Acoustics RB Pty Ltd

Report No. 18-964.R13

Second Addendum Report

Amity Narangba
Residential Estate
Callaghan Rd, Narangba
Rail and Road Traffic Noise Assessment

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Report Prepared by		Report Prepared for	
Acoustics RB Pty Ltd		Dahua Pointcorp Narangba Pty Ltd	
PO Box 150		c/o APD	
Wilston Q 4051		Lobby 1, Level 2, Gasworks Plaza	
Ph: 07 3356 5555		76 Skyring Terrace	
		Newstead Q 4006	
e-mail: hugh@acousticsrb.com.au			
		Attention: Mr Josh Botten, Development Assistant	
Status:	**Final**	**Author:**	**Hugh Brown**
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SUMMARY

Pointcorp Development has been granted approval by Moreton Bay Regional Council (MBRC) to re-develop land at Callaghan Rd, Narangba for residential purposes.

Ref. Approval No. DA/31898/2016/VCHG/1.

It is noted that the site adjoins two Council-controlled roads; Callaghan Road to the north and Burpengary Road to the west. According to the MBRC Interactive Mapping website, Callaghan Road and Burpengary Road have been designated Council sub-arterial and arterial roads, respectively.

In addition, the nearest point of the subject site is located within 25m of North Coast Rail Line. A Transport Noise Corridor (TNC) has been designated along both sides of North Coast Rail Line (NCRL).

As part of the DA application, two reports were prepared by TTM Consulting Pty Ltd and submitted to Council:

(i) Rail Noise Assessment Report, ie TTM Report Ref. 16BRA030 R01 *Residential Estate Callaghan Rd, Narangba - Rail Noise Assessment Report* (dated 8 June 2016), and

(ii) Road Traffic Noise Assessment Report, ie TTM Report Ref. 16BRA0130 R02_0 *Residential Estate Callaghan Rd, Narangba – Road Traffic Noise Assessment Report* (dated 14 August 2016).

Both TTM reports made the same recommendations for the construction of a noise barrier along the western extent of the site to control transport noise intrusion from both (i) North Coast Rail Line (NCRL) as well as (ii) Burpengary Road. In addition, both reports drew the same conclusion that, with this barrier in place, "the development is predicted to comply with the noise criteria outlined in Section 4 [of the relevant TTM Report]", ie criteria for land affected by emissions from (rail/road) transport activities as stated in Module 1.1 of SDAP and DTMR's *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure, Ver 2*.

Since preparation of the time of preparation of the TTM reports, an addendum report was prepared by Acoustics RB Pty Ltd, ie Acoustics RB Report Ref RB/18-964.R01.Rev1 (22 March 2018). This addendum report harmonised the degree of transport noise intrusion onto the Amity Estate with the specific requirements of (i) the gazetted TNC associated with NCRL and (ii) Section 8 of Council's *Planning Scheme Policy – Noise* (PSP6.16). Acoustics RB Report Ref RB/18-964.R01.Rev1 has been approved by Council.

On 29 January 2020, the State Government gazetted new TNC's for the entire Rail Network of Queensland. The new TNC's supersedes any TNC's that were gazetted previously. The current NCRL TNC now extends over land within 250m of the nearest track of the rail line instead of the 100m which applied previously between 1 July 2015 and 28 January 2020 (inclusive).

Additionally, the State permits that the beneficial shielding effect of any approved residence may be included in any assessment of the degree of noise intrusion across a residential development. This includes residences which have been already constructed and/or approved to be constructed on lots within the Amity Estate.

In view of the recent update to the gazetted width of the TNC associated with NCRL as well as the completion of numerous approved residences on lots within the Amity Estate, Acoustics RB has been engaged by APD on behalf of Dahua Pointcorp to quantify the expected degree of rail and road traffic noise intrusion onto the site using the assumptions and calculation procedures previously adopted by TTM.

More specifically, the purpose of this report is to update the approved addendum noise report prepared in March 2018 to take account of the following matters:

1. The increase of the width of the NCRL TNC from 100m to 250m,
2. The beneficial shielding of the building bulk of approved residences on lots within Amity Estate,
3. The as-constructed noise barrier protecting lots within Stage 10 of Amity Estate, and
4. The approved form of the future noise barrier to protect lots within Stage 9 of Amity Estate.

By doing so, it is recommended that the advice presented in the already approved TTM reports and Acoustics RB report be amended in accordance with the results presented in Sections 4.4 and 4.5 of this report. Specifically, the breakdown of QDC MP4.4 noise categories applying to the 121 lots lying within either or both of the area of affectedness under the PSP6.16 and the NCRL TNC is as shown in Table 6.

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1.0 Introduction

Pointcorp Development has been granted approval by Moreton Bay Regional Council (MBRC) to re-develop land at Callaghan Rd, Narangba for residential purposes.

Ref. Approval No. DA/31898/2016/VCHG/1.

It is noted that the site adjoins Callaghan Road to the north and Burpengary Road to the west. Callaghan Road is a minor road (Types 4 and 5) under Queensland Globe, while Burpengary Road is an arterial road (Types 1, 2 and 3). Both Callaghan Road and Burpengary Road are Council-controlled roads. According to the MBRC Interactive Mapping website, Callaghan Road and Burpengary Road have been designated Council sub-arterial and arterial roads, respectively.

In addition, the nearest point of the subject site is located within 25m of North Coast Rail Line. A Transport Noise Corridor (TNC) has been designated along both sides of North Coast Rail Line.

As part of the DA application, two reports were prepared by TTM Consulting Pty Ltd and submitted to Council: (i) a Rail Noise Assessment Report, ie TTM Report Ref. 16BRA030 R01 *Residential Estate Callaghan Rd, Narangba - Rail Noise Assessment Report* dated 8 June 2016 and (ii) a Road Traffic Noise Assessment Report, ie TTM Report Ref. 16BRA0130 R02_0 *Residential Estate Callaghan Rd, Narangba – Road Traffic Noise Assessment Report* dated 14 August 2016.

Each of these reports is referred to in this report respectively as (i) the approved TTM rail noise report and (ii) the approved TTM road traffic noise report.

Both TTM reports made the same recommendations for the construction of a noise barrier along the western extent of the site to control transport noise intrusion from both (i) North Coast Rail Line as well as (ii) Burpengary Road. In addition, both reports drew the same conclusion that, with this barrier in place, "the development is predicted to comply with the noise criteria outlined in Section 4 [of the relevant TTM Report]", ie noise criteria for land affected by emissions from (rail/road) transport activities as stated in Module 1.1 of SDAP and DTMR's *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure, Version 2*.

For purposes of guidance, each TTM report also presented a pair of noise contour plots showing the extent of either rail or road traffic noise intrusion, as applicable, across the entirety of the site in 5dBA noise level contour bands, with each noise level contour band magnitude corresponding to each respective Queensland Development Code Mandatory Part (QDC MP) 4.4 noise category. At Section 6.2 of each report, further information was provided with regard to lots which were considered to be "noise-affected".

At the time of preparation of the rail noise assessment report, however, the State Government had already designated the Transport Noise Corridors (TNC's) applying to all rail lines within SE Queensland carrying at least 15 rail movements per day. This included the North Coast Rail Line. The TNC's were shown on the Department of Infrastructure, Local Government and Planning (DILGP) [1] State Planning Policy (SPP) Interactive Mapping (IMS) Website. The designated TNC across the Pointcorp land did not extend as far as the area of assessment adopted in the approved TTM rail noise report.

Similarly, at the time of preparation of the road traffic noise assessment report, and by reference to Section 8.1 of Council's Planning Scheme Policy – Noise (PSP6.16), an assessment of the extent of road traffic noise intrusion would have needed to have been undertaken for only those lots which are proposed to be located "within (a) 50m of a current or future designated sub-arterial road or (b) 100m of a current or future designated arterial road".

[1] DILGP is now the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP).

Clearly, because Burpengary Road is an arterial road, it would be necessary to assess the extent of road traffic noise intrusion from Burpengary Road onto the lots lying within only 100m of the edge of the nearest running lane of Burpengary Road. In this case, the affected lots would be far fewer than those assessed in the approved TTM road traffic noise report.

Notwithstanding the minor road designation of Callaghan Road under Queensland Globe, if the designation of this road were to elevated by Council to sub-arterial status, it would be necessary to assess the extent of noise intrusion from road traffic on Callaghan Road onto those lots proposed to be located within 50m of the Callaghan Road boundary [2]. In this case, the affected lots would again be far fewer than those assessed in the approved TTM road traffic noise report.

In view of this mismatch between the number of lots actually affected by rail or road traffic noise intrusion and those assessed in the TTM reports, in March 2018 Acoustics RB Pty Ltd was engaged by Pointcorp Development to update the results of the assessments undertaken by TTM with the objective of harmonising the number of noise-affected allotments identified by TTM with the following requirements applicable at that time:

(i) In the case of rail noise intrusion, the lots lying within the designated TNC across the Pointcorp land, and

(ii) In the case of road traffic noise intrusion, the lots lying within the 50m (if applicable) and 100m zones of road traffic noise affectedness designated by Council under PSP6.16.

Acoustics RB Report Ref RB/18-964.R01.Rev1, dated 22 March 2018 and titled *Addendum Report – Amity Narangba, Residential Estate – Callaghan Rd, Narangba – Rail and Road Traffic Noise Assessment* presented the results of that harmonisation.

Important note:

> Acoustics RB Report Ref RB/18-964.R01.Rev1 did not vary or modify either of the approved acoustical assessments prepared by TTM. Rather, it accepted the merits of the analyses conducted by TTM. The addendum report sought only to harmonise the results of the assessments conducted by TTM against the constraints of the areas of affectedness applying under the TNC associated with North Coast Rail Line and under Council's PSP6.16.

Acoustics RB Report Ref RB/18-964.R01.Rev1 (22 March 2018) has been approved by Council and is referred to in this report as the approved addendum noise report.

Subsequent to the preparation of the approved addendum noise report, the State Government gazetted new TNC's for the entire Rail Network of Queensland on 29 January 2020. The new TNC associated with any particular rail line supersedes any TNC that had previously been gazetted.

The current TNC associated with the North Coast Rail Line (NCRL) now extends over land within 250m of the nearest track of NCRL instead of the 100m which applied previously between 1 July 2015 and 28 January 2020 (inclusive).

Correspondingly, many lots which were previously identified in the approved addendum noise report in March 2018 as lying outside the TNC associated with NCRL, now lie within the extent of the new TNC.

[2] As stated in Table 5 of TTM Report Ref. 16BRA0130 R02_0, the traffic volume on Callaghan Road at 2016 had been determined to be 670 vehicles per day (AADT). The forecast traffic volume at the 10 year planning horizon, ie 2026, was 900 vehicles per day (AADT). Simply on this basis alone, it would be inappropriate to conclude that Callaghan Road would be designated as a sub-arterial road. Furthermore, it can also be readily concluded that under such a low 10 year planning horizon traffic volume (ie <1000vpd), there would be no warrant at all to consider the extent of road traffic noise intrusion onto the site.

Additionally, the State permits that the beneficial shielding effect provided by the building bulk of any approved residence may be included in any assessment of the degree of noise intrusion across a residential development. This includes residences which have been already constructed and/or approved to be constructed on lots within the Amity Estate.

In view of the recent update to the gazetted width of the TNC associated with NCRL as well as the completion of numerous approved residences on lots within the Amity Estate, Acoustics RB Pty Ltd has been engaged by APD on behalf of Dahua Pointcorp to quantify, by way of noise modelling, the expected degree of rail and road traffic noise intrusion onto the site using the underlying assumptions and calculation procedures previously adopted by TTM.

More specifically, the purpose of this report is to update the approved addendum noise report prepared in March 2018 to take account of the following matters:

5. The increase of the width of the NCRL TNC from 100m to 250m,
6. Beneficial shielding of the building bulk of approved residences on lots within Amity Estate,
7. The as-constructed noise barrier protecting lots within Stage 10 of Amity Estate, and
8. The approved form of the future noise barrier to protect lots within Stage 9 of Amity Estate.

The determination of transport noise impact onto each lot in the Amity Estate will be made on two bases:

1. In the case of rail noise intrusion, the lots lying within the current (ie new) TNC, and
2. In the case of road traffic noise intrusion, the lots lying within the 50m (if applicable) and 100m zones of road traffic noise affectedness designated by Council under PSP6.16.

To maintain consistency with the approved addendum noise report, ie Report Ref RB/18-964.R01.Rev1, this second addendum report has adopted the same general format again. This includes a summary of the results of the two assessments conducted by TTM.

2.0 Subject Site and Proposed Development

The real property description of the subject site is Lot 2 on RP185250, Lot 1 on RP170868, Lots 1 and 2 on RP171287 and Lots 1, 2 and 19 RP79384.

The approved development over the site comprises 467 allotments for residential purposes plus a number of open spaces recreation and drainage.

Refer Plan of Development No. 144097-10, dated 10 December 2019 prepared by RPS and reproduced in Figure 1.

3.0 Reports by TTM

3.1 Rail Noise Assessment Report Ref. 16BRA030 R01

Report Ref. 16BRA030 R01 *Residential Estate Callaghan Rd, Narangba - Rail Noise Assessment Report* was prepared by TTM Consulting Pty Ltd on 8 June 2016. The purpose of the approved TTM rail noise report was to determine the extent of the noise control measures that would be required to be implemented to ensure that the degree of rail noise intrusion onto the subject site achieves compliance with the noise level limits set under Module 1.1 of SDAP and DTMR's P*olicy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure, Version 2*.

Accordingly, and as noted above, to adequately control noise intrusion onto the site due to rail traffic on North Coast Rail Line, the approved TTM rail noise report presented recommendations for the construction of a noise barrier along the western extent of the site. The alignment barrier was shown in Figure 5 in Section 6.1 of the TTM report.

In addition for purposes of guidance, the report also presented a pair of noise contour plots showing the extent of rail noise intrusion across the entirety of the site. The noise level contours were presented in 5dBA bands, with the magnitude of each noise level contour band corresponding to each noise category of QDC MP 4.4.

The rail noise contour plots have been extracted from the TTM report and are re-presented in Figure 2.

In Table 8 of Section 6.2 of the TTM rail noise assessment report, further information was provided with respect to lots which were considered to be "noise-affected".

Table 8 of that report is reproduced below.

Table 8: Noise Affected Lots

Floor	Noise Affected Lots (QDC Noise Category 1 or higher)
Ground and First Floor	1-29, 37-54, 69-84, 102-110, 157-159, 186-190, 232, 233, 249-268, 273-467
First Floor only	30-36, 55-61, 65-68, 85-88, 100-101, 142, 143, 160-163, 183-185, 191, 214-220, 230, 231, 234-236, 246-248, 269-271,

By reference to the noise contour plots presented in Figure 2 and the details presented above in Table 8 extracted from the rail noise assessment report, it can be seen that approximately ¾ of the 467 allotments were considered to be "noise-affected" in the TTM report.

3.2 Road Traffic Assessment Report Ref. 16BRA0130 R02_0

Report Ref. 16BRA0130 R02_0 *Residential Estate Callaghan Rd, Narangba – Road Traffic Noise Assessment Report* was prepared by TTM Consulting Pty Ltd on 14 August 2016. The purpose of this TTM report was to determine the extent of the noise control measures that would be required to be implemented to ensure that the degree of road traffic noise intrusion onto the subject site achieves compliance with the noise level limits set under Module 1.1 of SDAP and DTMR's P*olicy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure, Version 2*.

Accordingly, and as noted above, to adequately control noise intrusion onto the site due to road traffic, the TTM report presented recommendations for the construction of a noise barrier along the western extent of the site. The alignment barrier was shown in Figure 5 in Section 6.1 of the report. It is noted that this barrier was required to control noise intrusion from Burpengary Road only. For perfectly understandable reasons, there was no recommendation made in the TTM report for the construction of a barrier along the boundary with Callaghan Road.

In addition and for purposes of guidance, the report also presented a pair of noise contour plots showing the extent of road traffic noise intrusion across the entirety of the site. These noise contours were presented in 5dBA bands, with the noise contour bands again corresponding to the noise categories of QDC MP 4.4.

The road traffic noise contour plots have been extracted from the TTM report and are re-presented in Figure 3.

In Table 8 of Section 6.2 of the TTM road traffic noise assessment report, further information was provided with respect to lots which were considered to be "noise-affected".

Table 8 of that report is reproduced below.

Table 8: Noise Affected Lots

QDC Noise Category	Lots requiring further acoustic design	
	Ground Floor	First Floor
4	N/A	N/A
3	N/A	N/A
2	N/A	302 - 318
1	302 - 318	8, 288, 319, 347

By reference to the noise contour plots presented in Figure 3 and the details presented above in Table 8 extracted from the rail noise assessment report, it can be seen that 11 of the 467 allotments have been considered to be "noise-affected" with respect to road traffic noise intrusion, ie very substantially fewer than the ¾ of the 467 allotments considered to be "noise-affected" due to rail noise intrusion.

In addition, it can be seen that only one lot located in proximity to Callaghan Road, ie Lot 8, was identified as being noise-affected by road traffic noise intrusion. Furthermore, the applicable QDC MP 4.4 noise category for this lot was determined to be Noise Category 1 with this designation applying solely to the first floor level of a highset residence constructed on Lot 8. It is noted that Noise Category 1 is the lowest category applying to noise affected lots. Notwithstanding the requirement to implement relatively minor building upgrades under the deemed-to-comply upgrade schedules of QDC MP 4.4, it has been determined that, almost invariably, when a site-specific acoustical design review of the residence is conducted, there is no requirement to implement any acoustical upgrades at all.

As discussed above in Section 2.0 at Footnote 2, the traffic volume on Callaghan Road at 2016 was determined to be 670 vehicles per day (AADT). (Ref. Table 5 of TTM Report Ref. 16BRA0130 R02_0.) The forecast traffic volume at the 10 year planning horizon, ie 2026, was only 900 vehicles per day (AADT). Simply on this basis alone, it would be inappropriate to conclude that Callaghan Road would be designated as a sub-arterial road. Furthermore, it can also be readily concluded that for such a low 10 year planning horizon traffic volume (ie <1000vpd), there would be no requirement at all to consider the extent of road traffic noise intrusion onto the site.

Accordingly, it is considered there is no warrant to either evaluate or consider the effect of noise intrusion onto the site due to road traffic on Callaghan Road.

4.0 Extent of Transport Noise Intrusion

4.1 Examination of Applicability of QDC MP 4.4 *Buildings in a Transport Noise Corridor*

Section 8 *Assessment of Road Traffic and Railway Noise* of SC 6.16 *Planning Scheme Policy – Noise* outlines the process for establishing acceptable acoustical amenity at sites impacted by noise from roads and railways.

At Section 8.1 *Reconfiguring a Lot* of SC 6.16, it is stated:

> "The [transport noise impact] assessment is to be in accordance with MP 4.4 of the QDC. The assessment is to identify the noise category applicable to each lot in the proposed development for both lower and first floor levels. Noise categories are defined in Schedule 3 of MP 4.4."

The purpose of QDC MP 4.4 is to ensure control of transport noise intrusion into particular residential buildings, specifically "relevant residential buildings", where a relevant residential building must be located within a Transport Noise Corridor (TNC) as defined at Chapter 8B of *Building Act 1975*.

Having regard to Chapter 8B of *Building Act 1975*, it is observed that (i) a TNC for any road may be gazetted in accordance with Section 246X and Section 246Y or Section 246Z and Section 246ZA, while (ii) a TNC for any railway may be gazetted in accordance with only Section 246Z and Section 246ZA. Sections 246X and 246Y relate to gazettal of TNC's by a local government in Queensland whereas Sections 246Z and 246ZA relate to gazettal of TNC's by the State Government.

4.1.1 Applicability of QDC MP 4.4 to Control Rail Noise Intrusion

On 1 July 2015, the State Government first gazetted a TNC for NCRL. At that time, the TNC applied solely to land within a distance of 100m either side of the nearest railway track.

On 29 January 2020, the State Government gazetted new TNC's for the entire Rail Network of Queensland. The new TNC's supersedes any TNC's that were gazetted previously. The current TNC associated with NCRL now extends over land within 250m of the nearest track of the rail line instead of the 100m which applied previously between 1 July 2015 and 28 January 2020 (inclusive).

In these circumstances, all "relevant residential buildings" on land within 250m of the nearest railway track of NCRL must be designed and constructed in accordance with Schedules 1 and 2 or Schedule 3 of QDC MP 4.4 in order to adequately control rail noise intrusion to each habitable space.

4.1.2 Applicability of QDC MP 4.4 to Control Road Traffic Noise Intrusion

On the other hand, it is noted that neither MBRC nor the Queensland Government has yet gazetted a TNC for Burpengary Road. As a result, the provisions of QDC MP 4.4 are not triggered in order to control road traffic noise intrusion. Consequently, for road traffic noise, it is not appropriate to apply QDC MP 4.4 as a basis for building design.

Further discussion re this matter is presented in Attachment A of this report.

Notwithstanding, and as discussed with Council, it is noted that at Section 5 of QDC MP 4.4, AS3671-1989 *Acoustics – Road traffic noise intrusion - Building siting and construction* and AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors* are both cited as referenced documents for QDC MP 4.4. In fact, the minimum R_w ratings set at Schedule 1 of the Code have been derived directly by application of the calculation methods of AS3671-1989 to achieve compliance with the recommended internal sound levels of AS/NZS 2107:2016.

Furthermore, when undertaking a site-specific acoustical design review of any relevant residential building located within a TNC, QDC MP 4.4 permits such assessments to be conducted using the more refined and more accurate noise level calculation methods of AS3671-1989 to achieve compliance with the recommended internal sound levels of AS/NZS 2107:2016.

Finally, prior to the introduction of QDC MP 4.4 on 1 September 2010, all assessments to determine the degree of upgrade required to be implemented into any noise-affected residence located on land adjoining a State-controlled road were conducted using the methods of AS3671-1989 to achieve compliance with the recommended internal sound levels of AS/NZS 2107:2016 [3].

Consequently, the appropriate means of achieving adequate control of road traffic noise intrusion is to apply the more robust methodology of the calculation methods of AS3671-1989 to the design of noise-affected residences, with the goal being to achieve compliance with the recommended internal sound levels of AS/NZS 2107:2016. This method has been adopted successfully for other recently approved developments within the bounds of MBRC as well as in other local authority jurisdictions where gazettal of TNC's is yet to occur, notably Ipswich City Council.

Finally, it should be noted that, notwithstanding the fact that it is quite reasonable to conclude that QDC MP 4.4 cannot be applied to the current circumstances, the net result of adoption of the more robust methodology of calculation discussed above will be to achieve a more rigorous and more efficient acoustical outcome for the design of the noise-affected dwellings than would have resulted from an application of QDC MP 4.4.

4.1.3 Application of Construction Categories of AS3671-1989 to Control Road Traffic Noise

A discussion of AS3671-1989 together with the appropriate method of applying the calculation procedures of the Standard is presented below. Further information is presented in Attachment B following.

AS3671-1989 sets Construction Categories by reference to $L_{Aeq,T}$ noise levels, notably $L_{Aeq,1hr\ night}$ [4] and $L_{Aeq,1hr\ day}$ [5]. Noise level prediction programs determine road traffic noise levels in terms of the $L_{10(18hour)}$ [6] noise level parameter. The offsets between $L_{10(18hour)}$ and the day and night $L_{Aeq,T}$ values are site-specific and depend upon the hourly distribution of road traffic.

[3] At that time, ie prior to 1 September 2010, the version of the standard current at that time was AS/NZS 2107:2000.

[4] $L_{Aeq,1hr\ night}$ is defined as the maximum rolling average $L_{Aeq,1hr}$ value from 10:00pm to 6:00am, where the integrating time for $L_{Aeq,T}$ (ie equal energy) values used to determine the $L_{Aeq,1hr}$ value is typically 10minutes or 15 minutes.

[5] $L_{Aeq,1hr\ day}$ is defined as the maximum rolling average $L_{Aeq,1hr}$ value from 6:00am to 10:00pm, where the integrating time for $L_{Aeq,T}$ (ie equal energy) values used to determine the $L_{Aeq,1hr}$ value is typically 10minutes or 15 minutes.

[6] $L_{10(18hour)}$ is defined by DTMR in their *Road Traffic Noise Management: Code of Practice* and by UK DoE in their *Calculation of Road Traffic*, as the arithmetic mean of each of the eighteen hourly $L_{10,1hr}$ levels between 6:00am and 12:00 midnight on an average weekday where $L_{10,1hr}$ is the noise level measured in dBA that is exceeded for 10% of the specific one hour period. While this terminology is not in strict accordance with the recommendations of Standards Australia because it does not identify the A-weighting requirement, it is adopted here to maintain consistency with common practice and with the terminology of CRTN '88 SDAP *Module 1* and DTMR's *Code of Practice*.

To establish offsets which can be used satisfactorily in most commonly encountered situations, it is appropriate to refer to standard offset values derived from an extensive study of a large number of comparable sites in SE Queensland located adjacent to major roads [7]. When this is done, the relevant Construction Categories can be determined in terms of the predicted $L_{10(18hour)}$ value directly.

The derivation of the bounds of the Construction Categories is presented in Attachment B.

From the results presented in Attachment B, it can be seen that Construction Category 1 means that the relevant level of the dwelling (ie lower or first floor level) is subjected to noise levels that do not exceed 48dBA $L_{10(18hour)}$ facade-corrected. For any dwellings subject to Construction Category 1, there will be no requirement to apply any specific acoustical upgrades to the design of the relevant level of the dwelling.

Construction Category 2 means that the relevant level of the dwelling (ie lower or first floor level) is subjected to noise levels in the range 48dBA to 63dBA $L_{10(18hour)}$ facade-corrected. By reference to AS3671-1989 *Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction*, "standard construction (ie brick veneer), except for the lightweight elements such as fibre cement or metal cladding or all-glass facades" is deemed to be adequate to control noise intrusion for dwellings within the Construction Category 2 band, provided all windows and external doors to the dwelling are closed.

Construction Category 3 means that the relevant level of the dwelling (ie lower or first floor level) is subjected to noise levels in the range 63dBA [8] to 73dBA $L_{10(18hour)}$ facade-corrected.

Similarly, Construction Category 4 means that the relevant level of the dwelling (ie lower or first floor level) is subjected to noise levels exceeding 73dBA $L_{10(18hour)}$ facade-corrected.

For both of these higher Construction Categories, the design of the dwelling will need to be reviewed acoustically to ensure that the level of road traffic noise intrusion is adequately controlled.

(For purposes of initial guidance only, standard brick veneer or blockwork wall construction would normally be satisfactory in most instances to deal with external noise levels up to 63dBA $L_{10(18hour)}$ facade-corrected, ie for Construction Category 2 dwellings. For Construction Category 3 and 4 dwellings, however, it will be necessary to (i) upgrade the acoustical performance of windows and external sliding glass doors beyond standard STC/R_w 23 performance and (ii) close windows and external doors. Further guidance is provided in AS3671-1989 *Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction*.)

[7] Brown, AR & Brown, HD *A Re-Examination of the Relationship Between the $L_{10(18hour)}$ Noise Level Parameter and Other Road Traffic Noise Level Parameters,* proc. Joint Conference of Australian and New Zealand Acoustical Societies, Brisbane, 2016.

[8] DTMR and several local authorities in SE Queensland apply this limit of 63dBA $L_{10(18hour)}$ facade-corrected as the basis of setting limits for acceptable levels of road traffic noise intrusion onto residential allotments situated adjacent to major roads.

4.2 Noise Models and Modelling Inputs and Assumptions

4.2.1 Rail Noise Model

As required by Queensland Rail (QR), the prediction of airborne rail traffic noise intrusion onto the site has been conducted using the Kilde 130 [9] noise level prediction algorithms endorsed by QR and as applied by the SoundPLAN [10] computer program.

The input to the noise model included the lot layout and earthworks contours which were imported directly from electronic files provided by the Project Surveyor and Project Civil Engineer, respectively.

Further inputs were derived from the approved TTM rail noise report as well as information provided by QR with respect to rail alignment, train type, acoustic source height for each type of train, train length, train speeds and source noise levels for the relevant type of train, ie MaxL at 10m and 25m.

The noise model was configured to predict $L_{Max\ passby}$ noise levels. As required by the QDC, the facade-corrected $L_{Amax\ passby}$ noise levels are to be used as the basis for determining the extent of rail noise intrusion [11].

The calculations also took account of the various site-specific variables which influence the level of rail noise emission onto the site.

These included:

- Topographical shielding
- Distance from rail tracks
- Shielding provided by existing structures, including recently constructed noise barriers and residences on the site
- Shielding provided by approved, yet to be constructed, noise barriers (location and heights as per each of the approved TTM noise reports)
- Vertical and horizontal alignment of rail line
- Reflection from opposite facades, if any
- Angle of view to rail line
- Receptor height

[9] *Nordic Rail Traffic Noise Prediction Method* prepared for The Nordic Council of Ministers' Noise Group, NBG, December 1984. The Kilde 130 methodology is the set of noise prediction algorithms endorsed by QR

[10] SoundPLAN is an integrated software package for noise and air pollution evaluation developed in Germany by Braunstein + Berndt GmbH. It has been configured to predict the extent of (i) rail noise intrusion by application of the Kilde 130 rail noise intrusion algorithms, (ii) by application of the CRTN '88 road traffic noise intrusion algorithms and (ii) by application of the CONCAWE industrial noise emission algorithms. It is in use in more than 48 countries and has had widespread application throughout Australia. It is endorsed by DTMR, SCRC, Brisbane City Council, Queensland DES and most other State environmental authorities.

[11] Notwithstanding the slight differences in definition between $L_{Amax\ passby}$ as applied by SoundPLAN and Single Event Maximum Noise Level as designated by QR, for the purposes of assessment against the requirements of QDC MP 4.4, both metrics can be considered to be interchangeable.

4.2.2 Road Traffic Noise Model

The prediction of road traffic noise intrusion onto the site has been conducted using the CRTN '88 [12] algorithms as applied by the SoundPLAN computer program.

To maintain consistency with the rail noise assessment conducted over the site, the same noise model has been updated and extended to include Burpengary Road at Year 2026 (ie the 10-year planning horizon adopted in the approved TTM road traffic noise report).

In addition, the traffic volume, vehicle mix and road speed information for Burpengary Road under both contemporary and design conditions applicable at the time of the original DA (ie Year 2016 and Year 2026, respectively) have been derived from traffic volume data detailed in the approved TTM road traffic noise report.

This information is re-stated below in Table 1.

Road Traffic Parameter	Year	
	2016	2026
Traffic Volume	4560 AADT	6101 AADT
Percentage Heavy Vehicles	4.0%	4.0%
Traffic Speed	80 km/h (posted speed limit)	80 km/h (posted speed limit)
Road Surface	Chip seal	Chip seal (assumed)

Table 1 – Road Traffic Parameters – Burpengary Road

The calculations also took account of the various site-specific variables which influence the level of road traffic noise emission onto the site.

These variables included the following.

- Site topography
- Distance from road
- Shielding provided by existing structures, including recently constructed noise barriers and residences on the site
- Shielding provided by approved but yet-to-be-constructed noise barriers (location and heights as per each of the approved TTM noise reports)
- Vertical and horizontal alignment of road
- Reflection from opposite facades, if any
- Angle of view to road
- Receptor height

[12] "Calculation of Road Traffic", UK DoE, HMSO, 1988. This is the method endorsed by Queensland Department of Transport and Main Roads and various local authorities.

4.3 Validation of Transport Noise Models

4.3.1 Validation of Rail Noise Model

This Kilde 130 methodology has been shown to achieve good correlation with measured noise levels, especially at short distance from the rail line. Notwithstanding, it is appropriate to undertake a validation process for any new rail noise prediction model to confirm the suitability of the Kilde 130 algorithms at the site. Ideally, such validation should take account of both the $L_{Aeq(24hour)}$ and $L_{Max\ passby}$ noise level parameters.

By reference to the approved TTM rail noise report, the measured and predicted free-field noise levels at the reference location (shown in Figure 2 of that report) are each re-stated below in Table 2.

Parameter	Measured Value (dBA)	Predicted Value (dBA)
$L_{Aeq(24hour)}$	unknown	unknown
$L_{Max\ passby}$	91	91

Table 2 – Validation Results Presented in Approved TTM Rail Noise Report

As is evident from Table 2, no validation of the $L_{Aeq(24hour)}$ noise level parameter was presented in the approved TTM rail noise report. Nevertheless, the rail noise modelling undertaken by TTM achieved a very high degree of fit to the $L_{Max\ passby}$ noise level derived by way of measurement. In view of this, it is reasonable to expect that the resultant $L_{Max\ passby}$ noise level predictions will closely match the actual $L_{Max\ passby}$ noise levels expected across the site.

To ensure consistency with the results presented in the approved TTM rail noise report, the results of the noise model described above in Section 4.2.1 was validated against the 91dBA $L_{Max\ passby}$ noise level predicted by TTM at the same reference location. The results of the validation are presented below in Table 3.

Parameter	TTM Measured Value (dBA)	TTM Predicted Value (dBA)	Acoustics RB Predicted Value (dBA)
$L_{Max\ passby}$	91	91	90.6

Table 3 – Validation Results of Approved Report vs New Model

As can be seen in Table 3, at the reference location, the $L_{Max\ passby}$ noise level was predicted to be 90.6dBA. This agrees to within 0.5dBA of the measured noise level of 91dBA. This is a very good match.

4.3.2 Validation of Road Traffic Noise Model

The CRTN '88 algorithms have been validated for Australian conditions. Even so, it has been well established that the algorithms generally over-predict the level of road traffic noise.

The extent of the over-prediction tends to be site-specific. The degree of over-prediction is generally greater at sites with complex topography and significant distances of separation from the road as well as at sites located adjacent to signalised intersections.

In situations where the road has been formed and is operating with significant volumes of traffic, it is appropriate to conduct noise level measurements under the existing road traffic conditions. The results of these measurements can be used to validate/calibrate the noise prediction model for the site or the development.

By reference to Figure 2 of the approved TTM road traffic noise report, it is observed that road traffic noise level measurements were conducted at two reference locations in August 2016. Of the two measurement locations, Logger A has been identified as the appropriate reference location for measuring and calibrating road traffic noise levels from Burpengary Road.

The measured and predicted free-field noise levels at this reference location that have been established in the approved TTM road traffic noise report are re-stated below in Table 4.

Parameter	Measured Value (dBA)	Predicted Value (dBA)
$L_{A10(18hour)}$	65	65

Table 4 – Validation Results Presented in Approved TTM Road Traffic Noise Report

As is evident from Table 4, the road traffic noise modelling undertaken by TTM achieved a very high degree of fit to the measured $L_{A10(18hour)}$ noise level at the reference location. In view of this, it is reasonable to expect that the resultant $L_{A10(18hour)}$ noise level predictions will closely match the actual $L_{A10(18hour)}$ noise levels expected across the site.

To ensure consistency with the results presented in the approved TTM road traffic noise report, the results of the noise model described above in Section 4.1.2 were validated against the 65dBA $L_{A10(18hour)}$ noise level predicted by TTM at the same reference location. The results of the validation are presented below in Table 5.

Parameter	TTM Measured Value (dBA)	TTM Predicted Value (dBA)	Acoustics RB Predicted Value (dBA)
$L_{A10(18hour)}$	65	65	65

Table 5 – Validation Results of Approved Report vs New Model

As can be seen in Table 5, the free field $L_{10(18hour)}$ noise level due to road traffic on Burpengary Road was predicted to be 65dBA. This agrees directly with the measured noise level of 65dBA.

4.4 Rail Noise Prediction Scenarios and Resultant QDC MP 4.4 Noise Categories

Predictions of the extent of rail noise intrusion onto the site have been prepared for each of the habitable levels of detached residences which may be constructed on lots within the TNC associated with NCRL.

The resultant facade-corrected $L_{Max\ passby)}$ noise contour plots are presented at 5dBA intervals (that accord with each QDC MP 4.4 noise category) in the following figures:

- Figure 5: QDC MP 4.4 Noise Categories and $L_{Max\ passby}$ facade-corrected noise levels at mid-window level of ground floor level of residences within TNC
- Figure 6: QDC MP 4.4 Noise Categories and $L_{Max\ passby}$ facade-corrected noise levels at mid-window level of first floor level of highset residences within TNC

By reference to the QDC MP 4.4 noise category contours presented in Figures 9 and 10, the noise categories that will apply to the 121 lots located within the TNC (ie Lots 233-347 and Lots 355-360) are summarised overpage in Table 6.

Note:

Where more than one noise category band intrudes onto a lot, the higher/highest noise category is deemed to apply to the particular lot. By contrast, it is the placement of the residence on the lot that will determine the noise category/s applying to the design of the residence. Consequently, while part of a lot may be determined to lie within a particular noise category band, depending on the building setback, the residence may lie either (i) within one band, (ii) within a lower band or (iii) outside the TNC entirely. For lots affected in this way, an asterisk has been placed next to a noise category designation for the particular lot shown in Table 6.

In the case of Lots 233-242 and 355-360, the asterisk indicates that there is a very minor degree of intrusion (ie 4.2m) of the TNC onto the front of the lot. Assuming that front setback requires that the habitable spaces of the residence be constructed at least 4.2m from the front boundary, the residence on any of Lots 233-242 and 355-360 would lie outside the TNC.

For all other lots, the asterisk denotes that the lot is located within two or more noise category bands. For these lots, the actual placement of the dwelling on the lot will determine which of the noise category/s will apply to the lower or upper level of the residence, as applicable.

Lot No	QDC MP 4.4 Noise Category by Floor Level		Lot No	QDC MP 4.4 Noise Category by Floor Level		Lot No	QDC MP 4.4 Noise Category by Floor Level	
	Ground	First		Ground	First		Ground	First
233	0*	1*	274	1	2	315	3	4
234	0*	1*	275	1	2	316	2	4
235	0*	0*	276	1	2	317	2	4
236	0*	0*	277	1	2*	318	2	4
237	0*	0*	278	1	1	319	2	3
238	0*	0*	279	1	1	320	2	2
239	0*	0*	280	1	1	321	2	2
240	0*	0*	281	1	1	322	2	2
241	0*	0*	282	1	1	323	2	2
242	0*	0*	283	1	1	324	1	2
243	1	1	284	1	1	325	1	2
244	1	1	285	1	2	326	1	2
245	1	1	286	1	2	327	1	1
246	1	1	287	1	2	328	1	1
247	1	1	288	2	2	329	1*	1
248	1	1	289	2	2	330	0	1
249	1	1	290	2	2	331	0	1
250	1	1	291	2	2	332	0	1
251	1	1	292	2	2	333	0	1
252	1	1	293	1	2	334	0	1
253	1	1	294	1	2	335	0	1
254	1	1*	295	1	2	336	1*	1
255	1*	0	296	1	2	337	1*	1
256	1	0	297	1	2	338	1*	1
257	0	0	298	1	2	339	2	1
258	1	1	299	1	2	340	2*	2
259	1	1	300	1	2	341	1	2
260	1	1	301	2*	2	342	2*	2
261	1	1	302	2	3	343	2	2
262	1	1	303	2	3	344	2	2
263	1	1	304	2	3	345	2	2
264	1	1	305	2	3	346	2	3
265	1	1	306	2	4*	347	2	3
266	1	1	307	2	4	355	0*	0*
267	1	1	308	2	4	356	0*	0*
268	1	1	309	2	4	357	0*	0*
269	1	1	310	2	4	358	0*	0*
270	1	1	311	3	4	359	0*	0*
271	1	1	312	2	4	360	0*	0*
272	1	1	313	3	4			
273	1	2	314	1	4			

Table 6 – QDC MP 4.4 Noise Categories Applying to Lots within TNC

4.5 Road Traffic Noise Prediction Scenarios and Resultant Requirement for Noise Control

Predictions of the extent of road traffic noise intrusion onto the site have been prepared for each of the occupied levels of the development within 100m of Burpengary Road. The facade-corrected $L_{A10(18hour)}$ noise contour plots are presented at 5dBA intervals. For the purposes of comparison of the extent of road traffic noise intrusion onto the lots within 100m of Burpengary Road against the extent of rail noise intrusion onto the same lots, the 5dBA interval contours have been matched directly to the QDC MP 4.4 noise category bands.

This is notwithstanding the fact that, as discussed above in Section 4.1.2, it is inappropriate to adopt QDC MP 4.4 as the basis for building design to control road traffic noise intrusion onto the site. Rather, the QDC MP 4.4 noise category banding has been adopted for evaluating the extent of road traffic noise intrusion simply to determine whether the requirement to adequately control rail noise intrusion will take precedence over the requirement to control road traffic noise intrusion.

Or, more specifically, if it is determined that the noise category band applying to a lot as a result of rail noise intrusion is equal to or greater than that applying to road traffic noise intrusion, it can be concluded that any acoustical upgrades required to be implemented into the design of a residence on the particular lot to control rail noise intrusion will also adequately deal with the requirement to control road traffic noise intrusion.

The resultant road traffic noise level plots are presented in the following figures.

- Figure 7: Equivalent QDC MP 4.4 Noise Categories and $L_{A10(18hour)}$ facade-corrected noise levels at mid-window level of ground floor level of residences within 100m of Burpengary Road
- Figure 8: Equivalent QDC MP 4.4 Noise Categories and $L_{A10(18hour)}$ facade-corrected noise levels at mid-window level of first floor level of highset residences within 100m of Burpengary Road

By reference to the equivalent QDC MP 4.4 noise category contours presented in Figures 11 and 12, the noise categories that will apply to the 51 lots located within 100m of Burpengary Road (ie Lots 273-321, 346 and 347) are summarised overpage in Table 7.

The resultant schedule of dominant transport noise sources (ie for each lot, the type of transport noise source resulting in the higher QDC MP 4.4 noise category) for the 51 lots located within 100m of Burpengary Road is presented in Table 8 overpage.

Lot No	QDC MP 4.4 Noise Category by Floor Level		Lot No	QDC MP 4.4 Noise Category by Floor Level		Lot No	QDC MP 4.4 Noise Category by Floor Level	
	Ground	First		Ground	First		Ground	First
273	0*	0*	290	0	0	307	1*	3*
274	0*	0*	291	0	0	308	1*	3*
275	0*	0*	292	0	0	309	1*	3*
276	0*	0*	293	0	0	310	0	3*
277	0*	0*	294	0	0	311	1	3*
278	0*	0*	295	0	0	312	1*	3*
279	0*	0*	296	0	0	313	1	3*
280	0*	0*	297	0	0	314	1*	3*
281	0*	0*	298	0	0	315	1	3*
282	0*	0*	299	0	1	316	1	3*
283	0*	0*	300	0	1	317	1	3*
284	0*	0*	301	0	1	318	0	3*
285	0*	0*	302	0	3*	319	0	1
286	0*	0*	303	1	3*	320	0	1
287	0*	0*	304	1	3*	321	0	0
288	0	0	305	1*	3*	346	0	0*
289	0	0	306	1*	3*	347	0	1

Table 7 – Equivalent QDC MP 4.4 Road Traffic Noise Categories Applying to Lots within 100m of Burpengary Road

Lot No	QDC MP 4.4 Noise Category by Floor Level		Lot No	QDC MP 4.4 Noise Category by Floor Level		Lot No	QDC MP 4.4 Noise Category by Floor Level	
	Ground	First		Ground	First		Ground	First
273	Rail	Rail	290	Rail	Rail	307	Rail	Rail
274	Rail	Rail	291	Rail	Rail	308	Rail	Rail
275	Rail	Rail	292	Rail	Rail	309	Rail	Rail
276	Rail	Rail	293	Rail	Rail	310	Rail	Rail
277	Rail	Rail	294	Rail	Rail	311	Rail	Rail
278	Rail	Rail	295	Rail	Rail	312	Rail	Rail
279	Rail	Rail	296	Rail	Rail	313	Rail	Rail
280	Rail	Rail	297	Rail	Rail	314	Rail	Rail
281	Rail	Rail	298	Rail	Rail	315	Rail	Rail
282	Rail	Rail	299	Rail	Rail	316	Rail	Rail
283	Rail	Rail	300	Rail	Rail	317	Rail	Rail
284	Rail	Rail	301	Rail	Rail	318	Rail	Rail
285	Rail	Rail	302	Rail	Rail	319	Rail	Rail
286	Rail	Rail	303	Rail	Rail	320	Rail	Rail
287	Rail	Rail	304	Rail	Rail	321	Rail	Rail
288	Rail	Rail	305	Rail	Rail	346	Rail	Rail
289	Rail	Rail	306	Rail	Rail	347	Rail	Rail

Table 8 – Dominant QDC MP 4.4 Noise Category Applying to Lots within 100m of Burpengary Road

5.0 Discussion

From the results presented in Table 6 above and Figure 5, it can be seen that presently, at the ground floor level, 119 of the 121 lots within the NCRL TNC will be situated within the QDC MP 4.4 Noise Category 0, 1 and 2 bands. Three lots will lie partially within the Noise Category 3 band. Importantly, there will be no lots lying within the Noise Category 4 band.

From the results presented in Table 6 above and Figure 6, it can be seen that presently, at the first floor level, 109 of the 121 lots within the NCRL TNC will be located within the QDC MP 4.4 Noise Categories 0, 1, 2 and 3 bands. Thirteen lots will lie within the Noise Category 4 band.

Notwithstanding, it is important to note that, on 16 lots (ie Lots 233-242 and 355-360), it is fully expected that the placement of the residential building on the lot will be such that, even though a small part of the lot will be subject to the designated noise category shown in Table 6, the residence itself will be set back sufficiently from the boundary that the both floor levels of any residence will lie outside the NCRL TNC.

From the results presented in Tables 7 and 8 above, it can be seen that the dominant source of transport noise intrusion onto the lots within 100m of Burpengary Road is movements on the rail line.

In view of this, it can be concluded that any acoustical upgrades required to be implemented into design of a residence on the particular lot to control rail noise intrusion will also adequately deal with the requirement to control road traffic noise intrusion. Consequently, there will be no requirement to consider the impact of road traffic noise intrusion onto any lot [13].

Notwithstanding the outcome above, there is one further point to make.

Each of the residences located on lots within the NCRL TNC will need to be designed acoustically at BA in accordance with the requirements of QDC MP 4.4. It has been well-established that when considering the degree of noise intrusion from electric train passbys, the deemed-to-comply constructions set by QDC MP 4.4 usually result in compliance with the 45-50dBA target range set by QDC MP 4.4.

By contrast, when the same deemed-to apply acoustical performance requirements are applied to the same level of noise from diesel passbys, the resultant internal noise levels are significantly higher [14]. This results in noise levels which very frequently may be above the 45-50dBA target range set by QDC MP 4.4. Depending on the design of the facade of a residence, exceedances of the target internal noise levels to the tune of 5dBA to 8dBA may be encountered.

When this situation has arisen previously on other occasions, the advice from the relevant Building Certifier/s has been that the assessment of the extent of building upgrade is to be conducted by reference to the deemed-to-apply acoustical performance ratings set by Schedule 1 of QDC MP 4.4.

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[13] In addition and as noted in Section 3.2, the traffic volume on Callaghan Road at 2016 was determined to be 670 vehicles per day (AADT). (Ref. Table 5 of TTM Report Ref. 16BRA0130 R02_0.) The forecast traffic volume at the 10 year planning horizon, ie 2026, was only 900 vehicles per day (AADT). Simply on this basis alone, it would be inappropriate to conclude that Callaghan Road would be designated as a sub-arterial road. Furthermore, it can also be readily concluded that for such a low 10 year planning horizon traffic volume (ie <1000vpd), there would be no requirement at all to consider the extent of road traffic noise intrusion onto the site.

[14] This outcome as a direct result of there being a higher level of low frequency sound energy within the noise levels generated by diesel passbys compared to that generated by electric passbys. The acoustical performance of all building elements is frequency-dependent. This is exemplified by the fact that as the sound frequency increases, so does the performance of the building element. As a result, any particular building element (eg a window) will better control noise intrusion from electric passbys than it will for diesel passbys. Correspondingly, to achieve the same internal noise levels from diesel passbys electric passbys, higher R_w rated building elements will be required for diesel passbys than will be required for electric passbys, or for that matter, required by the deemed-to-comply constructions under QDC MP 4.4.

This is notwithstanding the fact that the level of noise transmitted by diesel passbys into habitable spaces will generally be higher than the upper end of the 45-50dBA target range set by QDC MP 4.4.

Rather, the advice is based on the following:

(i) An acceptance that the deemed-to-apply ratings set by Schedule 1 of QDC MP 4.4 provide an acceptable level of control of rail noise intrusion from both electric and diesel trains, and

(ii) The acknowledgement that the determination of the specific deemed-to-comply constructions in Schedule 2 of QDC MP 4.4 can be best made by reference to the actual site-specific noise categories that apply to the particular residence which are determined by reference to results of the relevant Noise Impact Assessment Report.

6.0 Conclusions

From the results of the assessment presented above, the following conclusions can be drawn:

- The actual noise categories applying to the 121 lots located within the TNC associated with NRCL are presented in Table 6. As permitted under the site-specific assessment provisions of QDC MP 4.4, the noise categories shown in Table 6 may be used to guide the subsequent acoustical design at BA of each of the residences on Lots 233-347 and 355-360.
- Notwithstanding, it is important to note that, on 16 lots (ie Lots 233-242 and 355-360), it is fully expected that the placement of the residential building on the lot will be such that, even though a small part of the lot will be subject to the designated noise category shown in Table 6, the residence itself will be set back sufficiently from the boundary that the both floor levels of any residence will lie outside the NCRL TNC.
- From the results presented in Tables 7 and 8 above, it can be seen that the dominant source of transport noise intrusion onto the lots within 100m of Burpengary Road is movements on the rail line. In view of this, it can be concluded that any acoustical upgrades required to be implemented into design of a residence on the particular lot to control rail noise intrusion will also adequately deal with the requirement to control road traffic noise intrusion. Consequently, there will be no requirement to consider the impact of road traffic noise intrusion onto any lot.

7.0 Recommendation

As noted above in Section 4.0, on 29 January 2020, the State Government gazetted new Transport Noise Corridors (TNC) for the entire Rail Network of Queensland. At the subject site, the width of the TNC associated with North Coast Rail Line has increased from 100m to 250m, resulting a larger number of lots being designated as affected by rail noise intrusion and was previously the case.

In addition, over the last two years, a 2.4m high noise barrier has been constructed along the SW boundary of Stage 10 of Amity Estate. Furthermore, in the same time period, number of residences have been constructed on Stage 10.

As a result, it is appropriate to update the most-recently approved transport noise report for Amity Estate to take account of the increase in width of the TNC as well as the beneficial shielding provided by the recently-constructed residences as well as the noise barrier constructed to Stage 10 and the future barrier required to be constructed to protect lots within Stage 9.

When these changes are taken into account, the resultant degree of rail noise intrusion onto Stages 9 and 10 will be as shown in Figures 5 and 6. Correspondingly, the resultant QDC MP 4.4 noise categories applying to lots within Stages 9 and 10 will be as shown in Table 6.

Note:

As discussed in Section 5.0, any acoustical upgrades required to be implemented into design of a residence on the particular lot to control rail noise intrusion will also adequately deal with the requirement to control road traffic noise intrusion. Consequently, there will be no requirement to consider the impact of road traffic noise intrusion onto any lot.

We trust that this information is adequate for your purposes at this stage, but should you require any further information, please do not hesitate to contact us.

Regards,
Acoustics RB Pty Ltd

Hugh Brown,
Project Engineer
BEng(Mech)(Hons)

Reviewed and approved by:

Russell Brown,
Director
RPEQ 2799

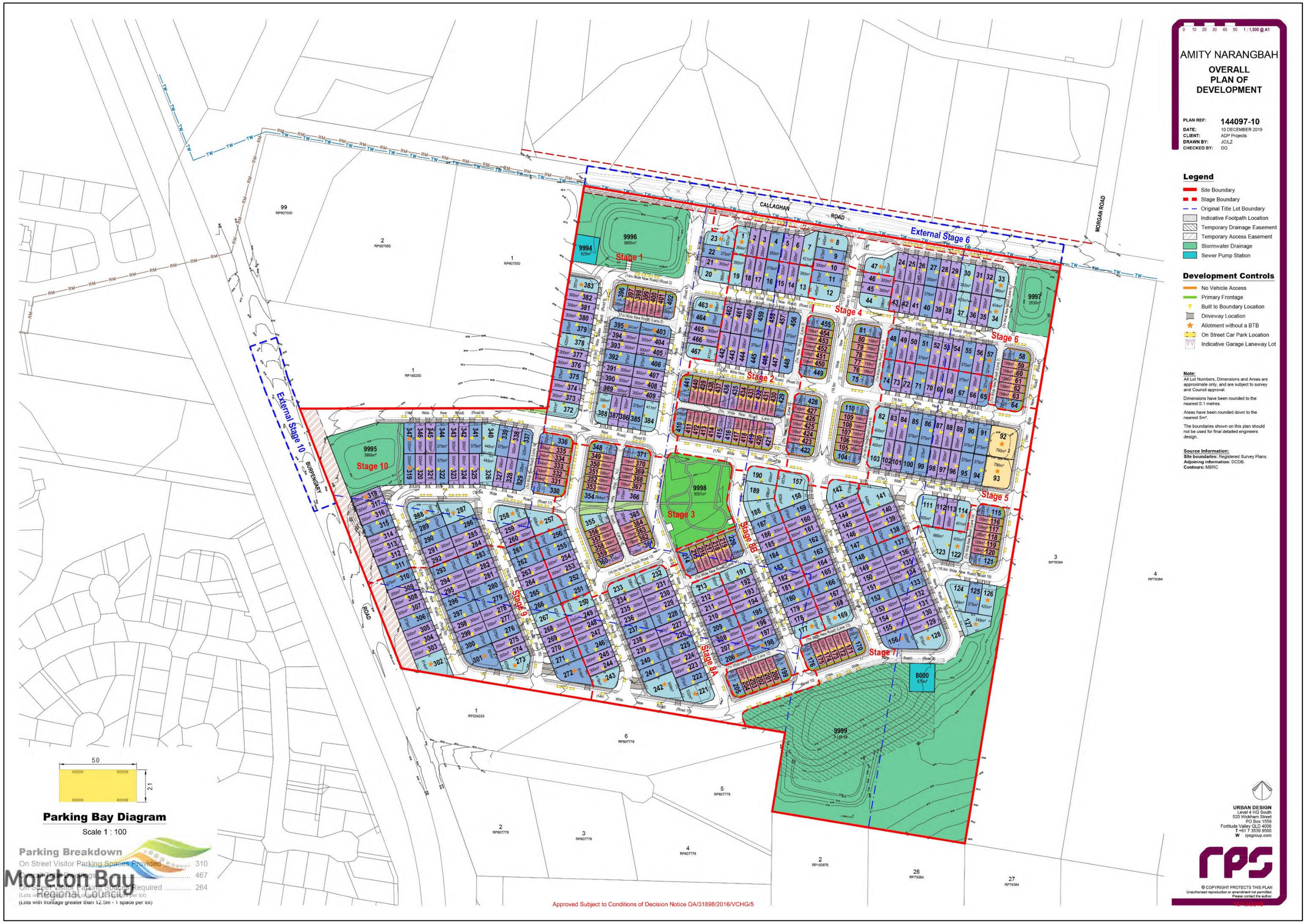

Figure 1 – Approved Plan of Development

5.4. Predicted Rail Noise Levels - L_{Amax}

Predicted rail noise levels are presented in Figure 3 and Figure 4 at ground floor and first floor levels respectively, inclusive of acoustic barriers as recommended in Section 6.

Figure 3: Predicted Rail Noise Levels L_{Amax} – Ground Floor

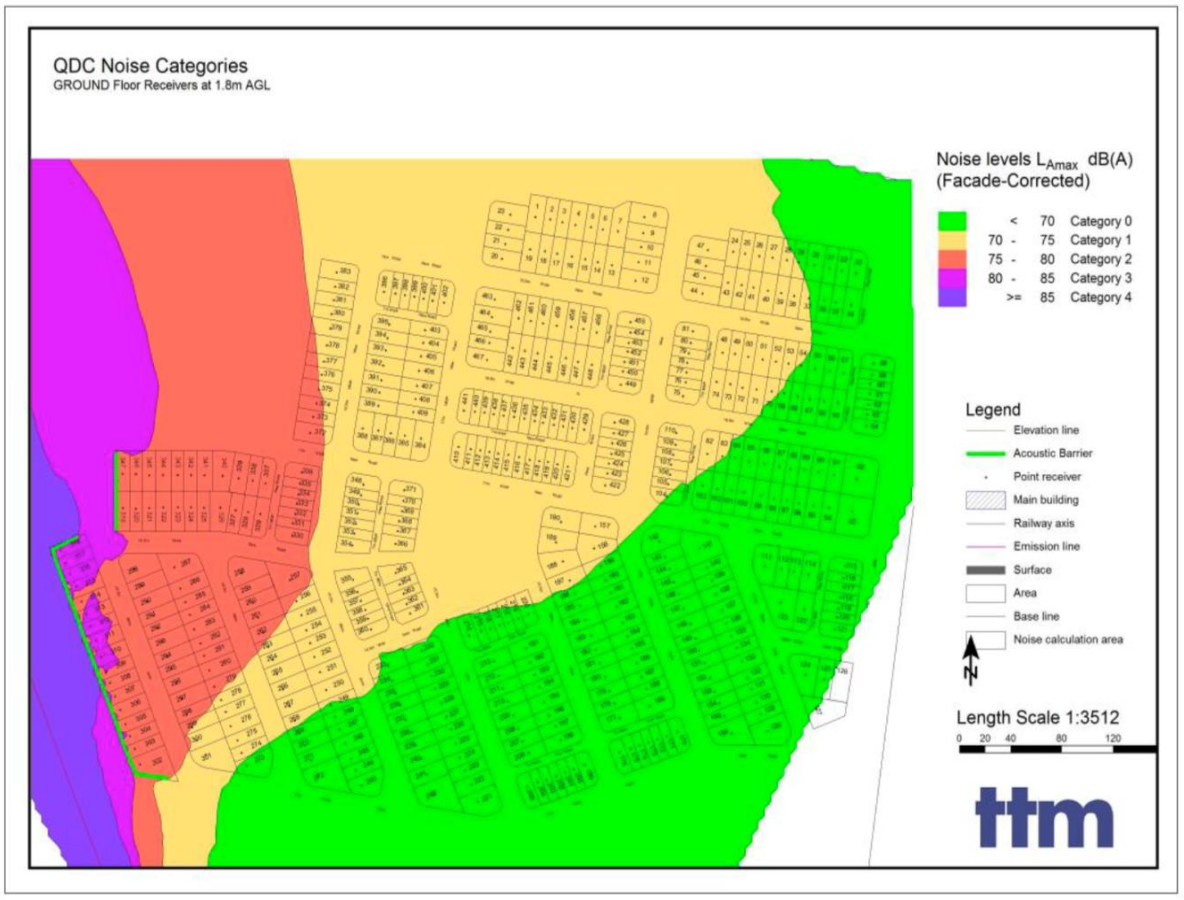

Figure 4: Predicted Rail Noise Levels L_{Amax} – First Floor

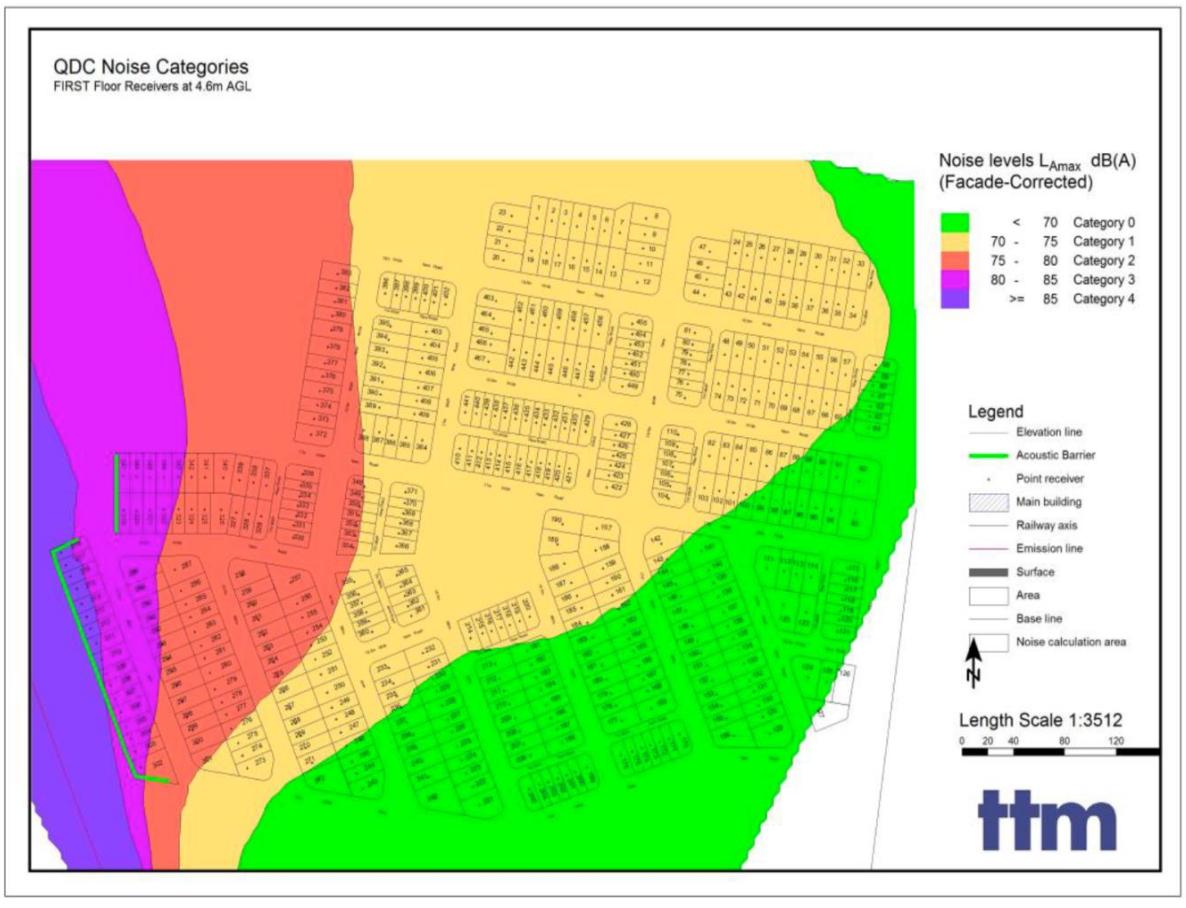

Figure 2 – Extent of Rail Noise Intrusion onto Site in 5dBA Bands
(Extracted from Report Ref. 16BRA030 R01 pp9)

5.4. Predicted Road Traffic Noise Levels

Modelling was conducted to determine road traffic noise levels at the development in the 10 year planning horizon. Predicted road traffic noise contour maps illustrated as QDC noise categories at the ground floor and first floor are presented in the following figures, inclusive of acoustic barriers as recommended in Section 6.

Figure 3: Road Traffic Noise Levels at Ground Floor

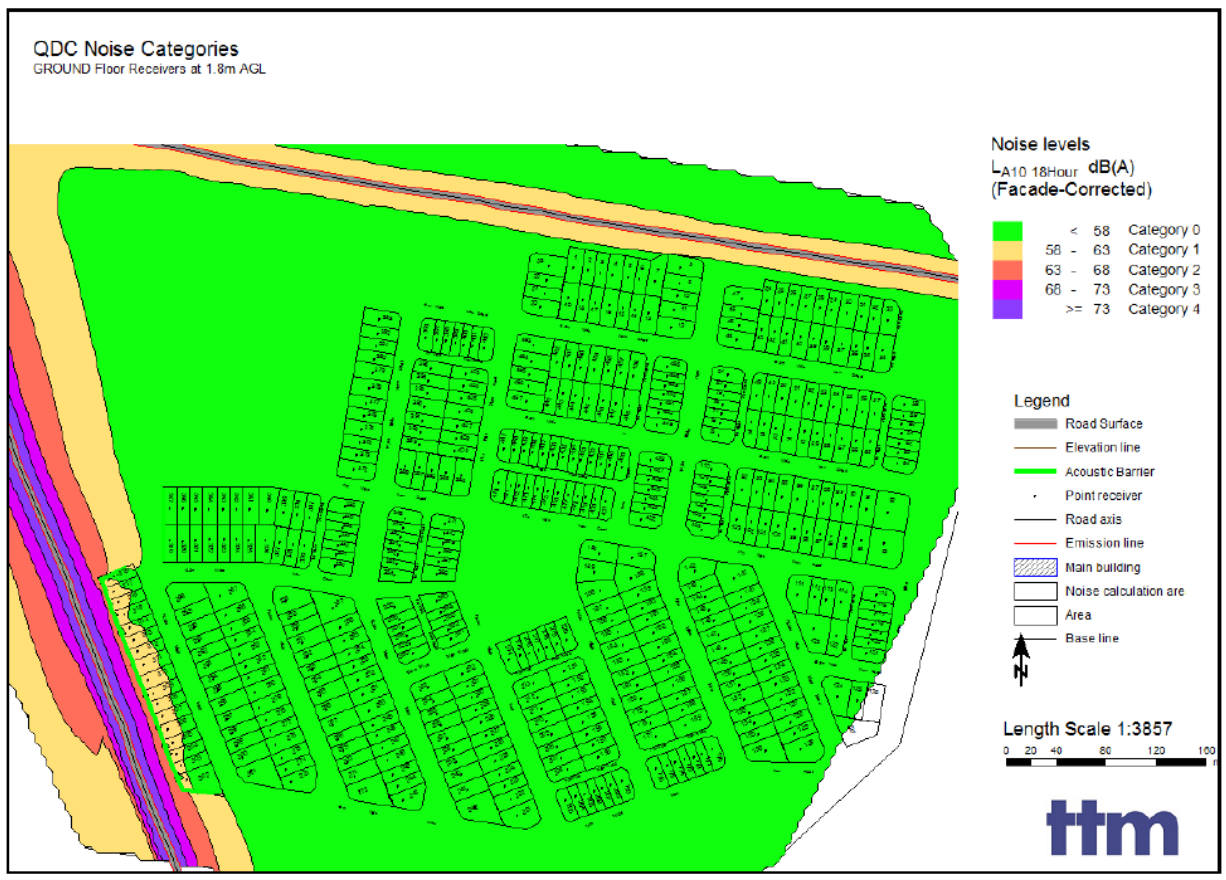

Figure 4: Road Traffic Noise Levels at First Floor

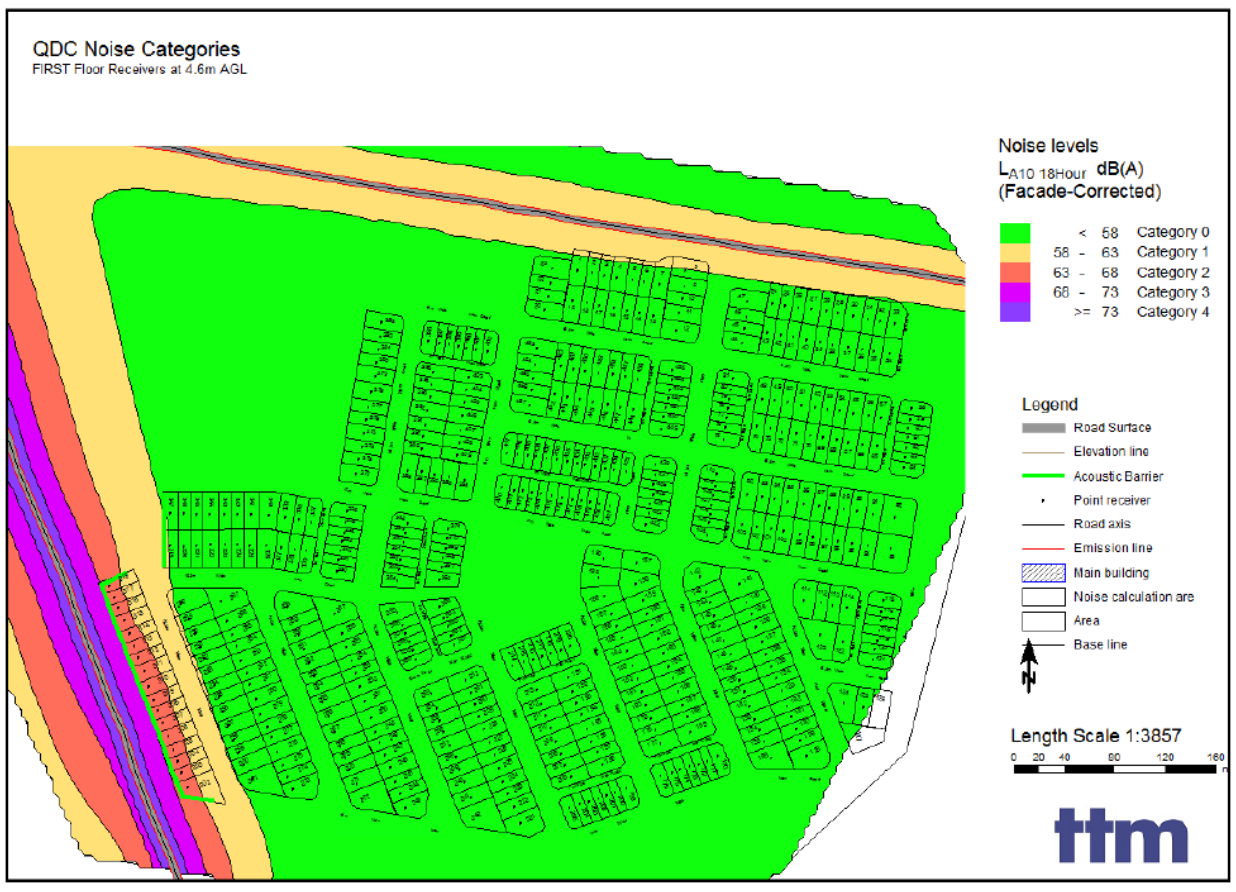

Figure 3 – Extent of Road Traffic Noise Intrusion onto Site in 5dBA Band

(Extracted from Report Ref. 16BRA0130 R02_0 pp10&11)

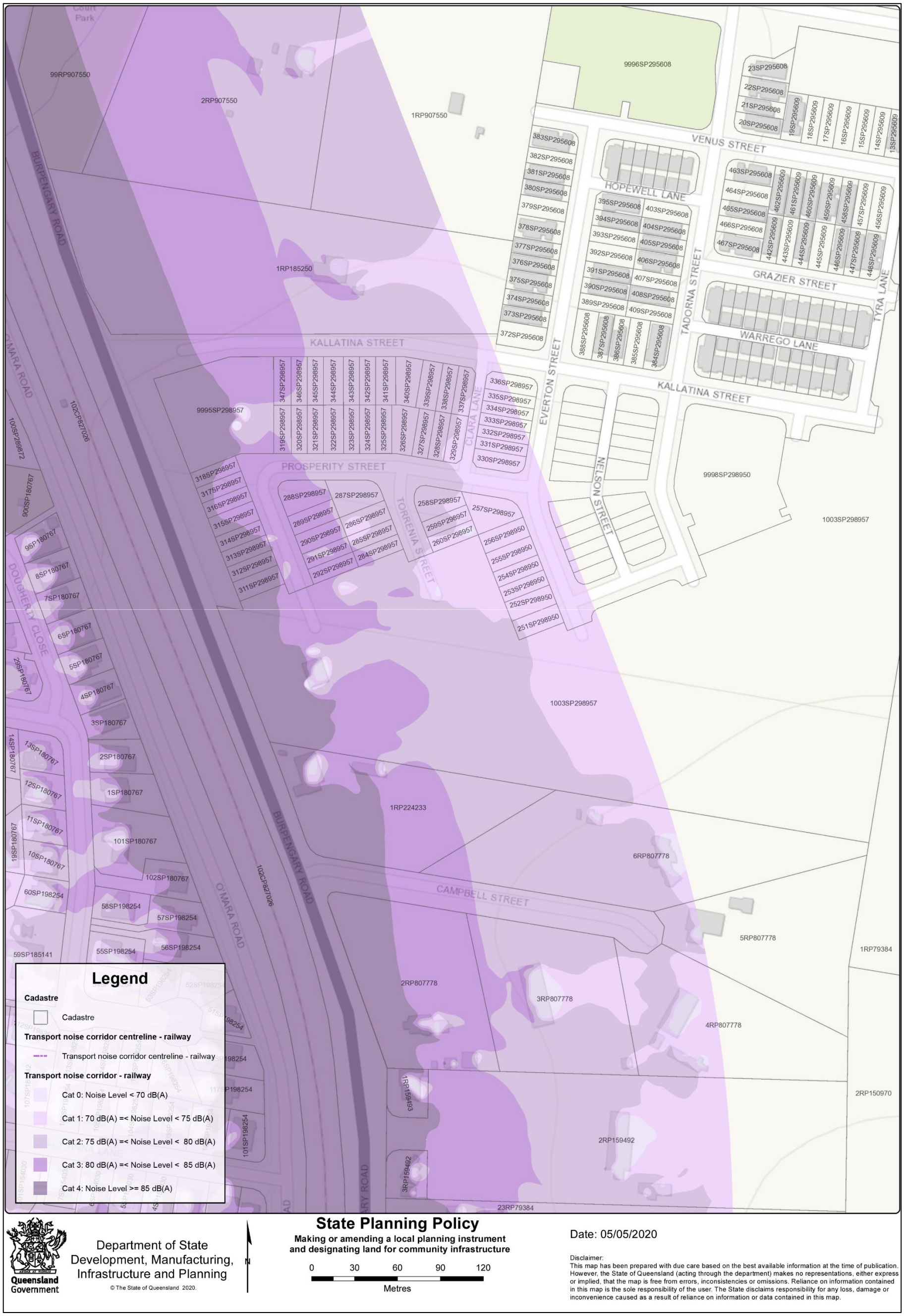

Figure 4 – Extent of Intrusion of NCRL TNC Associated across Site (Extract from DSDMIP SPP IMS Website)

Figures 5 and 6

QDC MP 4.4 Noise Categories at Ground Floor and First Floor Levels of Residences within NCRL TNC

Acoustics RB Pty Ltd

Report No. 18-964.R13 Figure 5

Facade-Corrected $L_{Max\ Passby}$ Noise Levels and QDC MP 4.4 Noise Categories

North Coast Rail Line

Ground Floor Level Facades

N

Extent of NCRL TNC

Extent of NCRL TNC

Extent of NCRL TNC

A3 Scale 1:1500

0 10 20 30 40 50 60 70 80 90 100 m

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA) and QDC MP 4.4 Noise Category

		<= 70	Noise Category 0
70 <	<=	75	Noise Category 1
75 <	<=	80	Noise Category 2
80 <	<=	85	Noise Category 3
85 <			Noise Category 4

Acoustics RB Pty Ltd

Report No. 18-964.R13 Figure 6

Facade-Corrected $L_{Max\ Passby}$ Noise Levels and QDC MP 4.4 Noise Categories

North Coast Rail Line

First Floor Level Facades

N

Extent of NCRL TNC

Extent of NCRL TNC

Extent of NCRL TNC

Extent of NCRL TNC

A3 Scale 1:1500

0 10 20 30 40 50 60 70 80 90 100 m

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA) and QDC MP 4.4 Noise Category

		<=	70	Noise Category 0
70 <		<=	75	Noise Category 1
75 <		<=	80	Noise Category 2
80 <		<=	85	Noise Category 3
85 <				Noise Category 4

Figures 7 and 8

Equivalent QDC MP 4.4 Noise Categories at Ground Floor and First Floor Levels of Residences within 100m of Burpengary Road

Acoustics RB Pty Ltd

Report No. 18-964.R13 Figure 7

Facade-Corrected $L_{A10(18hour)}$ Noise Levels and QDC MP 4.4 Noise Categories

Burpengary Road (Year 2026)

Ground Floor Level Facades

N

100m Setback from arterial road

100m Setback from arterial road

A3 Scale 1:1500

0 10 20 30 40 50 60 70 80 90 100 m

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA) and QDC MP 4.4 Noise Category

	<=	58	Noise Category 0
58 <	<=	63	Noise Category 1
63 <	<=	68	Noise Category 2
68 <	<=	73	Noise Category 3
73 <			Noise Category 4

Acoustics RB Pty Ltd

Report No. 18-964.R13 Figure 8

Facade-Corrected $L_{A10(18hour)}$ Noise Levels and QDC MP 4.4 Noise Categories

Burpengary Road (Year 2026)

First Floor Level Facades

N

100m Setback from arterial road

100m Setback from arterial road

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA) and QDC MP 4.4 Noise Category

	<=	58	Noise Category 0
58 <	<=	63	Noise Category 1
63 <	<=	68	Noise Category 2
68 <	<=	73	Noise Category 3
73 <			Noise Category 4

A3 Scale 1:1500

0 10 20 30 40 50 60 70 80 90 100 m

Attachment A

Constraint on Adoption of QDC MP 4.4

Section 8 *Assessment of Road Traffic and Railway Noise* of SC 6.16 *Planning Scheme Policy – Noise* outlines the process of establishing acceptable acoustical amenity at sites impacted by noise from roads and railways. At Section 8.1 *Reconfiguring a Lot* of SC 6.16, it is stated:-

> "The [transport noise impact] assessment is to conducted in accordance with MP4 .4 of the QDC. The assessment is to identify the noise category applicable to each lot in the proposed development for both lower and first floor levels. Noise categories are defined in Schedule 3 of MP4.4."

With respect to s.8.1, it is relevant to have regard to *Queensland Development Code MP4.4 Buildings in a Transport Noise Corridor* (QDC MP4.4) and Chapter 8B (especially s.246X) of *Building Act 1975.*

The relevant extracts from QDC MP4.4 follow below.

1 Purpose

To ensure *habitable rooms* of particular residential buildings located in *transport noise corridors* are designed and constructed to reduce the extent to which *transport noise* intrudes into those rooms.

3 Application

This QDC part applies to building work for a *relevant residential building* if the work is the subject of a building development application made on or after 17 August 2015.

6 What is a *relevant residential building*

A building is a *relevant residential building* if:

(a) a building development application for the construction of the building is made after 31 August 2010; and

(b) the building:

  (i) is a class 1, 2, 3 or 4 building; and

  (ii) is located in a *transport noise corridor*; and

  (iii) is not a *relocated building*; and

(c) the building development approval for the construction of the building was not given under the building assessment provisions in force immediately before 1 September 2010, under section 37 of the *Building Act 1975*.

At Section 8 *Definitions* of QDC MP4.4, "transport noise corridor is defined as follows:-

Transport noise corridor means land designated under Chapter 8B of the *Building Act 1975 as a transport noise corridor.*

Note: This is identified in State and Local Government records as described in a gazettal notice following designation of the transport noise corridor.

As noted above, the purpose of QDC MP4.4 is to ensure control of transport noise intrusion into particular residential buildings, specifically "relevant residential buildings", where as noted in the definition above, a relevant residential building must be located within a Transport Noise Corridor (TNC) as defined at Chapter 8B of *Building Act 1975* and, more particularly, at s.246X of the Act.

The subject site is not located in a TNC. Therefore, the provisions of QDC MP4.4 are not triggered.

Whether it is possible to extend the application of QDC MP 4.4 beyond its purpose is a town planning/legal question.

In the absence of an answer to that question and to avoid any inadvertent conflict by attempting to invoke QDC MP 4.4 where it cannot be properly applied, the appropriate means of controlling of road traffic noise intrusion is to apply the more robust methodology of the calculation methods of AS3671-1989 *Acoustics – Road traffic noise intrusion - Building siting and construction* to the design of noise affected residences, with the goal being to achieve compliance with the recommended internal sound levels of AS/NZS 2107:2016 A*coustics – Recommended design sound levels and reverberation times for building interiors*.

Attachment B

Derivation of Upper and Lower Bounds of Construction Categories

The upper and lower bounds of the Construction Categories can be derived in the following manner.

Internal noise level limits set by AS/NZS 2107:2016:-

* Bedrooms and sleeping areas: 35dBA ($L_{Aeq,1hr\ night}$)
* Living and work areas: 40dBA ($L_{Aeq,1hr\ day}$)

Reduction external to internal, glazing open (includes conversion from free field to facade-corrected): 10dBA

External noise limits (facade-corrected):-

* Night: 45dBA ($L_{Aeq,1hr\ night}$)
* Day: 50dBA ($L_{Aeq,1\ hr\ day}$)

Offsets: +3.3dBA (night)
-0.6dBA (day)

Resultant Facade-Corrected External $L_{10(18hour)}$ Limit:

* Based on internal limits during night: 48.3dBA (48dBA rounded)
* Based on internal limits during day: 49.4dBA (49dBA rounded)

On the basis of these results, the noise level external to the most exposed facade of any residence should not exceed a facade-corrected noise level of **48dBA** $L_{10(18hour)}$ if the internal noise level limits of AS/NZS 2107:2000 are to be met when windows and external doors are **open**. This is the upper bound Construction Category 1 and the lower bound of Construction Category 2.

Internal noise level limits set by AS/NZS 2107:2016:-

* Bedrooms and sleeping areas: 35dBA ($L_{Aeq,1hr\ night}$)
* Living and work areas: 40dBA ($L_{Aeq,1hr\ day}$)

Reduction external to internal, glazing open (includes conversion from free field to facade-corrected): 25dBA

External noise limits (facade-corrected):-

* Night: 60dBA ($L_{Aeq,1hr\ night}$)
* Day: 65dBA ($L_{Aeq,1\ hr\ day}$)

Offsets: +3.3dBA (night)
-0.6dBA (day)

Resultant Facade-Corrected External $L_{10(18hour)}$ Limit:

* Based on internal limits during night: 63.3dBA (63dBA rounded)
* Based on internal limits during day: 64.4dBA (64dBA rounded)

On the basis of these results, the noise level external to the most exposed facade of any residence should not exceed a facade-corrected noise level of **63dBA** $L_{10(18hour)}$ if the internal noise level limits of AS/NZS 2107:2016 are to be met when standard construction windows and external doors are **closed**. This is the upper bound Construction Category 2 and the lower bound of Construction Category 3.