENMM; and

(ii) - to maintain operational noise levels of 60 dB(A) / 55dB(A) LA eq 15hr (day) or less and 55dB(A) / 50dB (A) LAeq9hr (night) or less, for the years 2016 (at opening) and 2026 (ten years after opening) for redeveloped / new roads respectively as appropriate at the locations identified by the respective noise contour lines described in Figures 9.19 and 9.20 of Appendix 9 of the Scope of Works and Technical Criteria.

4.24 (f) - At-road operational noise mitigation measures must be contained within the Site, Local Road Works Corridors and existing road reserves.

5.0 Description of the Existing Environment

5.1 Ambient Noise Surveys and Monitoring Locations

In order to characterise the existing ambient noise environment across the project area, environmental noise monitoring was performed at twelve representative locations during March 2013.

These locations, as indicated in **Figure 1** and on the site plan in **Appendix B**, were selected giving consideration to other noise sources in the area which may adversely influence the measurements, security issues for the noise monitoring devices and gaining permission for access from the resident or landowner.

5.2 Methodology for Unattended Noise Monitoring

The purpose of the unattended noise monitoring is to determine the existing LAeq, LA90 and other relevant statistical noise levels during the daytime, evening and night-time periods.

Unattended noise loggers were deployed adjacent to sensitive receivers over a minimum period of one week in order to measure the prevailing levels of ambient noise. The measurements were generally conducted at a height of 1.5 m above the local ground level.

All noise measurement instrumentation used in the surveys was designed to comply with the requirements of Australian Standard *AS IEC 61672.12004 Electroacoustics – Sound level meters, Part 1: Specifications* and carried appropriate and current NATA calibration certificates.

The equipment utilised for the continuous unattended noise surveys comprised of Svantek Type 957 noise loggers. All noise loggers were fitted with microphone wind shields. The calibration of the loggers was checked before and after each measurement survey, and the variation in calibration at all locations was found to be within acceptable limits at all times. All noise loggers were set to record statistical noise descriptors in continuous 15 minute sampling periods for the duration of their deployment.

The results of the noise monitoring have been processed with reference to the procedures contained in the NSW EPA Industrial Noise Policy (INP) and ECRTN so as to establish representative sensitive receiver noise levels.

Weather data recorded during the noise monitoring survey periods by the Bureau of Meteorology (at Coffs Harbour) was used to assist in identifying potentially adverse weather conditions, such as excessively windy or rainy periods, so that weather affected data could be discarded..

The ECRTN notes that noise levels attributable to sources other than road traffic should be discarded from the noise logging data. Therefore in order for the measured data to reflect the prevailing levels of road traffic noise, the data was also processed to remove uncharacteristic changes in noise which are not related to road traffic noise.

5.3 Unattended Noise Monitoring Results

The results of the unattended ambient noise surveys are presented in **Table 2** and **Table 3**, with the 24 hour noise level plots for each monitoring location being shown graphically in **Appendix C**.

Representative Rating Background Levels (RBLs) and LAeq (energy averaged) noise levels during the standard INP defined daytime, evening and night-time hours are shown in **Table 3**, together with the ECRTN defined daytime LAeq(15hour) and night-time LAeq(9hour) noise indices.

Table 2: Summary of Noise Logging Locations

Loc.[1]	Address	Nearest Source of Significant Road Traffic Noise	
		Approx. Distance (m)	Road
1	70 Foxes Road, Nambucca	235	Existing Pacific Highway
2	47 Boggy Creek Road, Valla	450	Existing Pacific Highway
6	7 Valla Beach Road, Valla	5	Valla Beach Road
8	7440 Pacific Highway, Valla	355	Existing Pacific Highway
9	7443 Pacific Highway, Valla	220	Existing Pacific Highway
11	1316 Martells Road, Urunga	250	Existing Pacific Highway
12	358 South Arm Road, Urunga	>2000	Existing Pacific Highway
13	354 South Arm Road, Urunga	>2000	Existing Pacific Highway
14	17 Ridgewood Drive, Raleigh	580	Short Cut Road
15	79 Short Cut Road, Urunga	60	Short Cut Road
16	63 Waterfall Way, Raleigh	100	Waterfall Way
17	100 Old Pacific Highway, Raleigh	130	Existing Pacific Highway

Note 1: Several noise monitoring locations were removed from the data set due to data already being measured during previously undertaken surveys.

Table 3: Summary of Unattended Noise Logging – INP and ECRTN Periods

Loc.	Noise Level (dBA)[1]							
	INP Periods						ECRTN Periods	
	RBL			LAeq			LAeq	
	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night time (6pm to 7am)	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night time (6pm to 7am)	Daytime LAeq(15hour) (7am to 10pm)	Night time LAeq(9hour) (10pm to 7am)
1	35	38	37	46	47	46	47	46
2	38	39	36	48	47	45	47	45
6	42	42	39	63	58	56	63	54
8	40	42	43	51	51	53	51	52
9	45	45	40	53	54	51	53	51
11	42	44	40	51	52	49	51	49
12	27[2]	33	34	41	49	51	45[3]	51[3]
13	30	35	39	45	44	47	44[3]	47[3]
14	35	37	34	47	46	41	47[3]	41[3]
15	36	38	33	49	46	42	48	42

Loc.	Noise Level (dBA)[1]							
	INP Periods						ECRTN Periods	
	RBL			LAeq			LAeq	
	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night time (6pm to 7am)	Daytime (7am to 6pm)	Evening (6pm to 10pm)	Night time (6pm to 7am)	Daytime LAeq(15hour) (7am to 10pm)	Night time LAeq(9hour) (10pm to 7am)
16	44	41	35	52	52	49	52	49
17	47	45	38	54	57	53	55	52

Note 1: The RBL and LAeq noise levels have been obtained using the calculation procedures documented in the INP. -

Note 2: The INP requires that where the RBL is found to be less than 30 dBA, then it is set to 30 dBA. -

Note 3: Reference to the noise logging data indicates that the prevailing LAeq noise level is dominated by typical rural environmental - sources of ambient noise and not traffic noise.

5.4 Attended Airborne Noise Measurements

Attended noise measurements were undertaken at the noise logger locations listed in **Table 2** and illustrated in **Figure 1** in order to quantify the relative contributions from the various noise sources in the vicinity of the unattended noise monitoring locations.

At each location, measurements were performed using a Brüel & Kjær Type 2260 sound level meter for a minimum period of 15 minutes. Calibration of the sound level meter was checked before and after each measurement and the variation in calibration at all locations was found to be within acceptable limits at all times.

During each of the attended noise measurements the observer noted the various noise sources and levels influencing the ambient noise environment. A summary of the measured noise levels and observations is provided in **Appendix C**.

6.0 Road Traffic Noise Assessment Methodology

In developing the NH2U noise model, Appendices 4 and 9 of the SWTC provide details relating to the computer noise modelling requirements, including traffic volumes, speeds, calculation methods and minimum mitigation measures (including areas of low noise pavements). These assumptions and the extent of the proposed mitigation measures are documented in the following sections.

6.1 SoundPLAN and CORTN Modelling Parameters

A three-dimensional computer noise model was developed as part of the Operation Noise Assessment for the project. Noise modelling of the project area was carried out using the UK Department of Transport, *Calculation of Road Traffic Noise* (CORTN 1988) algorithms incorporated in SoundPLAN V7.1 noise software.

The modelling allows for traffic volume and mix, type of road surface, vehicle speed, road gradient, reflections off building surfaces, ground absorption and shielding from ground topography and other physical barriers.

The SoundPLAN noise model calculates noise levels at receiver points for each facade of each noise sensitive receiver over the entire project area. The daytime LAeq(15hour) and night-time LAeq(9hour) noise emission levels at noise sensitive receivers were computed for the entire project area.

6.1.1 Design Inputs

The various noise modelling design inputs and assumptions which have been used in this assessment are detailed in **Table 4**. These corrections are consistent with those specified in the SWTC for the project.

Table 4: Design Inputs and Assumptions

Input / Assumption	Description	
Noise Modelling Scenarios		
Year 2016 (at opening) and Year 2026 (plus ten years)	LAeq(15hour) daytime (7.00 am to 10.00 pm) and LAeq(9hour) night-time (10.00 pm to 7.00 am) Consistent with the requirements of ECRTN, ENMM and SWTC.	
Acoustic Parameters		
Noise source heights: Cars: Heavy vehicle Tyres: Engines: Exhausts:	 0.5 m / 0 dB 0.5 m / -5.4 dB 1.5 m / -2.4 dB 3.6 m / -8.5 dB	A three source height noise model has been used. The various heights are representative of Australian conditions. The three heights are as per the requirements of clause 4.24(g) (iii) of the SWTC.
Pavement corrections: Concrete: Dense graded asphalt: Stone mastic asphalt:	 +3.0 dB +0.0 dB -2.0 dB	As per requirements of clause 4.24(g) (iv) of the SWTC.
Minimum receiver height: Ground: First:	 1.5 m 4.5 m	As per requirements of clause 4.24(g) (v) of the SWTC.
Ground Absorption: Standard: Bushland: Water:	 50 % 100 % 0 %	As per requirements of clause 4.24(g) (vi) of the SWTC.

Input / Assumption	Description	
Noise Contour Calculations: Max. Search Radius: Grid Space: Height above ground:	 3000 m 20 m 1.5 m	As per requirements of clause 4.24(g) (vii) and (viii) of the SWTC.
Calibration: Daytime: Night-time: Risk Allowance: Daytime: Night-time:	 -0.9 dB -0.3 dB +1.5 dB +1.5 dB	The validation of the existing noise model with March 2013 data (ie monitored noise levels minus modelled noise levels) shows a general trend of the noise model being slightly conservative, with average over-predictions of 0.9 dB and 0.3 dB for the daytime and night-time periods, respectively. A minimum risk allowance of at least one standard deviation of the data set must also be applied. A risk allowance of +1.5 dB has been applied for both the daytime and night-time period. The above adjustments are a requirement of clause 4.24(g) (ix) and (x) of the SWTC.
Facade corrections: Reflections: ARRB:	 +2.5 dB -1.7 dB	Facade corrections, due to both reflections and adjustments to the model to account for Australian conditions, are required to be added to the noise level predictions for single point receiver calculations, at 1m from facade conditions, as per clause 4.24(g) (xi) of the SWTC.
At-Road Operational Noise Mitigation Measures		
Low noise pavements: Main carriageways/ramps:	 66.970 km to 68.670 km 80.690 km to 82.890 km	As per requirements of clause 4.24 (i) of the SWTC. For these areas, the pavement corrections for stone mastic asphalt (SMA) in clause 4.24(g) (iv) of the SWTC have been applied.
Noise Barriers	Nil	There are no noise barriers on the project. This is consistent with the findings of the EA.
Additional Noise Mitigation Measures		
Nil		
Road, Road Surface, Topography		
Road Alignment	Road carriageway alignment for main highway, ramps and intersections as provided by the Contractor.	
Road Surface	For areas where a low noise pavement is required as part of the SWTC a SMA road surface has been applied. For other areas on the main carriageways, a concrete pavement type has been applied. For all local roads and service roads, a dense graded asphalt road surface has been assumed in the noise modelling except for the section of Ballards Road to the west of the project site compound, which has been assumed to be unsealed (with a surface correction equivalent to concrete).	
Bridge Joints	The bridge joints nominated in the designs minimise the likelihood of impulsive noise events from vehicles passing over them. This is provided that all joints are installed correctly. Previous noise measurements in the vicinity of bridge joints confirm that correctly installed joints are not likely to significantly influence the nearby noise environment.	
Ground Contours	All ground contours used in the modelling are as supplied by the Contractor.	

Input / Assumption	Description	
Traffic and Speeds		
Traffic Volumes	Traffic volumes for Year 2016 (at opening) are as per the requirements of Appendix 9 Table 9.9 and Appendix 4.24 (g) (ii) of the SWTC. Traffic volumes for Year 2026 (ten years after opening) are as per the requirements of Appendix 9 Table 9.10 and Appendix 4.24 (g) (ii) of the SWTC.	
Traffic Speeds: Main-line daytime: Main-line night-time: Local roads, service roads and ramps:	 115km/h 120km/h 60 km/h local roads 90 km/h service road	Traffic speeds for 2016 (at opening) and 2026 (ten years after opening) as per the requirements of clause 4.24(g) (i) and Appendix 9 of the SWTC. A speed of 80 km/h has been assumed for all ramps.
Noise Limiting Contours		
Provided by RMS: 2016 – Figure 9.19 2026 – Figure 9.20	The RMS Noise Limiting Contours have been used as the basis for the assessment.	

6.1.2 Assessment Criteria

Existing noise levels were predicted at each facade of every dwelling within the project area. The appropriate criterion (ie 'new' or 'redeveloped') was determined on a facade by facade basis, with reference to Practice Note (i) of the ENMM.

6.2 Traffic Volumes – Vehicle Types and Vehicle Speed

2013 Base Year Traffic Figures (Validation Model)

For the 2013 Validation Scenario, the traffic volumes and speeds along the various sections of the existing pacific highway and surrounding road network were derived from traffic counts conducted in conjunction with the baseline ambient monitoring described in **Section 5.0**. These figures, as used in the noise model validation process, are summarised in **Table 5**.

Table 5: 2013 Base Traffic Volumes for Existing Roads – Week 1

Site	Location	Period	Traffic Data					
			Light	Heavy	Speed (km/h)[1]			
					NB or EB		SB or WB	
					Ave.	85%ile	Ave.	85%ile
1	Pacific Highway - 600m South of Railway Road	7:00 - 22:00	10159	1654	96	103	93	100
		22:00 - 7:00	785	696	100	106	95	102
2	Valla Beach Road - 400m East of Pacific Highway	7:00 - 22:00	2503	132	55	61	59	65
		22:00 - 7:00	126	13	56	62	61	68
3	East West Road - 100m West of Pacific Highway	7:00 - 22:00	586	31	65	74	55	62
		22:00 - 7:00	37	2	67	74	57	n/a
4	Pacific Highway - 400m South of Wenonah Close	7:00 - 22:00	8968	1583	82	87	81	87
		22:00 - 7:00	772	658	84	89	84	89
5	Short Cut Road - 150m West of Pacific Highway	7:00 - 22:00	2285	199	65	73	62	70
		22:00 - 7:00	157	19	65	72	61	69
6	Pacific Highway - 800m North of Short Cut Road	7:00 - 22:00	10390	1553	81	86	80	85
		22:00 - 7:00	992	634	84	91	84	91
7a	SB OFF Ramp to Raleigh Road - 50m South of Raleigh Road	7:00 - 22:00	1726	130	-	-	47	53
		22:00 - 7:00	99	15	-	-	47	51
7b	SB ON Ramp from Raleigh Road - 50m South of Raleigh Road	7:00 - 22:00	455	62	-	-	46	52
		22:00 - 7:00	19	9	-	-	45	53
8a	NB OFF Ramp to Waterfall Way - 50m South of Waterfall Way	7:00 - 22:00	568	70	64	72	-	-
		22:00 - 7:00	32	7	64	75	-	-
8b	NB ON Ramp from Waterfall Way - 50m South of Waterfall Way	7:00 - 22:00	1735	111	48	54	-	-
		22:00 - 7:00	130	10	50	55	-	-
9	Waterfall Way - 400m West of Roundabout	7:00 - 22:00	4203	366	65	73	67	74
		22:00 - 7:00	257	42	71	80	70	76
10	Old Pacific Highway - 100m North of Raleigh Road	7:00 - 22:00	1382	137	57	65	61	70
		22:00 - 7:00	87	16	58	66	63	71

Note 1: The measured average speed has been used in the noise modelling

2016 Future Existing Traffic Figures

The 2016 Future Existing traffic data for the NH2U project have been provided by RMS and are detailed in **Table 6**. The Future Existing is the scenario which represents the no-build situation at project opening.

Table 6: 2016 Future Existing Traffic Volumes

Location	Direction	Northbound			
		Daytime (15hour)		Night time (9hour)	
		Light	Heavy	Light	Heavy
Existing Pacific Highway					
South of Valla Rd NB	NB	4660	680	650	480
	SB	5190	680	730	480
Valla Road to Valla Beach Rd	NB	4620	670	650	480
	SB	5140	680	720	490
Valla Beach Rd to East West Rd	NB	4530	650	640	460
	SB	5060	690	710	500
East West Rd to Hungry Head Rd	NB	4500	640	630	460
	SB	5030	700	710	500
Hungry Head Rd to Short Cut Rd	NB	7560	690	1060	490
	SB	6150	570	860	400
Short Cut Rd to Raleigh Interchange	NB	6730	680	940	490
	SB	5510	550	770	390
North of Raleigh Interchange	NB	6900	700	970	500
	SB	5580	580	780	420
Local Roads					
Valla Road	Two-way	1630	120	230	80
Valla Beach Road	Two-way	2830	200	400	140
East West Road	Two-way	720	50	100	40
Ballards Road	Two-way	NA	NA	NA	NA
Hungry Head Road	Two-way	NA	NA	NA	NA
Short Cut Road	Two-way	1470	30	210	20
Waterfall Way	Two-way	5870	120	820	90
Raleigh Interchange					
Northbound Off-ramp	One-way	1180	10	170	10
Northbound On-ramp	One-way	1340	30	190	20
Southbound Off-ramp	One-way	980	50	140	40
Southbound On-ramp	One-way	920	20	130	10

2016 Opening and 2026 Future Design Traffic Figures

The projected traffic data taken from Table 9.9 and Table 9.10 of the SWTC are detailed in **Table 7**. -

Table 7: 2016 and 2026 Future Traffic Volumes

Location	Year 2016 (Opening)				Year 2026 (Future Design)			
	Daytime (15hour)		Night time (9hour)		Daytime (15hour)		Night time (9hour)	
	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy
Main Carriageway								
North of Nambucca Heads Interchange	8580	1440	1200	1030	10100	1750	1420	1250
North of Ballards Road Interchange	7340	1310	1030	930	9060	1620	1270	1150
Nambucca Heads Interchange								
Northbound On Ramp	1130	100	160	70	1330	130	190	100
Northbound Off Ramp	1210	170	170	120	1560	210	230	150
Southbound On Ramp	2210	240	310	170	3010	290	420	220
Southbound Off Ramp	1980	250	280	180	2230	300	310	220
Ballards Road Interchange								
Northbound On Ramp	250	10	40	10	320	10	50	10
Northbound Off Ramp	520	40	70	30	530	30	90	30
Southbound On Ramp	1320	190	190	130	1310	210	190	150
Southbound Off Ramp	340	70	50	50	470	100	70	70
Waterfall Way Interchange								
Northbound On Ramp	4510	150	640	110	5060	170	710	120
Northbound Off Ramp	290	10	50	10	310	10	50	10
Southbound On Ramp	390	30	60	30	430	30	60	30
Southbound Off Ramp	3770	120	530	90	4380	150	610	110
Local Roads								
Service Road - South of Nambucca Heads Interchange	6300	360	890	270	7150	410	1010	290
Service Road - Nambucca Heads Interchange to Ballards Road	3700	300	530	220	5060	410	720	300
Service Road - Ballards Road Interchange to Urunga	4090	310	580	230	4660	340	660	240
Service Road - Urunga to Waterfall Way	7590	210	1070	150	4110	230	1140	170
Valla Road	1290	130	180	100	2200	220	310	160
East West Road	1910	110	280	70	2410	120	340	90
Ballards Road	2420	290	350	200	2590	340	370	240
Short Cut Road	3610	40	500	30	3620	30	520	30

6.3 Noise Modelling Validation

The validation of the noise model was performed by comparing the 2013 Validation Scenario noise level predictions with the results from the ambient noise monitoring survey presented in **Section 5.0**. The Validation Scenario makes use of the road traffic volumes measured during the ambient noise monitoring survey presented in **Table 5**.

Comparison of measured and predicted levels has been performed by undertaking single point receiver calculations at noise model locations coinciding with the ambient monitoring locations.

Small variations between measured and predicted values are to be expected within any noise model. This is due to the dependence of measured noise levels on road surface characteristics near the specific measurement sites, the incidence of vehicles changing gears near the site, the use of brakes in downhill sections, the bias in use of multiple lanes during different periods of the day, the effects of local screening (eg fences, sheds), etc.

The comparison of the noise level predictions for the 2013 Validation Scenario is shown in **Table 8**.

Table 8: Comparison of Measured and Predicted Noise Data (2013 Validation Scenario)

No.	Address	Noise Level (dBA)					
		Measured		Predicted		Predicted MINUS Measured	
		LAeq(15hr)	LAeq(9hr)	LAeq(15hr)	LAeq(9hr)	LAeq(15hr)	LAeq(9hr)
1	70 Foxes Road, Nambucca[1]	47	46	-	-	-	-
2	47 Boggy Creek Road, Valla	47	45	49	46	2	1
6	7 Valla Beach Road, Valla	63	54	63	55	0	1
8	7440 Pacific Highway, Valla	51	52	52	49	1	-3
9	7443 Pacific Highway, Valla	53	51	54	52	1	1
11	1316 Martells Road, Urunga	51	49	52	49	1	0
12	358 South Arm Road, Urunga[2]	45	51	-	-	-	-
13	354 South Arm Road, Urunga[2]	44	47	-	-	-	-
14	17 Ridgewood Drive, Raleigh[2]	47	41	-	-	-	-
15	79 Short Cut Road, Urunga	48	42	48	42	0	0
16	63 Waterfall Way, Raleigh	52	49	53	50	1	1
17	100 Old Pac. Highway, Raleigh	55	52	56	53	1	1
	Average { PREDICTED – MEASURED } Difference					**+0.9 dB**	**+0.3 dB**

Note 1: Noise logging location NM01 was excluded from the validation process due to significant influence of extraneous noise (ie non-road traffic related such as noise from birds, dogs, etc). Evaluation of the noise logging graphs in **Appendix B** shows that this site is not road traffic noise dominated.

Note 2: Noise logging locations NM12, NM13 and NM14 were excluded from the validation process as these locations are not affected by road traffic noise.

Reference to the above indicates that for the **daytime LAeq(15hr)** period, the predicted noise levels are on average 0.9 dB above the measured data. For the **night-time LAeq(9hr)** period, the predicted noise levels are on average 0.3 dB above the measured data.

The ENMM notes that *"it should be recognised that noise prediction modelling has some accuracy limitations and will commonly produce acceptable errors of around 2 dBA".*

The reason for 3 dB variation at site 8 is likely due to minor differences between the actual ground and the modelled ground that results in additional shielding being provided in the noise model to the HGV exhaust sources.

On the basis of the comparison of NH2U noise model predictions with baseline measurement results, it is concluded that the noise model provides results which enable a reliable assessment of the project.

7.0 Operational Noise Assessment Results

The SWTC for the project details that the Operational Noise Management Report is required to assess operational noise levels from the project in two distinct ways:

- Firstly, against the Noise Limiting Contours and Single Point Receiver Target Noise Levels as contained in the SWTC – this is detailed in **Section 7.3** to **7.5** of this report, and also contained in **Appendix D** and **Appendix E**.
- Secondly, against the requirements of the ECRTN and ENMM – this is detailed in **Section 7.6**, and also contained in **Appendix F**.

7.1 Changes Since Concept Design

The road alignment documented in the Final Design Documentation for the RD1 and RD2 design lots does not vary significantly from the Concept Design except for the locations indicated below in **Table 9**.

An assessment of the acoustical impact of the various design changes has been completed through the evaluation of the predicted noise contours and receiver noise level adjacent to the location of each design change.

Table 9: Summary of Notable Design Changes since Concept Design

No.	Design Change	Reason	Acoustical Change/Outcome
From Developed Concept Design to Preliminary Detailed Design			
1	Alignment shifted by up to around 40 m towards the western Project Boundary between 63.300 km and 65.200 km, at Valla Road / Cow Creek.	As a result of the Value Engineering process, the main carriageways have been re-aligned further west to improve constructability and safety during construction. This enables construction of both main carriageways off-line reducing the requirement for work under traffic control, minimising or avoiding construction work on the Existing Pacific Highway and Valla Road including at the intersection, as well as removing the retaining wall (RW03). However, a cut retaining wall on the west side of the northbound main carriageway and adjustment to Local Access Road B has resulted.	Marginal shift in the noise contours to the west for an approximately 800 m long section adjacent to design change. The shift is up to a maximum of around 10 to 20 m, depending on the exact location. Whilst the noise contours have marginally shifted to the west, this change in isolation did not result in any additional exceedances of the Noise Limiting Contours or additional property treatments over the receivers documented in the SWTC. The closest receiver to this change is ID1650 where a less than 1 dB increase is apparent.
2	Where possible the distances between the main carriageways and parallel local roads have been minimised.	To reduce the length of cross drainage culverts while also avoiding the need for headlight screens.	Minor reduction in extent of noise contours adjacent to location where distance minimised.
From Preliminary Detailed Design to Substantial Detailed Design			
3	The Service Road alignment at Cow Creek has been relocated west onto the existing alignment of the Existing Pacific Highway. The Cow Creek Service Road bridge will therefore now be constructed on the Existing Pacific Highway alignment instead of off-line to the east	To allow construction of the new bridge with minimum disruption to existing highway traffic.	Minor reduction in extent of noise contours adjacent to location where distance minimised.

No.	Design Change	Reason	Acoustical Change/Outcome
4	The vertical geometry of the Rest Area has been raised by up to 2.5 m.	To reduce surplus earthworks material.	Re-assessment of revised Rest Area provided in **Section 7.7**.
5	The vertical geometry of the main carriageways between 63.100 km (Boggy Creek) and 63.600 km (Cow Creek) has been raised.	To reduce surplus earthworks material.	Minor increase in noise contours adjacent to location. This change did not however result in any additional exceedances of the Noise Limiting Contours or additional property treatments over the receivers documented in the SWTC
6	The vertical geometry of the main carriageways between 69.200 km and 69.600 km has been raised.	To reduce surplus earthworks material.	Minor increase in noise contours adjacent to location. This change did not however result in any additional exceedances of the Noise Limiting Contours or additional property treatments over the receivers documented in the SWTC.
7	The vertical geometry of the main carriageways between 72.000 km and 72.700 km has been raised.	To reduce surplus earthworks material.	Minor increase in noise contours adjacent to location. This change did not however result in any additional exceedances of the Noise Limiting Contours or additional property treatments over the receivers documented in the SWTC.

Whilst a small number of non-conformant additional exceedances of the Target Noise Levels and Contours have been identified (refer to **Section 7.2** to **7.5**), none of these locations are in proximity to the above noted design changes.

7.2 Proposed and Agreed Non-Conformances

There are a number of areas where the noise modelling indicates that the design does not fully comply with the SWTC. These non-conformances have been identified at various stages during the design process of the project.

The agreed non-conformances to date are included in **Appendix G** for reference. The agreed non-conformances relate to:

- RFI 000077 – Receivers listed in Appendix 4.6 of Appendix 4 to the SWTC where the predicted receiver noise levels were found to exceed the target noise levels as part of the Preliminary Detailed Design. Refer to **Section 7.4** of this report.
- RFI No. PSW 00052 – Locations where the predicted noise contours were found to lie outside the Noise Limiting Contours as part of the Substantial Detailed Design. Refer to **Section 7.5** of this report.
- RFI No. PSW 00053 – Locations where a number of properties with ERCTN exceedances have been identified that are not listed in Appendix 4.6 to Appendix 4 of the SWTC. Refer to **Section 7.6** of this report.

7.3 Noise Limiting Contours and Design Noise Contours

Noise contours have been generated in accordance with the specified calculation procedure for each of the four noise modelling scenarios listed below.

- 2016 Daytime – LAeq(15hour)
- 2016 Night-time – LAeq(9hour)
- 2026 Daytime – LAeq(15hour)
- 2026 Night-time – LAeq(9hour)

A graphical comparison of the Final Design Documentation Noise Contours and the SWTC Appendix 9 Noise Limiting Contours is provided in **Appendix D**.

7.4 SWTC Appendix 4.6 – Receiver Noise Levels

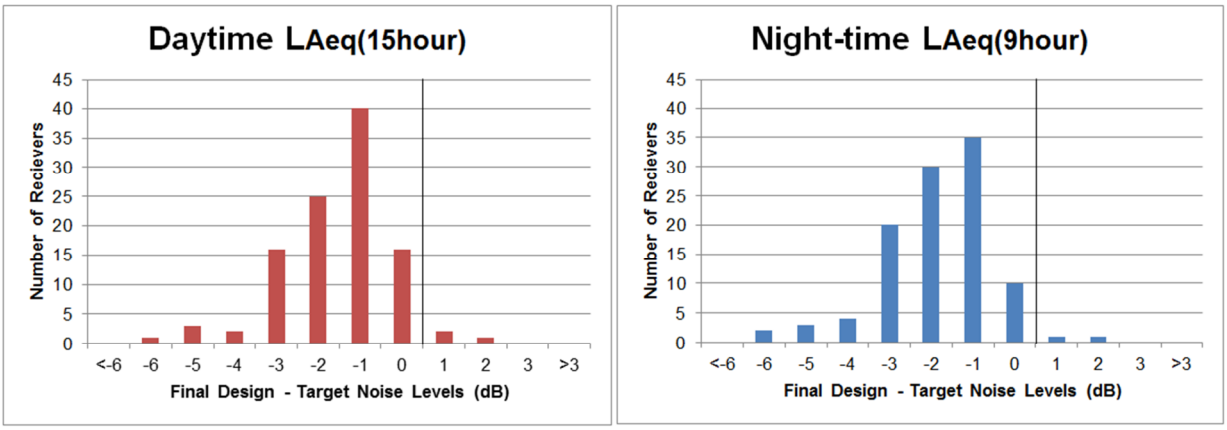
Noise Limiting Receiver Predictions for the Future Design 2026 scenario, which are to be maintained by the project, are presented in Appendix 4.6 of Appendix 4 of the SWTC. A noise level prediction for each assessment receiver is presented for both the daytime and night-time period.

Facade noise levels have been predicted at each noise sensitive receiver identified in Appendix 4.6. A comparison of the Final Design Documentation noise predictions against the Appendix 4.6 targets are presented in full in **Appendix E**.

The Appendix 4.6 target noise levels are presented as the *highest individual facade level* per receiver. It is noted that some cases the *highest individual facade level* of a particular receiver is not necessarily *the most affected facade*. For reference, the most affected facade takes into account the existing level of noise and the extent of the exceedance of the appropriate noise criteria.

A comparison of the 2026 Final Design Documentation Noise Levels in relation to the Target Noise Levels is provided in **Figure 2** for both the daytime and night-time data sets. The figures show the Final Design Documentation Noise Levels *minus* the Targets Noise Levels, therefore receivers in the groups with negative numbers indicate that the Final Design Documentation Noise Levels are predicted to be *lower* than the corresponding Target Noise Levels and therefore compliant.

Figure 2 Distribution of 2026 Data Sets, Final Design Documentation minus Target Noise Levels



The above figures indicate that out of the 106 receiver locations identified in Appendix 4.6, the vast majority of receivers comply with the Target Noise Levels. Three receivers are predicted to exceed the Target Noise Levels in either the 2026 daytime or 2026 night-time assessment scenario – these being receivers 1766, 2775 and 5001.

Receivers 1766 and 2775 exceed the Target levels for both the daytime and night-time periods, whilst receiver 5001 exceeds by 1 dB during the daytime period only. The three non-conformance locations are indicated in **Table 10**.

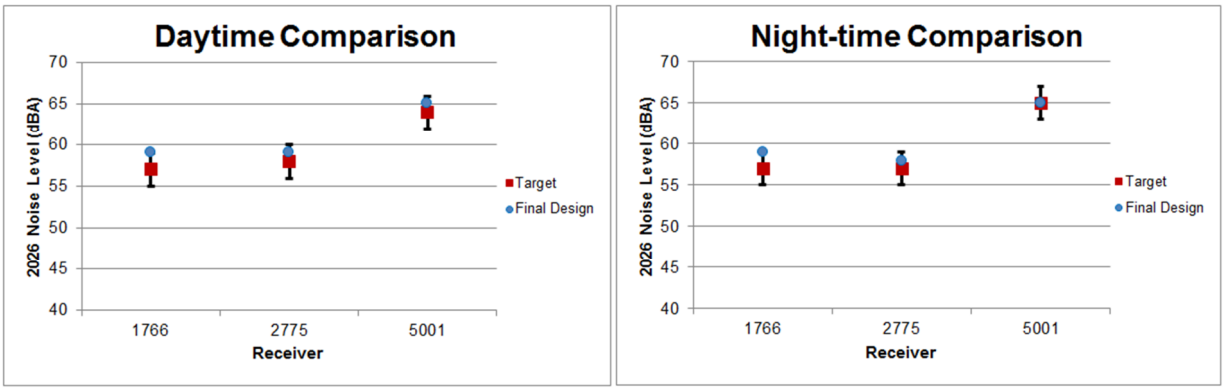
Table 10:Receiver Predictions, SWTC Appendix 4.6 Non-Conformance Locations

Count	Rec. ID	Co ordinates		2026 Design Noise Levels (dBA)			
				Appendix 4.6 Targets		FDD Highest Noise Level	
		X	Y	Daytime LAeq(15hr)	Night time LAeq(9hr)	Daytime LAeq(15hr)	Night time LAeq(9hr)
35	1766	499709	6616180	57	57	59	59
77	2775	499665	6628150	58	57	59	58
105	5001	500298	6618300	64	65	65	65

It is noted that at the three identified locations, the exceedances of the Target Noise Levels are 1-2 dB and are therefore considered to be minor as the exceedances are within the typically accepted accuracy of noise modelling – noting that the ENMM states *"it should be recognised that noise prediction modelling has some accuracy limitations and will commonly produce acceptable errors of around 2 dB(A)"*.

A comparison of the Final Design Documentation and Target Noise Levels at the three exceedance locations is provided in **Figure 3**. The graphs show error bars in black indicating the accepted 2 dB accuracy of the Target predictions.

Figure 3 2026 Final Design Documentation and Target Noise Levels – Comparison of Exceedance Locations



Reference to the above figures indicates that all locations are within the accepted accuracy of the noise modelling algorithms.

7.4.1 Discussion of Non-Conformance Locations

A comparison of the 2026 Final Design Documentation Noise Contours with the Noise Limiting Contours at the three non-conformance locations has been undertaken. This is provided below with further discussion of the three identified non-conformance locations.

- The 2026 Final Design Documentation Noise Levels given in **Table 10** indicate that for receiver 1766, the daytime and night-time noise levels are predicted to be 2 dB above the corresponding Appendix 4.6 Target noise levels.

  It is however noted that the Final Design Documentation Noise Contours are typically consistent with, or well within, the Noise Limiting Contours for the majority of the area surrounding this receiver in both 2026 scenarios. A small section of exceedance (around 10 to 15 m) is apparent near chainage 67,600 and 67,900.

  A comparison of the Appendix 4.6 Target Noise Levels for the receivers surrounding receiver 1766 is shown in **Figure 4**. Evaluation of the figure indicates that receiver 1766 has Target Noise Levels that are 3 dB lower than receiver 1755, yet receiver 1755 is of a similar setback

distance from the main carriageway alignment (which is the main source of traffic noise in the area) and of similar elevation above the road way. Receiver 1766 also has lower Targets than receiver 1771, yet receiver 1766 is located closer to the main carriageway than receiver 1771.

It is noted that the 2026 Final Design Documentation receiver noise level predictions comply with all other receiver Target Noise Levels in the area surrounding receiver 1766.

As such, in the absence in any major design changes in this location for the Final Design Documentation alignment, and given the above discussion, the apparent isolated exceedance at receiver 1766 is considered of minor significance.

Figure 4 Appendix 4.6 2026 Target Noise Levels at Receiver 1766 and Surrounding Area

- For receivers 2775 and 5001 the Final Design Documentation Noise Contours are consistent with, or well within, the Noise Limiting Contours for the 2026 scenarios. The apparent exceedances of the Target Noise Levels therefore appear to be inconsistent with the noise contour calculations, and are considered to be of minor significance.

7.4.2 Receiver Noise Level Non-Conformances – RFI 000077

The above listed exceedances of the Target Noise Level have been previously reviewed by RMS in September 213 as part of the Preliminary Detailed Design assessment, within RFI 000077.

The non-conformances were accepted on the basis that they do no trigger additional architectural mitigation requirements. The predictions at these receiver locations have not changed as part of this assessment. The agreed non-conformances are included in **Appendix G** for reference.

7.5 Comparison of Final Design Noise Contours with Noise Limiting Contours

Reference to the four sets of noise contours indicates that the Final Design Documentation Noise Contours correlate well with the Noise Limiting Contours. For the vast majority of the project area, the Final Design Documentation Noise Contours are compliant with the Noise Limiting Contours in each of the four assessment scenarios.

For a small number of isolated locations the Final Design Documentation Noise Contours can be seen to exceed the Noise Limiting Contours by relatively small distances (ie around 5 to 10 m). At around 100 m from the road side, a modelling accuracy of ±1 dB equates to a change in distance of around ±25 m. Given that ±2 dB is the accepted accuracy of the CoRTN algorithms, where isolated small exceedances exist which are within a ±1 dB tolerance distance, the exceedance has been considered to be well with the accepted accuracy of the noise modelling procedure.

The following provides a summary and discussion of the notable minor exceedance locations:

- **67,600 to 67,900, west of alignment, adjacent to East West Road** – in this section the Final Design Documentation Noise Contours exceed the Noise Limiting Contours by up to 10 to 15 m, in the area near to East West Road. Given that the exceedance location is immediately adjacent to the carriageway and over a relatively short distance, the exceedance is considered marginal. Reference to the single point receiver predictions in **Section 7.4** indicates that compliance with the Target Noise Levels is apparent for the Final Design Documentation at all apart from one location, at which the Target Noise Level appears to be inconsistent with the targets for the surrounding receivers.
- **72,000 to 72,300, east of alignment, adjacent to Pacific Highway** – in this section the Final Design Documentation Noise Contours exceed the Noise Limiting Contours by up to 10 m, in the area adjacent to the Existing Pacific Highway. The difference between the contours appears likely to be due to differences in ground elevation data. Given that the difference equates to less than 1 dB and the affected location is within a forest, the exceedance is considered marginal.
- **72,000, west of alignment, along Ballards Road** – in this section the Final Design Documentation Noise Contours exceed the Noise Limiting Contours by up to 10 m for an approximately 200 m long section of Ballards Road. Given that the difference equates to less than 1 dB and that there are no receivers in the vicinity of this location the exceedance is considered marginal.
- **78,700 to 78,900, west of alignment** – in this section the Final Design Documentation Contours are around 10 m to 25 m outside the Noise Limiting Contours. This feature is most apparent in the daytime contours. The Final Design Documentation Contours are up to 0.5 to 1 dB higher than the Noise Limiting Contours. Given the location is within a forest, the exceedance is considered of negligible significance.
- **81,500, east of alignment, adjacent to Short Cut Road** – in this section the Final Design Documentation Contours exceed the Noise Limiting Contours immediately adjacent to Short Cut Road for an approximately 100 m long section to the east of the main alignment. Given that the single point receiver predictions indicate compliance with the Target Noise Levels is apparent for the Final Design Documentation at all nearby locations, this small exceedance is considered minor.
- **81,700 to 82,500, east of alignment, adjacent to Pacific Highway** – in this section the Final Design Documentation Contours are up to around 20 m outside the Noise Limiting Contours. Given this exceedance occurs over a small area and is only apparent in the 2016 Daytime LAeq(15hour) scenario, the exceedance is considered of negligible significance. Reference to the single point receiver predictions indicates that compliance with the Target Noise Levels is apparent for the Final Design Documentation at all nearby locations.

7.5.1 Noise Limiting Contour Non-Conformances – RFI No PSW 00052

The above listed exceedances of the Noise Limiting Contours have been reviewed by RMS in November 213 as part of the Substantial Detailed Design assessment, within RFI No. PSW 00052. The non-conformances were accepted on the basis that they are typically of minor significance.

The Final Design Documentation does not result in any additional exceedance locations over those contained in the Substantial Detailed Design. The agreed non-conformances are included in **Appendix G** for reference.

7.6 ECRTN/ENMM Assessment

Road traffic noise levels have been predicted to all identified residential sensitive receiver locations, as shown in **Figure 1** and illustrated on the site plan in **Appendix B**, for the Future Design assessment year of 2026. The predictions are based on the design inputs detailed in **Table 4** and include the specification of low noise pavement on the main carriageway between 66.970 km and 68.670 km, and between 80.690 km and 82.890 km.

Of the 223 total receiver locations modelled as part of the ECRTN Operational Noise Assessment, 102 are predicted to experience levels exceeding the appropriate criteria. These locations are indicated on

the site plan in **Appendix B**, whilst the full assessment results at every receiver are detailed in **Appendix F**.

It is noted that the summary of ECRTN receiver noise levels in **Appendix F** presents the predictions for the most affected facade of every identified receiver location. As noted previously, the most affected facade is not always the facade with the highest noise level. For reference, the assessment against the Target Noise Levels in Appendix 4.6 of the SWTC (refer to **Section 7.4** and **Appendix E**) has been undertaken on the basis of the highest noise level per receiver.

A number of the 102 ECRTN exceedance locations are at receivers which are not identified in Appendix 4.6 of the SWTC. These locations are summarised below in **Table 11** with commentary relating to the additionally identified locations being provided in **Table 12**.

Table 11:Summary of Additional ECRTN Exceedance Locations

Rec. ID	New or Redev	2016 Future Existing		Criteria		2026 Future Design Most Affected Facade		2026 Future Design LAeq(9hour) Exeedance at Most Affected Facade		
		$L_{Aeq(15hr)}$	$L_{Aeq(9hr)}$	$L_{Aeq(15hr)}$	$L_{Aeq(9hr)}$	$L_{Aeq(15hr)}$	$L_{Aeq(9hr)}$	A[1]	B[2]	Acute?
1678EA	r	51	50	60	55	56	**56**	1	5.4	-
1782	r	54	54	60	55	56	**56**	1	1.9	-
1788	r	54	54	60	55	57	**57**	2	3.0	-
1841	n	45	45	55	50	**56**	**56**	6	-	-
1958	n	31	30	55	50	**59**	**59**	9	-	-
1960a	n	<30	<30	55	50	**66**	**67**	17	-	Yes
1960b	n	<30	<30	55	50	**63**	**64**	14	-	Yes
2240	n	<30	<30	55	50	**65**	**65**	15	-	Yes
2776	n	48	46	55	50	**58**	**57**	7	-	-

Note 1: Exceedance of ECRTN base criteria if facade exceeds applicable criteria.
Note 2: Increase due to project if facade exceeds and ECRTN base criteria are already exceeded in Future Existing.

Table 12:Comments Regarding ECRTN Exceedance Locations

Rec. ID	Notes
1678EA	The identified receiver was known as 1678 in the EA and has been treated for at house noise mitigation. The second building (1678EA) is a shed at the rear of the property. No treatment required.
1782	RMS has advised that their assessment found the noise level at this location was dominated by East West Road and not the main alignment. The exceedance in the Final Design Documentation assessment has been found to be at the north eastern facade (ie facing the future highway). It is however noted that the predicted Future Design noise level at this location is within 2 dB of the Future Existing noise level and no more than 2 dB above the target ECRTN noise levels. RMS generally considers it is not reasonable to take action in such instances on the basis of the insignificant change in noise level and the insignificant exceedance of the targe noise level (refer to ENMM page 98).
1788	RMS has advised that this receiver qualifies for at-house treatment and will manage the treatment options with the landowner.
1841	Receiver identified in EA as requiring treatment, but is not detailed in Appendix 4.6 of SWTC. This is a communications tower and therefore no treatment is required.

Rec. ID	Notes
1958	Receiver identified in EA as requiring treatment, but is not detailed in Appendix 4.6 of SWTC. An agreement has been reached between the landowner and RMS in regard to noise mitigation for this property. No further action is required
1960a	This receiver was previously identified in the EA as being acquired by project. The buildings are derelict and treatment for noise is therefore not possible.
1960b	
2240	This receiver was previously identified in the EA as being acquired by project. Lend Lease are using this house during construction as an ancillary facility. Treatment will be provided after completion of the project, prior to being sold.
2776	Receiver identified in EA as requiring treatment, but is not detailed in Appendix 4.6 of SWTC. This building has been acquired and demolished as part of the upgrade.

7.6.1 ECRTN Assessment Non-Conformances – RFI No PSW 00053

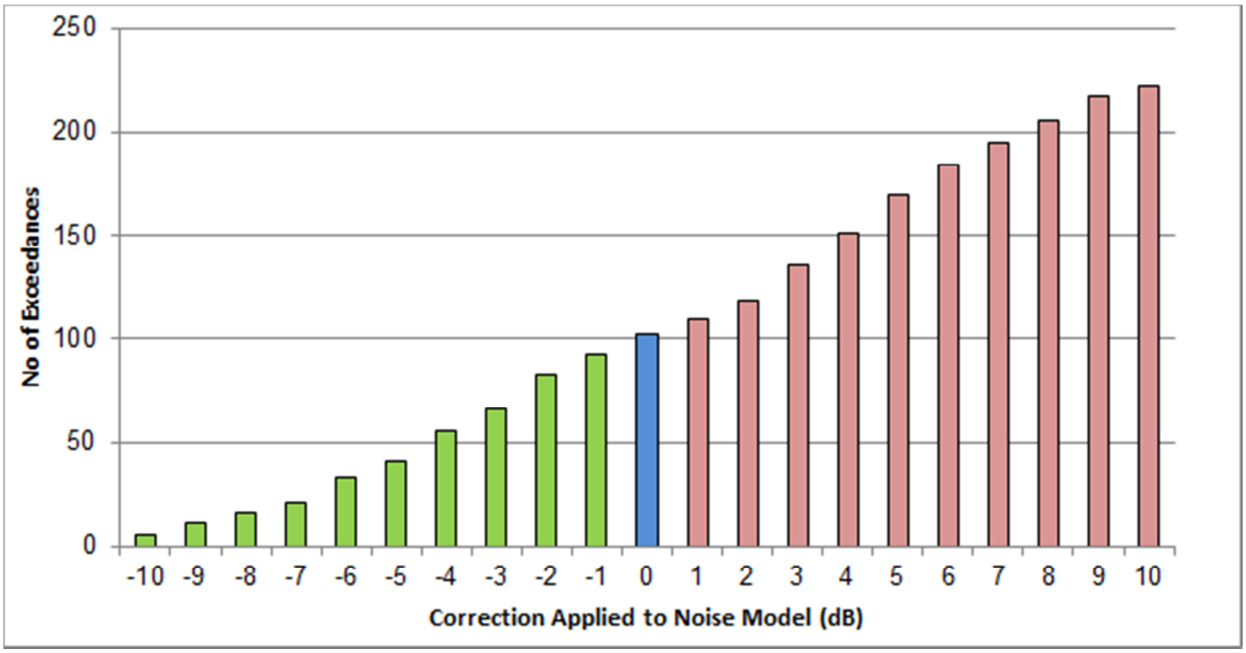
The above mentioned additional ECRTN exceedance locations (over those listed in Appendix 4.6 of the SWTC) were reviewed and accepted by RMS within RFI No. PSW 00053.

The Final Design Documentation does not result in any further ECRTN exceedance locations over those listed in RFI No. PSW 00053. The agreed non-conformances are included in **Appendix G** for reference.

7.6.2 ECRTN Sensitivity Analysis

A sensitivity analysis of the ECRTN assessment and noise modelling methodology has been undertaken. The likely change in the predicted number of exceedance locations has been determined by applying a correction factor to the 2026 Future Design noise model predictions in 1 dB increments. This exercise is summarised in **Figure 5**. The 102 ECRTN exceedances that are currently predicted in the model are shown by the blue bar.

Figure 5 ECRTN Sensitivity Analysis



Reference to the above indicates that an additional 8 exceedances would be apparent if a +1 dB correction were to be added to the future noise model predictions. A reduction of 9 exceedances would occur if 1 dB was to be subtracted.

7.7 Nambucca Heads Rest Area

The Minister's Conditions of Approval for the project require an assessment of the Nambucca Heads Rest Area to be undertaken as part of the detailed design assessment of operational noise. It is noted that the Environmental Assessment (EA) for the project contained an assessment of the Rest Area against criteria derived from the NSW *Industrial Noise Policy* (INP).

Following completion of the EA, RMS Engineering Technology Branch reviewed the original concept design and investigated a number of alternatives for the Nambucca Heads Interchange and Rest Area. After assessment of potential alternative configurations, it was apparent that there were significant advantages in a design refinement that comprised:

- Relocation of the interchange about 80-100 m to the south, avoiding a previously affected environmentally sensitive area (Subtropical Coastal Floodplain Forest EEC (endangered ecological community) adjacent to Boggy Creek).
- Relocation of the proposed Rest Area, shifting it from the eastern side of the upgrade to the western side, and generally to the immediate north west of the relocated interchange.

The relocated Rest Area was reassessed in RMS document *'Environmental Assessment – Nambucca Heads Interchange & Rest Area Design Refinement – Pacific Highway Upgrade, Warrell Creek to Urunga'*, dated October 2012.

Noise emissions from the operation of the relocated Rest Area were predicted to comply with all relevant noise criteria at the nearest affected receivers.

The Final Design Documentation positioning of the Rest Area is essentially the same as the location assessed in the Design Refinement EA, however the vertical geometry of the Rest Area has been raised by around 2 m, between the Preliminary Detailed Design and Substantial Detailed Design, in order to reduce surplus earthworks material. The location of the Rest Area is illustrated in **Figure 6**.

Figure 6 Surrounding Receivers at Rest Area

The nearest potentially affected residential receivers are as follows:

- Receiver 1625. Located approximately 400 m to the east of the proposed Rest Area, 240 m from the existing highway and 350 m from the future highway. This receiver is shielded from view of the Rest Area by the intervening elevated ground.
- Receiver 1630 (27 Boggy Creek Road, Valla). Located approximately 300 m to the north of the proposed Rest Area and 170 m from the future highway.

7.7.1 Noise Criteria

There are no specific criteria for assessing noise from rest areas associated with road projects. The INP is however typically used for assessing noise of an industrial nature from fixed facilities. Whilst rest areas are not considered to be an industrial source of noise, the application of the INP is considered to be the most appropriate criteria to determine the likely noise impacts from this facility.

The INP sets two separate noise criteria to meet environmental noise objectives – one to account for intrusive noise and the other to protect the amenity of particular land uses. Typically, the more stringent of these two criteria usually defines the project specific noise levels.

For both amenity and intrusiveness, night-time criteria are usually more stringent than daytime or evening criteria. As the Rest Area has the potential to be in use during any period, the night-time period is likely to be the controlling time period.

Assessing Intrusiveness

To provide for protection against intrusive noise, the INP states that the LAeq noise level of the source, measured over a period of 15 minutes, should not be more than 5 dB above the ambient (background) LA90 noise level (or RBL), during the daytime, evening and night-time periods at the nearest sensitive receivers.

Assessing Amenity

To protect against impacts on amenity, the INP identifies recommended acceptable and maximum LAeq(period) noise levels for particular land uses and activities during the daytime, evening and night-time periods. Assessment against the amenity criteria for the Rest Area is however not necessary as the noise events in the Rest Area would tend to be of short duration and would only occur infrequently within the day, evening and night-time periods. Achieving compliance with the intrusiveness criterion would automatically ensure compliance with the amenity criterion.

7.7.2 Summary of Noise Criteria

The applicable intrusiveness criteria for the Rest Area, based on the ambient noise monitoring data discussed in **Section 5.0**, are presented in **Table 13**.

Table 13:Summary of Intrusiveness Criteria for Rest Area

Receiver	Intrusiveness LAeq(15min) Criteria (dBA)[1]		
	Daytime	Evening	Night time
1625	38 + 5 = **43**	39 + 5 = **44**	36 + 5 = **41**
1630			

Note 1: Based on the data from Location 2 shown in **Table 3**.

7.7.3 *Operational Noise Assessment – Rest Area*

The likely noise emissions from the Rest Area have been predicted using SoundPLAN V7.1. The same worst-case assessment scenario and sound power level data as defined in the *'Environmental Assessment – Nambucca Heads Interchange & Rest Area Design Refinement – Pacific Highway Upgrade, Warrell Creek to Urunga'* document has been used in the modelling. This consists of:

- 4 trucks entering the Rest Area
- 4 trucks idling continuously
- 4 trucks exiting the Rest Area
- 4 vehicle doors closing
- 2 vehicle engines starting

Based on the above scenario and input data, the predicted operational noise levels during the most sensitive night-time period are presented in **Table 14**.

Table 14:Summary of Rest Area Assessment

Receiver	Night time Noise Level LAeq(15min) (dBA)		
	Criteria	Predicted Level[1]	Complies?
1625	41	26	Yes
1630	41	40	Yes

Note 1: Predicted with a moderate (f-class stability category) temperature inversion.

Noise emissions from the operation of the Rest Area are predicted to comply with the noise criteria at the nearest affected residential receiver locations.

7.8 Maximum Noise Level Assessment

Maximum noise levels were assessed for the project during the Environmental Assessment, based on the concept design. The approach taken during that assessment was to predict maximum internal noise levels for receivers adjacent to the project area, assuming a situation where windows are open on the most exposed facade.

Whilst the detailed design alignment includes a number of modifications and design changes since completion of the concept design, the maximum noise levels as detailed in the Environmental Assessment are considered to be indicative of the maximum noise environment for the project, given that no significant design changes have been made to the alignment.

Furthermore, sleep disturbance criteria are not currently defined in the ECRTN and the ENMM notes that the maximum noise assessment can be used *"as a tool to help prioritise and rank mitigation strategies"*, for example during the evaluation of various route options during the early stages of a project, *"but should not be applied as a decisive criterion in itself"*.

As such, the assessment of maximum noise levels as completed during the Environmental Assessment of the project is considered sufficient and does not require re-assessment as part of this report

8.0 RMS and Project Verifier Review

The Substantial Detailed Design report was assessed by both RMS and the Project Verifier. The various comments from the review process are listed in full in **Appendix H** and **Appendix I**.

9.0 CONCLUSION

The Final Design Documentation is predicted to comply with the levels defined at the majority of the 106 receiver locations identified in Appendix 4.6 of the SWTC. Three receivers are predicted to exceed the Target Noise Levels in either the 2026 daytime or 2026 night-time assessment scenario. The exceedances of the Target Noise Levels for these receivers are however considered minor and within the known accuracy of noise modelling procedure. A comparison of the noise contours adjacent to these locations indicates that they are generally compliant with the Noise Limiting Contours.

In general, the Final Design Documentation noise level predictions are typically within the Noise Limiting Contours. A small number of isolated areas show very minor exceedances in the Final Design Documentation Contours, however, these exceedances also lie well within the acceptable modelling accuracy for this type of assessment.

Of the 223 total receiver locations modelled as part of the ECRTN operational noise assessment, 102 are predicted to experience an exceedance of the appropriate criterion. A small number of the exceedance locations are at receivers which are not identified in Appendix 4.6 of the SWTC. These additional exceedance locations have been identified and were accepted by RMS within RFI No. PSW 00053.