Acoustics RB Pty Ltd

# Report No. 11-291.R21.Rev1

## Proposed Residential Development

## Peet Riverbank
## Market Drive, Caboolture South
## Stages 20, 21, 22A and 22B

## Assessment and Control of Rail and Road Traffic Noise Intrusion onto Stages 21, 22A and 22B

**October 2022**

# DOCUMENT CONTROL PAGE

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**Status:** **Rev1**
**Date of Issue:** **10 October 2022**

**History of Revisions**

| Date | Version | Changes / Page Reference |
|---|---|---|
| 11 August 2020 | Draft | |
| 12 August 2020 | Final | |
| 10 October 2022 | Rev1 | Update to Proposal Plans, earthworks design, and stages subject to application. |

**Record of Distribution**

| Copy No. | Revision No. | Destination |
|---|---|---|
| electronic | Rev1 | File - Controlled copy |
| electronic | Rev1 | Peet Caboolture Syndicate Ltd |

# SUMMARY

On 15 March 2021, Peet Caboolture Syndicate Ltd lodged a development application over land immediately adjoining NCRL and bounded to the north by Market Drive. The site of the subject application is designated as Stages 20, 21, 22A and Stage 22B of Riverbank Estate.

Council subsequently granted approval of the development (Ref Decision Notice (Approval) for Application No DA/2021/0066 – Reconfiguring a Lot - Development Permit for Subdivision (1 into 124 lots, and 2 detention basins and balance land), dated 10 June 2022) by reference to the requirements of (i) the Caboolture ShirePlan as well as (ii) the relevant Planning and Environment Court Order (ie P&E Court Order 1441 of 2014, dated 2 May 2014).

In addition to the approval granted by MBRC, State Assessment and Referral Agency (SARA) issued their Referral agency response – with conditions dated 7 December 2021. This response was enclosed in the MBRC approval package as Attachment 6 – Referral Agency Response.

Since the time of preparation of the August 2020 report, the lot layout and earthworks design across Stages 20, 21, 22A and 22B have both changed. In order to confirm that these changes form only a minor change to the original approval granted on 7 December 2021, Peet Caboolture Syndicate Ltd will be lodging a minor change to referral agency response application with the expectation that SARA will again re-assess the changes to the proposed development against the requirements of SDAP State Code Version 2.6.

Accordingly, Acoustics RB Pty Ltd has been engaged by Peet Caboolture Syndicate Ltd to prepare an update to Report No. 11-291.R21 to support the minor change application.

The subject report, ie Report No. 11-291.R21.Rev1 has been prepared as a result. It updates the assessment of the degree of road and rail noise intrusion across Stages 21, 22A and 22B. Importantly, it also provides updated recommendations with respect to (i) the rail noise barrier arrangement, (ii) suggested conditions of approval and (iii) schedule of QDC MP 4.4 noise categories applying to lots located within the Transport Noise Corridor associated with North Coast Rail Line.

From the results of the assessment presented in this report, the following conclusions have been drawn:-

- There will be no intrusion of the 63dBA noise contour onto any of the lots of Stage 22A. Consequently, there is no warrant to require that any further action be taken to attenuate road traffic noise intrusion into any residences of Stage 22A.
- With no acoustic barrier in place, the 84dBA free field Single Event Maximum SPL (LAmax passby) noise level limit for rail noise intrusion into private open spaces (as set by DTMR's Interim Guideline – Operational Railway Noise and Vibration – Government Supported Transport Infrastructure and Table 2.2.2 of State Code 2: Development in a Railway Environment of SDAP Version 2.6) will be exceeded across parts of Lots 1508-1518, 1547-1554, 1565 and 1566.
- With the 2.0m-4.0m high acoustic barrier arrangement shown in Figures 10A and 10B, compliance with the 84dBA free field Single Event Maximum SPL (LAmax passby) and 62dBA free field LAeq,24hr noise level limits set under DTMR Interim Guideline and SDAP State Code 2 will be achieved across all lots within Stages 21, 22A and 22B.
- With this barrier arrangement in place, and as required by DTMR, the updated QDC MP 4.4 noise categories applying to both the ground floor and first floor levels will be as presented in Tables 3-5. Refer also Figures 8 and 9.

Details of the barrier alignment and barrier design requirements are presented in Section 9.0 of this report.

Recommendations for the wording of the relevant DTMR Concurrence Agency Condition are also presented Section 9.0 of this report.

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## 1.0 Introduction

Over the past 13 years, Peet Caboolture Syndicate Ltd has lodged several development applications with Moreton Bay Regional Council (MBRC) over a parcel of land at Caboolture South. The land is located on the eastern side of North Coast Rail Line (NCRL) and is bisected by Market Drive. The development is Riverbank Estate.

On 15 March 2021, Peet Caboolture Syndicate Ltd lodged a development application over land immediately adjoining NCRL and bounded to the north by Market Drive. The site of the subject application is designated as Stages 20, 21, 22A and Stage 22B of Riverbank Estate.

Council subsequently granted approval of the development (Ref Decision Notice (Approval) for Application No DA/2021/0066 – *Reconfiguring a Lot - Development Permit for Subdivision (1 into 124 lots, and 2 detention basins and balance land)*, dated 10 June 2022) by reference to the requirements of (i) the Caboolture ShirePlan as well as (ii) the relevant Planning and Environment Court Order (ie P&E Court Order 1441 of 2014, dated 2 May 2014).

In addition to the approval granted by MBRC, State Assessment and Referral Agency (SARA) issued their *Referral agency response – with conditions* dated 7 December 2021. This response was enclosed in the MBRC approval package as Attachment 6 – Referral Agency Response.

It is noted that, when determining the conditions subsequently imposed on the development, SARA had regard to the requirements of the State Development Assessment Provisions (SDAP) State Code 2 current at the time (ie SDAP version 2.6) as well as the original assessment of road and rail noise intrusion onto Stages 18A, 18B, 19A, 19B, 21, 22A and 22B presented in Acoustics RB Pty Ltd Report No. 11-291.R21, dated 12 August 2020.

Since the time of preparation of the August 2020 report, the lot layout and earthworks design across Stages 20, 21, 22A and 22B have both changed. In order to confirm that these changes form only a minor change to the original approval granted on 7 December 2021, Peet Caboolture Syndicate Ltd will be lodging a minor change to referral agency response application with the expectation that SARA will again re-assess the changes to the proposed development against the requirements of SDAP State Code Version 2.6.

Importantly, however, given that (i) the layout and earthworks design across Stages 18A, 18B, 19A and 19B remains unchanged and (ii) these stages are not subject to the original SARA approval, it is understood that Peet Caboolture Syndicate Ltd does not intend to lodge any new applications for development over the land within Stages 18A, 18B, 19A and 19B.

Accordingly, Acoustics RB Pty Ltd has been engaged by Peet Caboolture Syndicate Ltd to prepare an update to Report No. 11-291.R21 to support the minor change application.

The subject report, ie Report No. 11-291.R21.Rev1 has been prepared as a result. It updates the assessment of the degree of road and rail noise intrusion across Stages 21, 22A and 22B. Importantly, it also provides updated recommendations with respect to (i) the rail noise barrier arrangement, (ii) suggested conditions of approval and (iii) schedule of QDC MP 4.4 noise categories applying to lots located within the Transport Noise Corridor associated with North Coast Rail Line.

To ensure consistency with the assessment presented Report No 11-291.R21, this updated report follows the same format as that adopted for the approved report.

## 2.0 Existing Situation and Proposed Development

### 2.1 Stages 22A and 22B

The locations of Stages 22A and 22B are shown in Figure 1. The real property description of each is Part of Lot 1028 on SP321913.

Stage 22A adjoins the Market Drive to the north and North Coast Rail Line (NCRL) to the west. Stage 22B adjoins NCRL to the west, but is well removed from Market Drive.

Market Drive is an existing Council-controlled road. By reference to the current MBRC Planning Scheme (2016, v6) Overlay Map – Road Hierarchy, Market Drive is designated as a sub-arterial road.

Four lots in Stage 22A, ie Lots 1505-1508, adjoin Market Drive.

Adjacent to the site, NCRL is currently trafficked by approximately 130 trains each day. Of these, approximately 15 are trains drawn by diesel locomotives (ie freight and livestock trains, Spirit of Queensland, and Spirit of the Outback) with the balance comprising electric multiple units (ie Citytrain passenger trains, and the Bundaberg and Rockhampton tilt trains) [I].

The layouts of the proposed developments over Stages 22A and 22B are presented in Figures 2A and 2B. As shown in these figures, the proposed development over the site consists of 24 residential allotments in Stage 22A and 38 residential allotments within Stage 22B.

A total of 31 lots adjoin the rail line. Of these, 11 lots are located in Stage 22A (ie Lots 1508-1518) and 20 lots (ie Lots 1547-1566) are situated within Stage 22B.

### 2.2 Stage 21

Stage 21 is also shown in Figure 1. The real property description of Stage 21 is also Part of Lot 1028 on SP321913.

Stage 21 is located to the east of Stage 22B and to the south of the already-approved Stages 18B and 19B.

The layout of the proposed development over Stage 21 is presented in Figure 2C. As shown in this figure, the proposed development over Stage 21 consists of 30 residential allotments. None of the lots adjoins either NCRL or Market Drive.

### 2.3 Stage 20

Stage 21 is also shown in Figure 1. The real property description of Stage 20 is also Part of Lot 1028 on SP321913.

Stage 20 is located to the east of Stage 21. At its closest point, Stage 20 is located approximately 325m from the nearest line of NCRL. Additionally, at its closest point, Stage 20 is located approximately 320m from the nearest running lane of Market Drive.

Due to the significant distance of separation between Stage 20 and each transport noise source, it is not necessary to as the impact of road or rail noise intrusion onto Stage 20. As a result, Stage 20 has not been considered further in this assessment.

[I] From information supplied originally by QR, one half of the total of the diesel freight and livestock trains (ie approx seven total) transit the site during the night time period (ie between 10:00pm and 7:00am) daily. During the same period, there are 27 movements of Citytrain passenger trains.

## 3.0 Requirements of Regulatory Authorities

### 3.1 MBRC Conditions of Approval

The current Assessment Manager Conditions of Approval issued by MBRC (Ref Decision Notice (Approval) for Application No DA/2021/0066 – *Reconfiguring a Lot - Development Permit for Subdivision (1 into 124 lots, and 2 detention basins and balance land)*, dated 10 June 2022) do not include a requirement to control transport noise intrusion.

Rather, at Condition 29 *Concurrence Agency*, MBRC has set a requirement that the conditions issued by SARA are achieved. For Reference, Conditions 29 is reproduced below.

The relevant SARA Conditions are discussed in more detail in Section 3.2.

| **CONDITION** | | **TIMING** |
|---|---|---|
| **CONCURRENCE AGENCY** | | |
| **29.** | **Concurrence Agency** | |
| A | Comply with the conditions of the State Assessment and Referral Agency response dated 7 December 2021 (Reference: 2103-21760 SRA) or as amended. | At all times. |
| B | Provide certification to Council prepared by a suitably qualified person or the agency demonstrating the requirements of the Department of State Development, Manufacturing, Infrastructure and Planning have been met. | Prior to submitting to the Council any request for approval of a plan of subdivision (i.e. a survey plan). |

Notwithstanding the lack of specific conditions set by Council in respect of a requirement to control transport noise intrusion, as has been the case for each already-approved stage of Riverbank, assessment of the extent of transport noise intrusion onto Stages 21, 22A and 22B is to be conducted under the now-superseded Caboolture Planning Scheme. Ultimately, the noise assessment report is required to be conducted in accordance with Caboolture *Planning Scheme Policy 15 – Noise*.

Based on previous advice from Council with respect to development over earlier stages of the Riverbank Estate, and as was the case for the original noise report over Stages 18A, 18B, 19A, 19B, 21, 22A and 22B, this report identifies all lots which will be affected by nearby transport noise sources and provides recommendations for the noise control treatments required to achieve effective amelioration of any excessive noise intrusion.

### 3.2 SARA Condition 4

As discussed above at Section 3.1, Council Condition 29 *Concurrence Agency* requires that the development over Stages 20, 21, 22A and 22B comply with the SARA conditions dated 7 December 2021 (Ref SRA Response No. 2103-21760 SRA) or as amended.

The spec requirements are set out in SARA Condition 4.

SARA Condition 4 is reproduced overpage.

| No. | Conditions | Condition timing |
|---|---|---|
| **Reconfiguring a lot** | | |
| Planning Regulation 2017, Schedule 10, Part 9, Division 4, Subdivision 2, Table 1, Item 1 – State transport corridors and future State transport corridors—The chief executive administering the *Planning Act 2016* nominates the Director-General of Department of Transport and Main Roads to be the enforcement authority for the development to which this development approval relates for the administration and enforcement of any matter relating to the following conditions: | | |
| 4. | (a) Carry out the development generally in accordance with the report, Assessment and Control of Rail and Road Traffic Noise Intrusion onto Stages 19A, 19B, 21, 22A and 22B, prepared by Acoustics RB Pty Ltd, dated 12 August 2020, reference report number 11-291.R21, revision 2, in particular:<br>• Construct noise barriers in accordance with Section 9.0 Recommendations and Figures 10A and 10B (alignment of acoustic barriers to Stage 22A and 22B).<br>(b) The noise barriers, including foundation structures, must be constructed on the site and not in the railway corridor, and must be designed in accordance with:<br>• Queensland Rail Civil Engineering Technical Specification – QR-CTS-Part 41 – *Design and Construction of Noise Fences/Barriers and Transport*;<br>• Transport and Main Roads Specifications, MRTS15 *Noise Fences*, prepared by Department of Transport and Main Roads, dated March 2019;<br>• the drainage considerations for the acoustic fence set out in Section 3.1.5 and Appendix B of the report, *Upstream Flood Impact Investigation & Site Based Stormwater Quality Management Plan*, prepared by Calibre Professional Services Pty Ltd, dated 18/11/21, reference 21-000058-01B,revision B.<br>(c) RPEQ certification, with supporting documentation, must be provided to the North Coast Region Development Assessment Team (North.Coast.IDAS@tmr.qld.gov.au) within the Department of Transport and Main Roads confirming that the development has been constructed in accordance with parts (a) and (b) of this condition. | (a), (b) and (c)<br>Prior to submitting the Plan of Survey to the local government for approval for the relevant stage |

Note:

SARA Condition 4a makes reference to Acoustics RB Pty Ltd Report No 11-291.R21 revision 2 dated 12 August 2020. The reference to "revision 2" is incorrect. Rather, the correct reference (if any needed) would have been "Copy 2". In fact as is evident on page 2 above, this new report is the first revision of Report No 11-291.R21, ie Report No 11-291.R21.Rev1, dated 10 October 2022.

By reference to Section 9.0 of Report No 11-291.R21, dated 12 August 2020, the following recommendation was made:

> "To achieve the optimum degree of control of rail noise intrusion onto 18A, 18B, 19A, 19B, 21, 22A and 22B, it is recommended that a stepped 3.0m-4.7m high noise barrier be constructed along common boundary of the site with the rail reserve and returned along side boundaries of selected lots."

## 4.0 Appropriate Noise Level Limits

### 4.1 Caboolture Planning Scheme Policy 15 – Noise

As noted above in Section 2.0, assessment of extent of transport noise intrusion onto Stages 21, 22A and 22B is to be conducted in accordance with the now-superseded Caboolture *Planning Scheme Policy 15 – Noise*.

It is noted that Caboolture *Planning Scheme Policy 15 – Noise* provided information as "a guide to Council's requirements for a Noise Assessment Report", but it did not set specific noise level limits or provide details of noise impact assessment methodologies.

In these circumstances, it is appropriate to defer to Caboolture ShirePlan Part 7 Development Codes, specifically Division 16 – *Reconfiguration of a Lot Code* and Division 15 A – *Noise Code* that applied under the now-superseded planning scheme. It is noted that each document sets the same limits for acceptable levels of road traffic noise intrusion, but each is silent on the matter of noise level limits for rail noise intrusion.

In these circumstances, to establish limits for acceptable levels of rail noise intrusion, it is appropriate to make reference to the current requirements of SARA/DTMR, ie (i) DTMR *Interim Guideline – Operational Railway Noise and Vibration – Government Supported Transport Infrastructure* (DTMR Interim Guideline) and *State Code 2: Development in a Railway Environment* of State Development Assessment Provisions Version 2.6[II] (SDAP State Code 2).

The requirements of each of these documents, ie (i) *Reconfiguration of a Lot Code* and *Noise Code* for assessment of road traffic noise intrusion and (ii) DTMR Interim Guideline and SDAP State Code 2 for assessment of rail noise intrusion are discussed below.

### 4.2 Road Traffic Noise Intrusion – *Reconfiguration of a Lot Code* and *Noise Code*

When dealing with the control of road traffic noise intrusion, Specific Outcome SO3 of Caboolture ShirePlan *Reconfiguration of a Lot Code* and SO1 of Caboolture ShirePlan *Noise Code* each set objective limits for acceptable levels of road traffic noise intrusion.

By reference to each of these documents, the appropriate limits for establishing acceptable levels of road traffic noise intrusion onto Riverbank Estate has been derived and have been presented in several reports prepared for earlier stages of development of the estate. The most recent of these reports prior to the original version of this report (ie Report No. 11-291.R21) was the road traffic noise impact report prepared for Stage 18A, ie Report No. 11-291.R15 (dated 31 July 2017).

The derived noise level limits are as follows:-

- 63dBA $L_{A10(18hour)}$ facade-corrected[III] for a State-controlled road
- 63dBA $L_{A10(18hour)}$ facade-corrected for any other public road
- 60dBA $L_{Aeq,1hr\ night}$ facade-corrected

By way of further reference, it is noted that the current version of QDC MP 4.4 *Buildings in a Transport Noise Corridor* (ie version 1.1, dated 17 August 2015) imposes a more stringent set of criteria.

[II] It is noted as of 18 February 2022, the current version of SDAP State Code 2 is Version 3.0. However, given the noise level limits specified in Version 3.0 are the same as Version 2.6 (notwithstanding caveats on when/for which type of development the noise level limits apply), the same version of State Code 2 that was used for the original report and for the preparation of the SARA conditions has been adopted again in this report.

[III] $L_{A10(18hour)}$ 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 $L_{A10,1hr}$ levels between 6:00am and 12:00 midnight on an average weekday where $L_{A10,1hr}$ is the noise level measured in dBA that is exceeded for 10% of the specific one hour period.

Notwithstanding, the fact that QDC MP 4.4 does not apply to the control of road traffic noise intrusion onto the subject site, the acceptance criteria of QDC MP 4.4 are examined below.

For residences located in Noise Category 0, QDC MP 4.4 states: "No additional acoustical treatment required – standard building assessment provisions apply". Consequently, the likely most stringent requirement (to ensure no additional acoustical treatment is required to be implemented to the design of a residence) would be achievement of compliance with the upper bound of the Noise Category 0 band of QDC MP 4.4. For road traffic noise intrusion, the upper bound of the Noise Category 0 band is 58dBA $L_{A10(18hour)}$ facade-corrected.

Even so, it can be readily demonstrated that, provided that (i) the $L_{A10(18hour)}$ facade-corrected noise level due to road traffic noise intrusion does not exceed 63dBA and (ii) the residence does not feature large areas of glazing or significant areas of lightweight external wall construction, standard building construction will suffice throughout, ie no building upgrades would be required.

Finally, it is appropriate to have regard to Planning Scheme Policy 6 *Traffic Noise Attenuation* (PSP6) of (former) Pine Rivers Shire Council. PSP6 gives further support for the adoption of the 63dBA limit.

As stated at Clause (4)(a) of PSP6, the intention of the planning scheme policy is to reduce road traffic noise levels so that the noise levels do not exceed 63dBA $L_{A10(18hour)}$ at residential dwellings. In addition, under PSP6 it was determined that $L_{A10(18hour)}$ road traffic noise levels less than 55dBA are generally acceptable and do not warrant any specific attention being paid to the construction of dwellings subjected to noise of this level.

Under PSP6, for lots subjected to road traffic noise levels of 55dBA or greater, Council requires that property notes be placed on Council's property note system alerting potential purchasers to the adverse impact of road traffic noise on the individual properties.

Having regard to the discussion above, it is considered that the most appropriate criterion to adopt is the 63dBA facade-corrected $L_{A10(18hour)}$ noise level limit. This criterion is to apply at all lowset residences and the lower level of highset residences. If compliance with this limit is met, there will be no warrant to undertake any further action to ameliorate noise intrusion onto the site or into any residences.

It should be noted that 63dBA is the same limit as that which was applied to the earlier Development Application lodged in 2004/05 for the earlier stages of Riverbank as well as for the assessment of (i) Stages 3A and 3B (August 2014), (ii) Stage 6A1 (September 2015), (iii) Stage 10C (March 2016), (iv) Stages 11, 12 and 14 (August 2016), (v) Stage 8 (July 2017), and (vi) Stage 18A (July 2017).

### 4.3 Rail Noise Intrusion – DTMR Interim Guideline and SDAP State Code 2

In March 2019, DTMR issued *Interim Guideline – Operational Railway Noise and Vibration – Government Supported Transport Infrastructure* (DTMR Interim Guideline). At Table 2.2.1, DTMR Interim Guideline states the limits for acceptable levels of noise intrusion from rail movements. It also provides guidance on the appropriate modelling and measurement methodologies to be used when assessing the impact of noise and/or vibration intrusion.

The same limits for acceptable levels of rail noise intrusion are also presented in Table 2.2.2 of State Code 2: *Development in a Railway Environment* of State Development Assessment Provisions Version 2.6 (Refer Footnote II, above) (SDAP State Code 2).

Performance Outcomes PO25 and PO26 and the accompanying Acceptable Outcomes (including the relevant noise level limits) presented in Table 2.2.2 of SDAP State Code 2 are restated below.

| Performance Outcomes | Acceptable Outcomes |
|---|---|
| **PO25** Development involving:<br>1. an accommodation activity; or<br>2. land for a future accommodation activity minimises noise intrusion from a railway or type 2 multi-modal corridor in habitable rooms. | **AO25.1** A noise barrier or earth mound is provided which is designed, sited and constructed:<br>1. to meet the following external noise criteria at all facades of the building envelope:<br>a. ≤65dBA $L_{Aeq(24hour)}$ facade corrected<br>b. ≤87dBA (single event maximum sound pressure level, $L_{Amax\ passby}$) facade corrected<br>2. in accordance with the Civil Engineering Technical Requirement – CIVIL-SR-014 Design of noise barriers adjacent to railways, Queensland Rail, 2011.<br>Note: To demonstrate compliance with the acceptable outcome, it is recommended a RPEQ certified noise assessment report be provided.<br>If the building envelope is unknown, the deemed-to-comply setback distances for buildings stipulated by the local planning instrument or relevant building regulations should be used.<br>In some instances, the design of noise barriers and mounds to achieve the noise criteria above the ground floor may not be reasonable or practicable. In these instances, any relaxation of the criteria is at the discretion of the Department of Transport and Main Roads.<br>OR all of the following acceptable outcomes apply:<br>**AO25.2** Buildings which include a habitable room are setback the maximum distance possible from a railway or type 2 multi-modal corridor.<br>AND<br>**AO25.3** Buildings are designed and oriented so that habitable rooms are located furthest from a railway or type 2 multi-modal corridor.<br>AND<br>**AO25.4** Buildings (other than a relevant residential building or relocated building) are designed and constructed using materials which ensure that habitable rooms meet the following internal noise criteria:<br>1. ≤45dBA single event maximum sound pressure level, $L_{Amax\ passby}$.<br>Note: Noise levels from railways or type 2 multi-modal corridors are to be measured in accordance with AS1055.1– 1997 Acoustics – Description and measurement of environmental noise.<br>Note: To demonstrate compliance with the acceptable outcome, it is recommended that a RPEQ certified noise assessment report be provided.<br>Habitable rooms of relevant residential buildings located within a transport noise corridor must comply with the Queensland Development Code MP4.4 Buildings in a transport noise corridor, Queensland Government, 2015. Transport noise corridors are mapped on the State Planning Policy Interactive Mapping System. |
| **Performance Outcomes** | **Acceptable Outcomes** |
| **PO26** Development involving an accommodation activity minimises noise intrusion from a railway or type 2 multi-modal corridor in outdoor spaces for passive recreation. | **AO26.1** A noise barrier or earth mound is provided which is designed, sited and constructed:<br>1. to meet the following external noise criteria in outdoor spaces for passive recreation:<br>a. ≤62dBA LAeq(24hour) free field<br>b. ≤84dBA (single event maximum sound pressure level, $L_{Amax\ passby}$) free field<br>2. in accordance with the Civil Engineering Technical Requirement – CIVIL-SR-014 Design of noise barriers adjacent to railways, Queensland Rail, 2011.<br>OR<br>**AO26.2** Each dwelling has access to an outdoor space for passive recreation which is shielded from a railway or type 2 multi-modal corridor by a building, a solid gap-free fence, or other solid gap-free structure.<br>AND<br>**AO26.3** Each dwelling with a balcony directly exposed to noise from a railway or type 2 multi-modal corridor has a continuous solid gap-free balustrade (other than gaps required for drainage purposes to comply with the Building Code of Australia). |

### 4.4 Rail Noise Intrusion – Specific Requirements for Stages 21, 22A and 22B

Under the provisions of Section 246Z and Section 246ZA of *Building Act 1975*, a Transport Noise Corridor (TNC) has been designated along both sides of North Coast Rail Line. A graphical depiction of the TNCs throughout Queensland is available from the Department of State Development, Infrastructure, Local Government and Planning (DSDILGP) State Planning Policy (SPP) Interactive Mapping System (IMS) website.

An extract from the SPP IMS website showing the current NCRL TNC across Stages 21, 22A and 22B is presented in Figure 3. As is evident in this figure, the NCRL TNC extends 250m from the centreline of the nearest rail line.

All residential allotments located within a TNC will need to be acoustically designed in accordance with the requirements of QDC MP 4.4 having regard to the relevant noise categories. The QDC MP 4.4 noise categories can be determined by reference to the DSDILGP SPP IMS website or in accordance with the alternative site-specific noise level assessment method [IV].

An overview of QDC MP 4.4 is presented in Attachment A together with a summary of advice from DTMR regarding the application of AS3671 - 1989 *Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction* to the acoustical design of residential premises within a TNC. Details regarding QDC MP 4.4 are presented below in Section 4.5.

### 4.5 QDC MP 4.4 Buildings in a Transport Noise Corridor

#### 4.5.1 Overview

The stated purpose of QDC MP 4.4 is "to ensure habitable rooms of Class 1, 2, 3 and 4 buildings located in a Transport Noise Corridor are designed and constructed to reduce transport noise". Table 1 in Schedule 3 of QDC MP 4.4 sets noise categories depending upon the external noise level to which the dwellings are subjected when measured at a distance of 1m from the facade of the proposed or existing building [V].

The noise category levels of Table 1 are reproduced below.

| QDC MP 4.4 Noise Category | State-Controlled Roads and Designated Local Government Roads, $L_{A10(18hour)}$ (dBA) | Railway Land Single Event Maximum Noise Level, $L_{Amax\ passby}$ (dBA) |
|---|---|---|
| Category 4 | ≥ 73 dBA | ≥ 85 dBA |
| Category 3 | 68 - 72 dBA | 80 - 84 dBA |
| Category 2 | 63 - 67 dBA | 75 - 79 dBA |
| Category 1 | 58 - 62 dBA | 70 - 74 dBA |
| Category 0 | ≤ 57 dBA | ≤ 69 dBA |

**Table 1 – Noise Category Levels Reproduced from QDC MP 4.4 Schedule 3, Table 1**

[IV] On advice from DTMR (and as noted in DTMR's Transport Noise Management Code of Practice, November 2013) as well as per Schedule 3 of QDC MP 4.4, building upgrade requirements may be determined either (i) by application of noise categories determined from the DSDILGP SPP IMS website, or (ii) from the results of the alternative site-specific noise assessment.

[V] In contrast to other Codes and Guidelines, QDC MP 4.4 permits assessment of extent of road and rail noise intrusion onto the site to take account of shielding provided by existing and approved buildings, only where "approved buildings" refers to (i) buildings for which formal building approval has been granted, or (ii) in the case of the specific building being assessed, where building approval is being sought. It does not allow the shielding of future yet-to-be-constructed buildings which are not part of the application being made to be taken into account when determining the extent of noise intrusion onto other parts of a site that will ultimately be shielded, rather in whole or in part, by future intervening buildings.

Recognising the discontinuities and resultant practical uncertainties evident in the noise level class intervals set in Table 1 [VI], DTMR issued a directive requiring that, in the case of State-controlled roads, the class intervals be adjusted.

The updated road traffic class intervals are presented in Table 2 overpage together with, for consistency, the class intervals for rail noise reconciled in the same manner. These updated class intervals have recently been included in the SPP mapping.

| QDC MP 4.4 Noise Category | State-Controlled Roads and Designated Local Government Roads, $L_{A10(18hour)}$ (dBA) | Railway Land Single Event Maximum Noise Level, $L_{Amax\ passby}$ (dBA) |
|---|---|---|
| Category 4 | ≥ 73 dBA | ≥ 85 dBA |
| Category 3 | 68 dBA ≤ noise level < 73 dBA | 80 dBA ≤ noise level < 85 dBA |
| Category 2 | 63 dBA ≤ noise level < 68 dBA | 75 dBA ≤ noise level < 80 dBA |
| Category 1 | 58 dBA ≤ noise level < 63 dBA | 70 dBA ≤ noise level < 75 dBA |
| Category 0 | < 58 dBA | < 70 dBA |

**Table 2 – Corrected QDC MP 4.4 Noise Categories**

### 4.5.2 Determination of QDC MP 4.4 Noise Categories

As noted above, the noise categories applicable to any particular site adjoining the rail reserve can be determined by reference to the DSDILGP SPP IMS website.

Alternatively, the noise categories may be determined in accordance with the alternative site-specific noise level assessment method of Schedule 3 of QDC MP 4.4.

In addition, QDC MP 4.4 also permits building upgrade requirements to be determined either (i) by application of noise categories determined from the DSDILGP SPP IMS website, or (ii) from the actual noise categories resulting from the alternative site-specific noise assessment.

When applying the alternative site-specific noise assessment method to the determination of either the noise categories or the building upgrade requirements that apply to any specific residence located within a TNC, due consideration may be given to the following matters:-

1. Site topography.
2. Beneficial shielding provided by any barriers – either existing or required to be constructed as a condition of the approval of the Development Application over the subject site.
3. Acoustical shielding provided by existing and approved buildings, where "approved buildings" refers to (i) buildings for which formal building approval has been granted, or (ii) in the case of the specific building/s being assessed, where building approval is being sought.
4. Determination of the relevant noise category may be made on a facade-specific basis, but where the total area of the facade of a habitable space is exposed to two or more noise categories, the higher noise category would apply to the whole facade of the particular habitable space.

[VI] The discontinuities are the gaps between the upper bound of one Noise Category and the lower bound of the next higher Noise Category. Discontinuities give rise to resultant practical uncertainties. For example, should the residence subjected to an external noise level of 74.5dBA $L_{A10(18hour)}$ be ascribed a Noise Category 1 designation or a Noise Category 2 designation? To resolve this uncertainty, the upper bound of one Noise Category must be equivalent to the lower bound of the next higher Noise Category. The corrected Noise Categories are presented in Table 2 and are also presented on mapping from the DSDILGP SPP IMS website, refer Figures 3A-3C.

Furthermore, and as a result of advice provided by DTMR, the following refinements to the site-specific noise assessment may also be applicable:-

5. In April 2012, updated advice from DTMR resulted in further refinement of the acoustical design procedures. This updated advice contends that in situations where noise contours can be plotted at fine gradation around the external facades of the building being assessed, such that noise levels can be determined with precision at individual building facade elements, the calculation procedures of AS3671 - 1989 *Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction* may be adopted in lieu of the noise categories and the minimum $R_w$ values presented in Schedule 1 of QDC MP 4.4 to determine the precise level of building upgrade required to be implemented to achieve compliance with the internal sound level of AS/NZS 2107:2016 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* [VII] that is applicable to the specific space.

Notes:

Each of these items of advice has been endorsed in DTMR's *Transport Noise Management Code of Practice*, November 2013.

AS3671 – 1989, as its name suggests, provides guidance on dealing with road traffic noise intrusion. There is currently no equivalent standard to deal with rail noise intrusion into habitable spaces. Notwithstanding, even though AS3671 – 1989 is not directly applicable to the control of rail noise intrusion, it can be demonstrated that it is a relatively simple matter to apply standard acoustical theory and calculation techniques to the processes of AS3671 – 1989 to yield acceptable outcomes for noise intrusion from electric trains. Refer also to Attachment A for further discussion regarding the impact of noise intrusion generated by diesel trains.

## 5.0 Methodology

### 5.1 Calculation of Extent of Road Noise Intrusion onto Stage 22A

To determine the actual extent of road traffic noise intrusion onto the site, the SoundPLAN [VIII] prediction model that was prepared for the original assessment of road traffic noise intrusion onto Stage 18A was extended to include Stage 22A as well.

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[VII] The minimum $R_w$ values presented in Schedule 1 of QDC MP 4.4 were determined for a generic building design by applying the calculation techniques of AS3671 – 1989 to achieve compliance with the satisfactory internal sound levels of AS/NZS 2107:2016. Refer tabulation of *Referenced Documents* of QDC MP 4.4. Because it was necessary to cover a moderately wide range of functional variances for each particular space (ie number of exposed facades, floor areas, areas of glazing, ceiling height, presence of roof/ceiling construction, presence of entry door, etc) in doing so, as well as deal with (i) a 5dBA spread of noise levels within each noise category and (ii) generalised (and usually conservative) offsets between (a) $L_{A10(18hour)}$ and $L_{Aeq,1hrnight}$ values and (b) $L_{A10(18hour)}$ and $L_{Aeq,1hrday}$ values, a significant degree of conservatism was built into the minimum $R_w$ values of Schedule 1.

In addition, the minimum $R_w$ values of Schedule 1 have been determined on the basis that equal levels of acoustic energy are transmitted via each of the specific building elements. In practice, the acoustical performance of wall and roof/ceiling constructions, even under "standard construction" conditions, often exceeds the minimum $R_w$ values of Schedule 1. As a result of this, a re-balancing of the $R_w$ performance requirement for glazing can be undertaken without increasing the level of noise intrusion and without jeopardising compliance with the relevant internal sound levels of AS/NZS 2107:2016.

When due consideration is also given to the actual level of noise exposure at the facade, rather than adoption of the applicable 5dBA noise category band, a further refinement of the $R_w$ performance requirement for glazing can be conducted, again without jeopardising compliance with the relevant internal sound level requirement. As a result, when these refinements are adopted, it has been determined that, in almost all instances, the glazing to habitable spaces will not need to be upgraded to the degree stated in Schedule 1. Furthermore and in particular, for spaces with relatively low areas of glazing and exposed to noise levels at or around 63dBA $L_{A10(18hour)}$ for road traffic noise intrusion, it has been determined routinely that full compliance with the relevant internal sound levels of AS/NZS 2107:2016 can be achieved without requiring any upgrade beyond standard construction be made to the acoustical performance of the glazing.

[VIII] 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) road traffic noise intrusion by application of the CRTN '88 road traffic noise intrusion algorithms, (ii) rail noise intrusion by application of the Kilde Report 130 rail 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, MBRC, BCC, Queensland DES and most other State environmental authorities.

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

The noise model was prepared using the proposed site layout and the currently proposed finished ground levels as advised by Calibre Consulting. In addition, to maintain consistency with the assessments conducted for Stages 6A1, 8, 10C, 11, 12, 14 and 18A, the same data re the road traffic volume, mix and speed data for Market Drive, ie as provided by the Project Traffic Engineers, was adopted again [X]. This data is re-stated below.

Market Drive – West of Roundabout

- Traffic Volume: 8440 AADT
- Percentage Heavy Vehicles: 4%
- Traffic Speed: 60 km/h

Market Drive – East of Roundabout

- Traffic Volume: 9250 AADT
- Percentage Heavy Vehicles: 4%
- Traffic Speed: 60 km/h

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

These included:-

- Road gradient
- Site topography
- Receptor height
- Distance from road
- Angle of view to road
- Road surface conditions
- Vertical alignment of road
- Already-constructed residences
- Attenuation by intervening high ground
- Attenuation by purpose-designed Stage 18A barriers
- Attenuation by proposed barriers to attenuate rail noise intrusion (Ref. Figures 10A & 10B)

The level of noise intrusion across the site was determined for each of two heights above ground, ie:-

(i) 1.8m for lowset residences and lower level of any highset residences

(ii) 4.6m for first floor level of any highset residences

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

[X] It is noted that in February 2017, Council provided the results of traffic modelling for Weier Road which will join Market Drive in the future. The traffic volumes presented at that time were consistent with the traffic volume data adopted previously for Market Drive.

The results are shown as a series of noise contours presented in the following figures:-

- Figure 4: Lowset residences and lower level of highset residences, with 1.8m high barrier to Stage 18A Lots 945 and 946 as required by Report No 11-291.R15, 1dBA contours
- Figure 4A: Lowset residences and lower level of highset residences, with 1.8m high barrier to Stage 18A Lots 945 and 946 as required by Report No 11-291.R15, 55dBA and 63dBA contours
- Figure 5: First floor level of highset residences, with 1.8m high barrier to Stage 18A Lots 945 and 946 as required by Report No 11-291.R15, 1dBA contours
- Figure 5A: First floor level of highset residences, with 1.8m high barrier to Stage 18A Lots 945 and 946 as required by Report No 11-291.R15, 55dBA and 63dBA contours

As noted above in Section 5.2, it is considered that the most appropriate criterion to adopt when determining acceptable levels of road traffic noise intrusion is the 63dBA facade-corrected $L_{A10(18hour)}$ noise level limit. This criterion is to apply at all lowset residences and the lower level of highset residences. If compliance with this limit is met, there will be no warrant to undertake any further action to ameliorate noise intrusion onto the site or into any residences.

From the results presented in these figures, it can be seen that there was no intrusion of the 63dBA noise contour onto any of the lots of Stage 22A at either ground floor level facades or first floor level facades of highset residences. In these circumstances, there is no warrant to require that any further action be taken to attenuate road traffic noise intrusion into any residences of Stage 22A. It should be noted that this approach is fully consistent with the methodology adopted when assessing the impact of road traffic noise intrusion onto Stage 18A (Ref Report No 11-291.R15).

## 5.2 Calculation of Extent of Rail Noise Intrusion onto Stages 21, 22A and 22B

### 5.2.1 Historical Overview

In 2011, a rail noise model was prepared to evaluate the extent of noise intrusion onto the various stages of Riverbank located on the northern side of Market Drive. Having regard to each of Matters 1-4 above, this model was used to determine the actual QDC MP 4.4 noise categories that would apply all lots located within the relevant setback from NCRL (ie 250m as applied prior to 1 July 2015) or within the 100m wide TNC (as applied from 1 July 2015 to 28 January 2020, inclusive).

The prediction of rail noise intrusion onto the site was conducted using the Kilde Report 130 [XI] noise level prediction algorithms endorsed by Queensland Rail and as applied by the SoundPLAN computer program. The inputs into the Kilde Report 130 rail noise model were derived from 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 and SEL[XII] at 25m. In addition, due regard was given to the number of daily rail movements on the NCRL.

The rail noise model was configured to predict both $L_{Aeq,24hr}$ and $L_{Amax\ passby}$ noise levels onto the lots on the northern side of Market Drive. As required under Schedule 3 of QDC MP 4.4, the facade-corrected $L_{Amax\ passby}$ noise levels are to be used as the basis for determining the extent of rail noise intrusion [XIII].

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

[XII] SEL is the $L_{Aeq,1s}$ value which has the same energy sound pressure level as the $L_{Aeq,T}$ value measured during the passage of the particular train being assessed for the duration, T, of that passage.

[XIII] 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.

Due account was also taken of the site topography including the site earthworks levels across the various stages of Riverbank Estate current at that time as well as the noise barriers to proposed to be constructed along the rail reserve boundary of lots adjoining the rail line.

It should be noted that the transport noise models (ie both road and rail) were prepared using the Calibre earthworks design current at 16 July 2020 (*Southern Precinct 3d Design Contours.dwg*) and incorporated amendments made to the design by Calibre on 21 July 2020 (*Stg 22 Prelim 3d Contours.dwg*).

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, if any
- Vertical and horizontal alignment of rail line
- Reflection from opposite facades, if any
- Angle of view to rail line
- Receptor height

The output of the model was validated against the series of noise of measurements that was conducted on-site continuously from 9:30am Tuesday 1 November to 9:40am Wednesday, 2 November, 2011.

### 5.2.2 Update to Rail Noise Model

Historically, the Kilde Report 130 methodology has been shown to achieve good correlation with measured noise levels, especially at short distance from the rail line. This was the case for the original assessments conducted in 2011.

More recently, however, it has been determined on numerous occasions that the actual level of noise intrusion onto sites adjacent to rail lines trafficked by electric trains has been overstated on the QDC MP 4.4 noise category bands shown on the DSDILGP SPP IMS website. In these instances, the prudent course of action has been to undertake a validation process for any new or updated assessment of rail noise intrusion to confirm the suitability of the Kilde Report 130 algorithms at the site. Ideally, such validation should take account of both the $L_{Amax\ passby}$ and the $L_{Aeq(24hour)}$ noise level parameters.

To verify whether the original noise model was still appropriate and still accurately predicting the degree of intrusion of rail noise onto the site, it was necessary to re-validate the model. To re-validate the rail noise model, both attended noise level measurements and unattended noise level monitoring were undertaken. The monitoring location is shown as "A" [XIV] in Figure 1 and Figure 3C.

The attended noise level measurements were conducted over two peak rail traffic periods, ie (i) from 05:25am to 08:00am on Wednesday 01 July 2020 and (ii) from 04:55pm to 06:25pm on Friday 03 July 2020. The noise levels generated by and 20 inbound and 17 outbound train passbys were measured.

[XIV] Location "A" was 28m from the nearest rail line. It is noted that Location "A" was located on Stage 4B, rather than on either of Stage 22A or 22B. At the time of undertaking the noise of a measurements, construction activities were being conducted in close proximity to Stages 22A and 22B. In these circumstances, to avoid extraneous noise intrusion, it was deemed more appropriate to conduct the noise of measurements monitoring one away from any construction activities. The most appropriate secure location in these circumstances was determined to be Location "A".

In addition, unattended noise level measurements were conducted over the period ie from 10:00am on Wednesday 01 July 2020 to 06:30pm on Thursday 03 July 2020. From this data, the noise levels generated by clearly identifiable train passbys were able to be derived during periods when the otherwise prevailing ambient noise levels were comparatively low. The movements on the line for the periods of time of the unattended on-site noise level measurements were retrospectively cross-referenced against the "actual location train times" data provided by QR.

In total, the noise generated by 314 train passbys was able to be measured directly during the unattended noise level measurements. On each occasion, the $L_{Aeq,T}$ [XV] and MaxL [XVI] noise levels were recorded electronically. In both cases, the sampling and noise level derivation method of QR's *Attachment A - Railway Noise Assessment Report Structure and Specific Issues* has been adopted.

The measured free-field noise levels at Location "A" are presented below:-

- $L_{Amax\ passby}$: 83.3dBA
- $L_{Aeq(24hour)}$: 57.2dBA

The rail noise model was validated to the $L_{Amax\ passby}$ at Location "A". After incorporating the latest lot layout prepared by RPS and earthworks design levels as provided by Calibre (ie earthworks design current at 16 August 2022: *Tin Design 2022016.dxf* and *12d OUTOUT pads and string draped.dxf*), the validated noise model was then used to predict the actual level of rail noise intrusion (determined as $L_{Amax\ passby}$) across Stages 21, 22A and 22B.

### 5.3 Rail Traffic Noise Prediction Scenarios

Four rail noise scenarios have been modelled. The details of each are presented below.

Scenario 1: Receiver height set at 1.5m agl (ie occupant ear level in private open space), NCRL $L_{Amax\ passby}$ noise levels, no barriers constructed. Refer Figure 6 for free field $L_{Amax\ passby}$ noise levels.

Scenario 2: Receiver height set at 1.5m agl (ie occupant ear level in private open space), NCRL $L_{Amax\ passby}$ noise levels, 2.0m-4.0m high acoustic barrier arrangement to Stages 22A and 22B as shown in Figures 10A and 10B. Refer Figure 7 for 84dBA $L_{Amax\ passby}$ free field compliance noise level contour plot.

Scenario 3: Receiver height set at 1.8m agl (ie ground floor level facades), NCRL $L_{Amax\ passby}$ noise levels, 2.0m-4.0m high acoustic barrier arrangement to Stages 22A and 22B as shown in Figures 10A and 10B. Refer Figure 8 for the ground floor level QDC MP 4.4 Rail Noise Categories for all lots within the TNC associated with NCRL.

Scenario 4: Receiver height set at 4.6m agl (ie first floor level facades), NCRL $L_{Amax\ passby}$ noise levels, 2.0m-4.0m high acoustic barrier arrangement to Stages 22A and 22B as shown in Figures 10A and 10B. Refer Figure 9 for the first floor level QDC MP 4.4 Rail Noise Categories for all lots within the TNC associated with NCRL.

Note:

As discussed above in Section 5.2, the $L_{Aeq,24hr}$ noise level measured at Location "A" was 57.2dBA. This value includes noise measured from sources other than rail traffic (including bird noise and road traffic noise from Market Drive). As compliance with the $L_{Aeq,24hr}$ noise level limit for rail noise intrusion into private open spaces is achieved at Location "A", it can be readily determined that compliance would be achieved across the entirety of Stages 21, 22A and 22B.

[XV] $L_{Aeq,T}$ is the equivalent energy sound pressure level of the passage of a train measured over the measurement time period, T (sec), where T is set to 56 seconds, ie 60 second measurement interval less 4seconds time to "write" the data to the SD card.

[XVI] MaxL is the instantaneous maximum noise level measured during the passage of a train when the noise level is due to the train itself and not extraneous noise.

## 6.0 Discussion of Results

### 6.1 Road Traffic Noise Intrusion

As discussed in Section 5.1, there will be no intrusion of the 63dBA noise contour onto any of the lots of Stage 22A at either ground floor level facades of lowset and highset residences or the first floor level facades of highset residences. In these circumstances, there is no warrant to require that any further action be taken to attenuate road traffic noise intrusion into any residences within Stage 22A.

### 6.2 Degree of Compliance with Private Open Space Noise Level Limit for Rail Noise

From the results presented in Figure 6, it can be seen that, with no acoustic barriers in place, the 84dBA free field Single Event Maximum SPL ($L_{Amax\ passby}$) noise level limit for rail noise intrusion into private open spaces (as set by DTMR's *Interim Guideline – Operational Railway Noise and Vibration – Government Supported Transport Infrastructure* and Table 2.2.2 of State Code 2: Development in a Railway Environment of SDAP Version 2.6) will be exceeded on parts of Lots 1508-1518, 1547-1554, 1565 and 1566 (notably within the preferred private open space area on these lots).

Consequently, there is a requirement to construct an acoustic barrier to adequately control rail noise intrusion into the private open spaces of Lots 1508-1518, 1547-1554, 1565 and 1566.

As shown in Figure 7, with the 2.0m-4.0m high acoustic barrier to Stages 22A and 22B in place, compliance with the 84dBA free field Single Event Maximum SPL ($L_{Amax\ passby}$) noise level limit will be achieved across all lots within Stages 21, 22A and 22B. The alignment of this acoustic barrier arrangement is shown in Figures 10A and 10B.

### 6.3 Resultant Noise Categories

From the results presented in Figure 8 (ie ground floor level facades with the 2.0m-4.0m high acoustic barrier in place), it can be seen that, at the ground floor level, all lots within the TNC will be located in the Noise Category 2 band or lower. That is, none of the lots will be located in either the Noise Category 3 or Noise Category 4 bands when lowset residences are constructed.

Furthermore, from an inspection of the noise contours presented in Figure 9 (ie first floor level of highset residences with the 2.0m-4.0m high acoustic barrier in place), it can be seen that (i) only those lots adjoining the rail line will lie within either the Noise Category 3 or 4 band and (ii) depending on the placement of the residence on the lot, the upper level of the residences may be wholly within the Noise Category 3 band.

These outcomes are in stark contrast to the noise category designations that would apply otherwise under the SPP IMS website whereby all lots of Stages 22A and 22B – whether accommodating lowset or highset residences – are shown lying in either the Noise Category 3 or 4 bands.

The breakdown of the noise categories applicable to the 81 lots located within the TNC (ie Lots 1482-1487 and 1492-1566) is presented in Tables 3-5, overpage. For ease of comparison, the resultant noise categories have been colour-coded to the contours shown in Figures 8 and 9.

Note:

> As discussed further in the notes following Table 5, for lots exposed to two noise categories, the higher of the noise category has been designated for the particular lot. This is notwithstanding the fact that, in many instances, it is fully expected that the placement of the residential building on the lot will be such that the dwelling itself will be set back sufficiently from the boundary such that the lower noise category will apply to the residence.

| 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 |
| 1482 | 0 | 0 | 1493 | 0 | 0 | 1500 | 1 | 1 |
| 1483 | 0 | 0 | 1494 | 0 | 0 | 1501 | 1 | 1 |
| 1484 | 0 | 0 | 1495 | 0 | 0 | 1502 | 1 | 1 |
| 1485 | 0 | 0 | 1496 | 0 | 0 | 1503 | 1 | 1 |
| 1486 | 1 | 1 | 1497 | 0 | 1 | 1504 | 1 | 1 |
| 1487 | 1 | 1 | 1498 | 1 | 1 | | | |
| 1492 | 0 | 0 | 1499 | 1 | 1 | | | |

**Table 3 – QDC MP 4.4 Rail Noise Categories for Stage 21 (Lots 1482-1487 and 1492-1504) With Stepped 2.0m-4.0m High Acoustic Barrier to Site (Ref Figures 8-10B)**

| 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 |
| 1505 | 1 | 2 | 1513 | 2 | 4 | 1521 | 2 | 2 |
| 1506 | 2 | 2 | 1514 | 2 | 4 | 1522 | 2 | 2 |
| 1507 | 2 | 2 | 1515 | 2 | 4 | 1523 | 2 | 2 |
| 1508 | 2 | 4 | 1516 | 2 | 4 | 1524 | 2 | 2 |
| 1509 | 2 | 4 | 1517 | 2 | 4 | 1525 | 2 | 2 |
| 1510 | 2 | 4 | 1518 | 2 | 4 | 1526 | 2 | 2 |
| 1511 | 2 | 4 | 1519 | 1 | 1 | 1527 | 2 | 2 |
| 1512 | 2 | 4 | 1520 | 1 | 1 | 1528 | 2 | 2 |

**Table 4 – QDC MP 4.4 Rail Noise Categories for Stage 22A (Lots 1505-1528) With Stepped 2.0m-4.0m High Acoustic Barrier to Site (Ref Figures 8-10B)**

| 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 |
| 1529 | 2 | 2 | 1542 | 2 | 2 | 1555 | 2 | 4 |
| 1530 | 2 | 2 | 1543 | 2 | 2 | 1556 | 2 | 4 |
| 1531 | 2 | 2 | 1544 | 2 | 2 | 1557 | 2 | 4 |
| 1532 | 2 | 2 | 1545 | 2 | 2 | 1558 | 2 | 4 |
| 1533 | 2 | 2 | 1546 | 2 | 2 | 1559 | 2 | 4 |
| 1534 | 2 | 2 | 1547 | 2 | 4 | 1560 | 2 | 4 |
| 1535 | 2 | 2 | 1548 | 2 | 4 | 1561 | 1 | 4 |
| 1536 | 2 | 2 | 1549 | 2 | 4 | 1562 | 1 | 4 |
| 1537 | 2 | 2 | 1550 | 2 | 4 | 1563 | 1 | 3 |
| 1538 | 1 | 1 | 1551 | 2 | 4 | 1564 | 2 | 3 |
| 1539 | 1 | 1 | 1552 | 2 | 4 | 1565 | 2 | 4 |
| 1540 | 1 | 2 | 1553 | 2 | 4 | 1566 | 2 | 4 |
| 1541 | 2 | 2 | 1554 | 2 | 4 | | | |

**Table 5 – QDC MP 4.4 Rail Noise Categories for Stage 22B Lots 1529-1566 With Stepped 2.0m-4.0m High Acoustic Barrier to Site (Ref Figures 8-10B)**

Notes:

1. The Noise Category determinations presented above in Tables 3-5 have been derived directly from the noise contour plots presented in Figures 8 and 9 and in accordance with the advice from DTMR as outlined in Section 4.5.2 above. These noise categories may be used at BA to guide the acoustical design of residences to be constructed on the lots within the future TNC.
2. It is important to note that, on many lots, the noise category that has been designated for the particular lot in each of Tables 3-5 has been the result of a very minor incursion of the higher of the two noise category bands intruding onto the lot. In many instances, 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, the dwelling/s itself – either in whole or in large part – will likely be set back sufficiently from the boundary such that the next lower noise category will apply to the residence. The lots to which this consideration would apply can be determined by reference to Figures 8 and 9. These figures can also be used to determine the building setbacks which would need to be achieved to avoid intrusion of the higher noise category onto the residence itself.

## 7.0 Conclusions

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

- There will be no intrusion of the 63dBA noise contour onto any of the lots of Stage 22A. Consequently, there is no warrant to require that any further action be taken to attenuate road traffic noise intrusion into any residences of Stage 22A.
- With no acoustic barrier in place, the 84dBA free field Single Event Maximum SPL ($L_{Amax\ passby}$) noise level limit for rail noise intrusion into private open spaces (as set by DTMR's *Interim Guideline – Operational Railway Noise and Vibration – Government Supported Transport Infrastructure* and Table 2.2.2 of State Code 2: Development in a Railway Environment of SDAP Version 2.6) will be exceeded across parts of Lots 1508-1518, 1547-1554, 1565 and 1566.
- With the 2.0m-4.0m high acoustic barrier arrangement shown in Figures 10A and 10B, compliance with the 84dBA free field Single Event Maximum SPL ($L_{Amax\ passby}$) and 62dBA free field $L_{Aeq,24hr}$ noise level limits set under DTMR Interim Guideline and SDAP State Code 2 will be achieved across all lots within Stages 21, 22A and 22B.
- With this barrier arrangement in place, and as required by DTMR, the updated QDC MP 4.4 noise categories applying to both the ground floor and first floor levels will be as presented in Tables 3-5. Refer also Figures 8 and 9.

## 8.0 Recommendations

To achieve adequate control of rail noise intrusion onto Stages 21, 22A and 22B, it is recommended that a stepped 2.0m-4.0m high noise barrier be constructed along common boundary of the site with the rail reserve and returned along side boundaries of selected lots.

The barrier arrangement is shown in Figures 10A and 10B.

Specifically, by reference to Figure 10A (Stage 22A), the barrier is to extend (i) along the NW boundaries of Lots 1508-1512 at 3.4m high with a 3.0m high return constructed along the northern boundary of Lot 1508 and a 2.0m-3.0m high return constructed along the SW boundary of Lot 1512 and (ii) along the NW boundaries of Lots 1513-1518 at 3.8m-4.0m high with a 2.0m-3.4m high return constructed along the NE boundary of Lot 1513. This barrier is to connect to the Stage 22B barrier as shown in Figure 10B and described directly below.

Further, by reference to Figure 10B (Stage 22B), the barrier noted above that is to be constructed along the NW boundaries of 1513-1518 is to connect to a 2.0m-4.0m high barrier constructed along the NW boundaries of Lots 1547-1566 together with a 4.0m high return constructed along the southern boundary of Lot 1566.

All heights are relative to the top of the retaining wall. Notwithstanding, it should be noted that the details of the barrier, notably the heights of individual barrier elements along the NW boundary of individual lots will be sensitive to the detailed design of the retaining wall and any subsequent changes to the earthworks levels across Stages 22A and 22B made during the detailed design phase.

As required by AO25.1 and AO26.1 from State Code 2: Development in a Railway Environment of SDAP Version 2.6, the barrier will need to be designed and constructed in accordance with QR Civil Engineering Technical Requirement CIVIL-SR-014 *Design of Noise Barriers Adjacent to Railways* [XVII].

[XVII] It is noted that the current version of SDAP (ie Version 3.0) specifies that rail noise barriers comply with different QR/DTMR technical requirements/specifications. These different QR/DTMR technical requirements/specifications have been (prematurely) adopted by SARA at Condition 4b of SRA Response No. 2103-21760 SRA, dated 7 December 2021.

Adopting generally the same wording in the current SARA conditions, however, the suggested wording for the updated condition is presented below.

**Referral Agency Condition xx**

(a) Carry out the development generally in accordance with the report, *Assessment and Control of Rail and Road Traffic Noise Intrusion onto Stages 20, 21, 22A and 22B*, Acoustics RB Pty Ltd Report Ref 11-291.R21.Rev1 (dated 7 October 2022), in particular:

- Construct 2.0m-4.0m high noise barriers in accordance with Section 9.0 Recommendations and Figures 10A and 10B (alignment of acoustic barriers to Stage 22A and 22B).

(b) The noise barriers, must be designed in accordance with:

- Queensland Rail Civil Engineering Technical Specification – QR-CTS-Part 41 – *Design and Construction of Noise Fences/Barriers and Transport*; and
- Transport and Main Roads Specifications, MRTS15 *Noise Fences*, prepared by Department of Transport and Main Roads, dated March 2019.

(c) RPEQ certification, with supporting documentation, must be provided to SARA/DTMR confirming that the development has been constructed in accordance with parts (a) and (b) of this condition.

Notes:

The combined barrier arrangement shown in Figure 10A (Stage 22A) and Figure 10B (Stage 22B) must be constructed to achieve the overall degree of beneficial attenuation shown in Figures 8 and 9. That is, it will not be sufficient to erect only one part of the barrier to achieve the required degree of attenuation for the corresponding stage of the development.

The resultant degree of rail noise intrusion onto each of Stages 21, 22A and 22B is presented in Figures 8 and 9 and summarised in Tables 3-5. The information presented in these figures, tables and notes following Table 5 should be used to set the noise category/s applying to each lot located within the NCRL TNC and, subsequently, to guide the acoustical design of residences to be constructed on Lots 1482-1487 and 1492-1566.

| Report prepared by: | Reviewed and approved by: |
|---|---|
|  |  |
| Hugh Brown,<br>Senior Project Engineer<br>BEng(Mech)(Hons) | Russell Brown,<br>Director<br>RPEQ 2799 |

# Attachment A

# Overview of QDC MP 4.4 and Advice from DTMR

Under the provisions of Section 246Z and Section 246ZA of *Building Act 1975*, a Transport Noise Corridor (TNC) applies along both sides of North Coast Rail Line (NCRL).

In general, all residential allotments located within a TNC will need to be acoustically designed in accordance with the requirements of QDC MP 4.4 having regard to the relevant noise categories. The QDC MP 4.4 Noise Categories can be determined at DA by reference to the DSDILGP SPP IMS website or in accordance with the alternative site-specific noise level assessment method.

On advice from DTMR and as noted in DTMR's *Transport Noise Management Code of Practice*, November 2013, building upgrade requirements can be determined at BA either (i) by application of QDC MP 4.4 Noise Categories determined from the DSDILGP SPP IMS website, or (ii) from the results of the alternative site-specific noise assessment.

The alternative site-specific noise assessment allows the actual building upgrades that need to be incorporated into the design of the dwelling to be optimised. In most commonly encountered situations, and especially for residences located in QDC MP 4.4 Noise Categories 2, 3 and 4, the optimisation of building upgrades results in lower overall building costs relative to those that would be incurred using the deemed-to-comply constructions of QDC MP 4.4.

When applying the alternative site-specific noise assessment method to the determination of either the QDC MP 4.4 Noise Categories or the building upgrade requirements that apply to any specific residence located within a TNC, due consideration may be given to the following matters:-

1. Site topography.
2. Beneficial shielding provided by any barriers – either existing or required to be constructed as a condition of the approval of the Development Application over the subject site.
3. Acoustical shielding provided by existing and approved buildings, where "approved buildings" refers to (i) buildings for which formal building approval has been granted, or (ii) in the case of the specific building/s being assessed, where building approval is being sought.
4. Determination of the relevant QDC MP 4.4 Noise Categories may be made on a facade-specific basis, but where the total area of the facade of a habitable space is exposed to two or more QDC MP 4.4 Noise Categories, the higher QDC MP 4.4 Noise Category would apply to the whole facade of the particular habitable space.

In addition, and as a result of advice provided by DTMR, the following refinements to the site-specific noise assessment may also be applicable (refer also constraint detailed following):-

5. In April 2012, updated advice from DTMR resulted in further refinement of the acoustical design procedures. This updated advice contends that in situations where noise contours can be plotted at fine gradation around the external facades of the building being assessed, such that noise levels can be determined with precision at individual building facade elements, the calculation procedures of AS3671 - 1989 *Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction* may be adopted in lieu of the QDC MP 4.4 Noise Categories and the minimum $R_w$ values presented in Schedule 1 of QDC MP 4.4 to determine the precise level of building upgrade required to be implemented to achieve compliance with the internal sound level of AS/NZS 2107:2016 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* [XVIII] that is applicable to the specific space.

Notes:

Each of these items of advice has been endorsed in DTMR's *Transport Noise Management Code of Practice*, November 2013.

AS3671 – 1989, as its name suggests, provides guidance on dealing with road traffic noise intrusion. There is currently no equivalent standard to deal adequately with rail noise intrusion. Notwithstanding, even though AS3671 – 1989 is not directly applicable to the control of rail noise intrusion, it can be demonstrated that it is a relatively simple matter to apply standard acoustical theory and calculation techniques to the processes of AS3671 to yield validated outcomes.

It has been well-established that when considering the degree of noise intrusion from electric train passbys, the application of the calculation procedures of AS3671 – 1989 (after validation) would result in the same internal noise levels (ie generally within ±1dBA) as would be obtained by application of the applicable deemed-to-comply constructions set by QDC MP 4.4 and, correspondingly, would result in compliance with the 45-50dBA target range set by QDC MP 4.4.

By contrast, when considering the degree of noise intrusion from diesel passbys, the direct application of AS3671 – 1989 results in internal noise levels which are significantly higher than those which result from a direct application of applicable deemed-to-comply constructions set by QDC MP 4.4 for the same external noise level [XIX]. This results in noise levels which very frequently may be above the 45-50dBA target range set by QDC MP 4.4. Exceedances of 5-8dBA may be encountered.

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[XVIII] The minimum $R_w$ values presented in Schedule 1 of QDC MP 4.4 were determined for a generic building design by applying the calculation techniques of AS3671 – 1989 to achieve compliance with the satisfactory internal sound levels of AS/NZS 2107:2016. Refer tabulation of Referenced Documents of QDC MP 4.4. Because it was necessary to cover a moderately wide range of functional variances for each particular space (ie number of exposed facades, floor areas, areas of glazing, ceiling height, presence of roof/ceiling construction, presence of entry door, etc) in doing so, as well as deal with (i) a 5dBA spread of noise levels within each noise category and (ii) generalised (and usually conservative) offsets between (a) $L_{A10(18hour)}$ and $L_{Aeq,1hrnight}$ values and (b) $L_{A10(18hour)}$ and $L_{Aeq,1hrday}$ values, a significant degree of conservatism was built into the minimum $R_w$ values of Schedule 1.

In addition, the minimum $R_w$ values of Schedule 1 have been determined on the basis that equal levels of acoustic energy are transmitted via each of the specific building elements. In practice, the acoustical performance of wall and roof/ceiling constructions, even under "standard construction" conditions, often exceeds the minimum $R_w$ values of Schedule 1. As a result of this, a re-balancing of the $R_w$ performance requirement for glazing can be undertaken without increasing the level of noise intrusion and without jeopardising compliance with the relevant internal sound levels of AS/NZS 2107:2016.

When due consideration is also given to the actual level of noise exposure at the facade, rather than adoption of the applicable 5dBA noise category band, a further refinement of the $R_w$ performance requirement for glazing can be conducted, again without jeopardising compliance with the relevant internal sound level requirement. As a result, when these refinements are adopted, it has been determined that, in almost all instances, the glazing to habitable spaces will not need to be upgraded to the degree stated in Schedule 1. Furthermore and in particular, for spaces with relatively low areas of glazing and exposed to noise levels at or around 63dBA $L_{A10(18hour)}$ for road traffic noise intrusion, it has been determined routinely that full compliance with the relevant internal sound levels of AS/NZS 2107:2016 can be achieved without requiring any upgrade beyond standard construction be made to the acoustical performance of the glazing.

[XIX] 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.

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, rather than by application of the validated calculation procedures of AS3671 – 1989.

This is notwithstanding the fact that by application of the deemed-to-apply ratings set by QDC MP 4.4, the level of noise transmitted by diesel passbys into habitable spaces will generally be above than the upper end of the 45-50dBA target range set by QDC MP 4.4 and sometimes substantially above.

Rather, the advice is based on (i) an acceptance that the deemed-to-apply ratings set by QDC MP 4.4 provide an acceptable level of control of rail noise intrusion from both trains drawn by diesel locomotives and electric trains and (ii) the acknowledgement that the determination of the specific deemed-to-comply constructions can be best made by reference to the actual site-specific QDC MP 4.4 Noise Categories applicable to the particular residence which are determined by reference to Considerations 1-4.

Consequently, given that the North Coast Rail Line is regularly trafficked by trains drawn by diesel locomotives, the objective of any site-specific acoustical design assessment should be to determine the deemed-to-apply minimum $R_w$ ratings for each component of the external envelope of the particular residence by reference directly to (i) the results presented in Table 1 and (ii) the details in Schedule 1 of QDC MP4.4 notwithstanding the fact that noise levels exceeding the upper end of the 45-50dBA target range set by QDC MP 4.4 will result from diesel train passbys.


**Figure 1 – Site Location and Monitoring Location "A"**

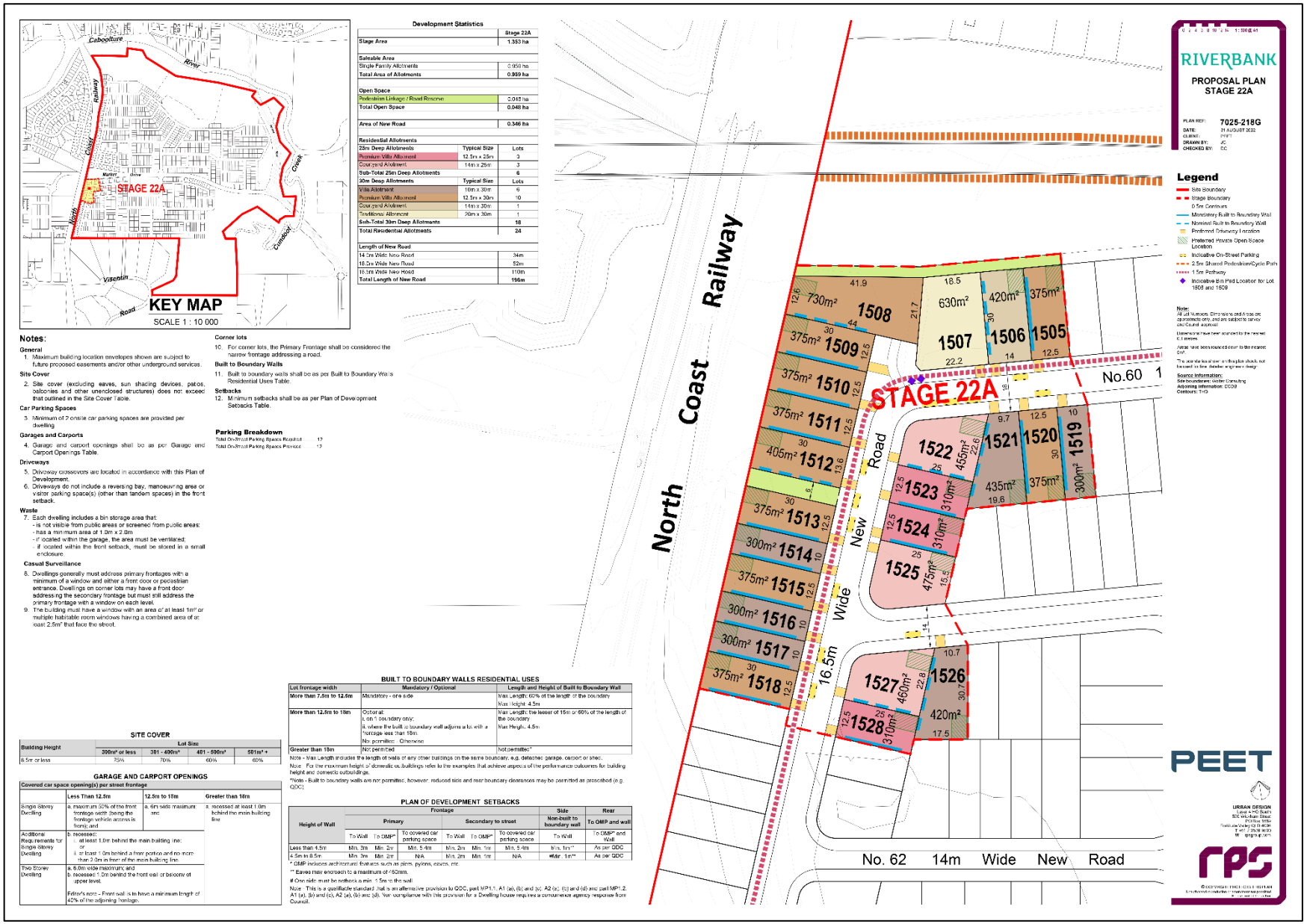


**Figure 2A – Lot Layout over Stage 22A**

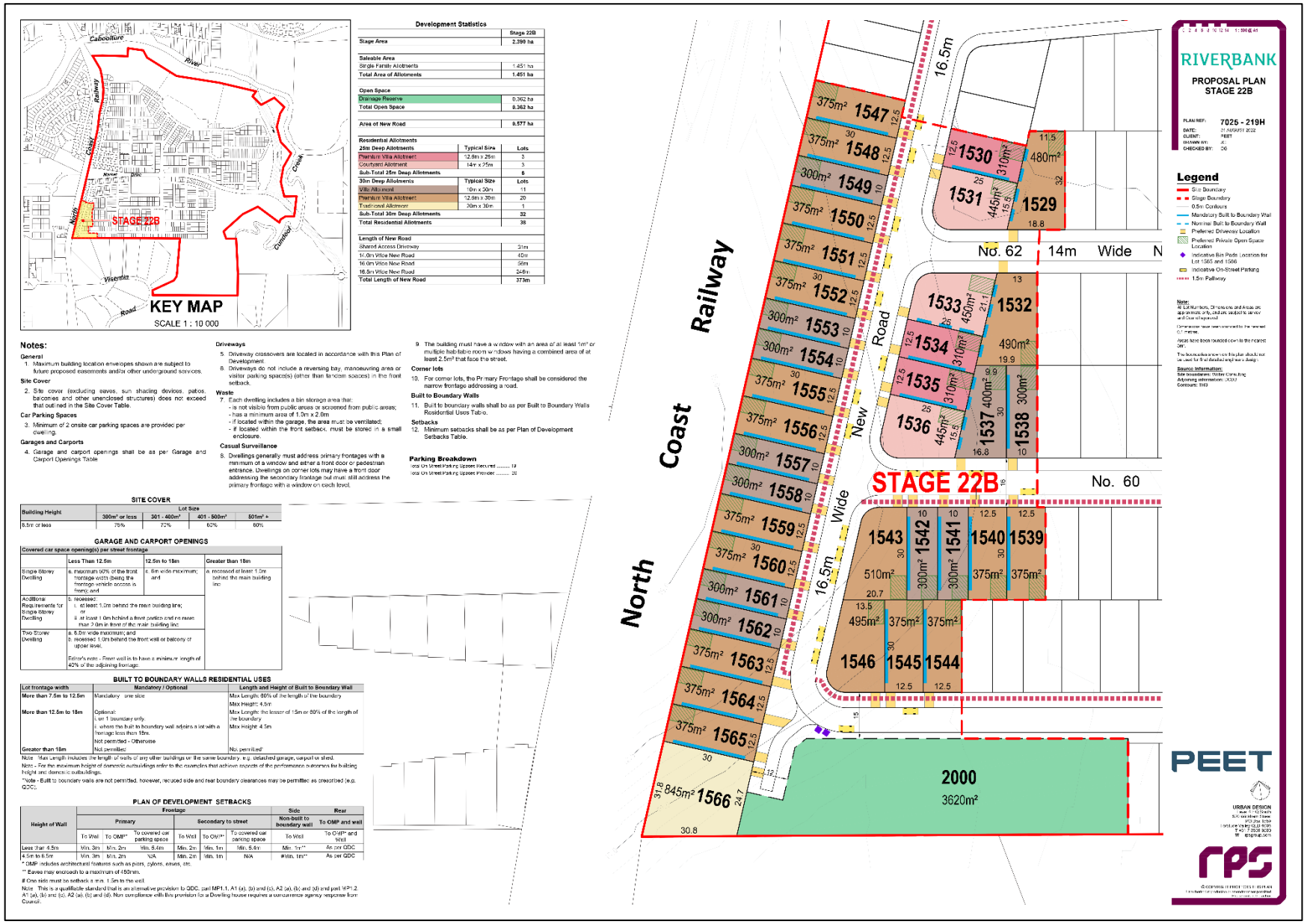


**Figure 2B – Lot Layout over Stage 22B**

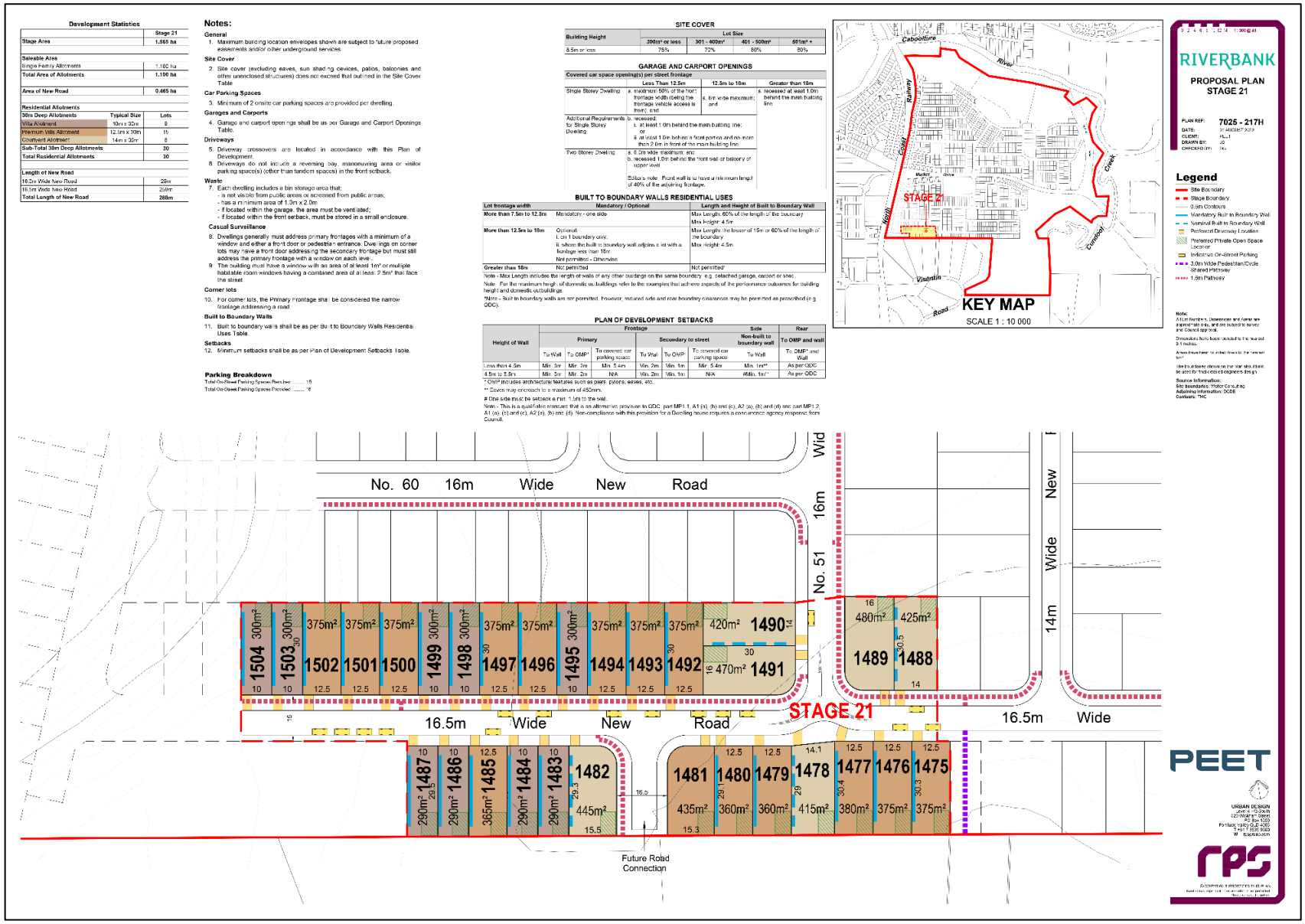


**Figure 2C – Lot Layout over Stage 21**

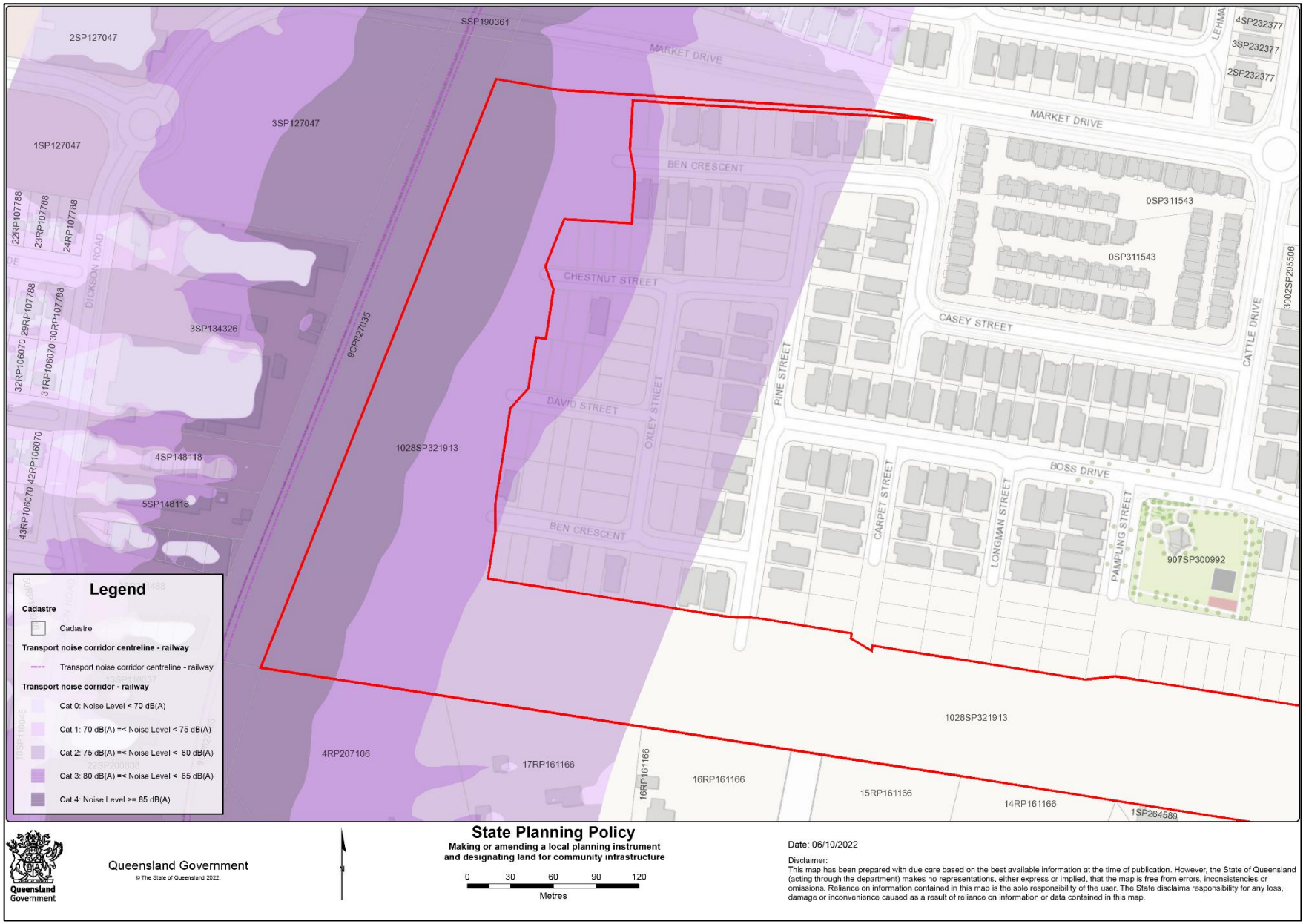


**Figure 3 – NCRL TNC by Reference to DSDILGP SPP IMS Website**

# Figures 4-5A

# Road Traffic Noise Levels

Acoustics RB Pty Ltd

Report No. 11-291.R21.Rev1 Figure 4

Facade-Corrected $L_{A10(18hour)}$ Noise Levels due to Road Traffic on Market Drive

Lowset and Ground Floor Level of Highset Residences

N

MARKET DRIVE

MARKET DRIVE

STAGE 22A

STAGE 19A

No.60 16m Wide New Road

No. 63 14m Wide New Road

New Road

16.5m Wide

1505 1506 1507 1508 1509 1510 1511 1512 1513 1514 1515 1516 1517 1518 1519 1520 1521 1522 1523 1524 1525 1526 1527 1528 1547

9 CP827035

951 SP308276 952 SP308276 953 SP308276 954 SP308276 955 SP308276 956 SP308276

957 SP308276 958 SP308276 959 SP308276 960 SP308276 961 SP308276

966 SP315945 967 SP315945 968 SP315945 969 SP315945 970 SP315945 971 SP315945 972 SP315945 973 SP315945 974 SP315945

915 SP315945 916 SP315945 917 SP315945 918 SP315945 919 SP315945

A3 Scale 1:750

0 5 10 20 30 40 50 m

Facade-Corrected $L_{A10(18hour)}$ Noise Level (dBA)

| | |
|---|---|
| | < 45 |
| 45 <= | < 46 |
| 46 <= | < 47 |
| 47 <= | < 48 |
| 48 <= | < 49 |
| 49 <= | < 50 |
| 50 <= | < 51 |
| 51 <= | < 52 |
| 52 <= | < 53 |
| 53 <= | < 54 |
| 54 <= | < 55 |
| 55 <= | < 56 |
| 56 <= | < 57 |
| 57 <= | < 58 |
| 58 <= | < 59 |
| 59 <= | < 60 |
| 60 <= | < 61 |
| 61 <= | < 62 |
| 62 <= | < 63 |
| 63 <= | < 64 |
| 64 <= | < 65 |
| 65 <= | < 66 |
| 66 <= | < 67 |
| 67 <= | < 68 |
| 68 <= | < 69 |
| 69 <= | < 70 |
| 70 <= | < 71 |
| 71 <= | < 72 |
| 72 <= | < 73 |
| 73 <= | < 74 |
| 74 <= | |

Acoustics RB Pty Ltd

Report No. 11-291.R21.Rev1 Figure 4A

Facade-Corrected 55dBA & 63dBA $L_{A10(18hour)}$ Noise Levels due to Road Traffic on Market Drive

Lowset and Ground Floor Level of Highset Residences

N

MARKET DRIVE

MARKET DRIVE

STAGE 22A

STAGE 19A

No.60 16m Wide New Road

No. 63 14m Wide New Road

16.5m Wide New Road

1508 1509 1510 1511 1512 1513 1514 1515 1516 1517 1518 1547 1507 1506 1505 1522 1521 1520 1519 1523 1524 1525 1527 1526 1528

956 SP308276 955 SP308276 954 SP308276 953 SP308276 952 SP308276 951 SP308276 950 SP308276 949 SP308276 948 SP308276

957 SP308276 958 SP308276 959 SP308276 960 SP308276 961 SP308276 962 SP308276 963 SP308276 964 SP308276 965 SP308276

974 SP315945 973 SP315945 972 SP315945 971 SP315945 970 SP315945 969 SP315945 968 SP315945 967 SP315945 966 SP315945

918 SP315945 917 SP315945 916 SP315945 915 SP315945 919 SP315945

9 CP827035

A3 Scale 1:750

0 5 10 20 30 40 50 m

Facade-Corrected $L_{A10(18hour)}$ Noise Level (dBA)

<= 55.5

55.5 < <= 63.5

63.5 <

Acoustics RB Pty Ltd

Report No. 11-291.R21.Rev1 Figure 5

Facade-Corrected $L_{A10(18hour)}$ Noise Levels due to Road Traffic on Market Drive

First Floor Level of Highset Residences

N

MARKET DRIVE

MARKET DRIVE

STAGE 22A

STAGE 19A

No.60 16m Wide New Road

No. 63 14m Wide New Road

New Road

Wide 16.5m New Road

1508 1509 1507 1506 1505 1510 1511 1512 1522 1521 1520 1519 1513 1523 1524 1514 1525 1515 1516 1517 1518 1527 1526 1547 1528

956 SP308276 955 SP308276 954 SP308276 953 SP308276 952 SP308276 951 SP308276

957 SP308276 958 SP308276 959 SP308276 960 SP308276 961 SP308276

974 SP315945 973 SP315945 972 SP315945 971 SP315945 970 SP315945 969 SP315945 968 SP315945 967 SP315945 966 SP315945

915 SP315945 917 SP315945 916 SP315945 919 SP315945

9 CP827035

Facade-Corrected $L_{A10(18hour)}$ Noise Level (dBA)

| | |
|---|---|
| | < 45 |
| 45 <= | < 46 |
| 46 <= | < 47 |
| 47 <= | < 48 |
| 48 <= | < 49 |
| 49 <= | < 50 |
| 50 <= | < 51 |
| 51 <= | < 52 |
| 52 <= | < 53 |
| 53 <= | < 54 |
| 54 <= | < 55 |
| 55 <= | < 56 |
| 56 <= | < 57 |
| 57 <= | < 58 |
| 58 <= | < 59 |
| 59 <= | < 60 |
| 60 <= | < 61 |
| 61 <= | < 62 |
| 62 <= | < 63 |
| 63 <= | < 64 |
| 64 <= | < 65 |
| 65 <= | < 66 |
| 66 <= | < 67 |
| 67 <= | < 68 |
| 68 <= | < 69 |
| 69 <= | < 70 |
| 70 <= | < 71 |
| 71 <= | < 72 |
| 72 <= | < 73 |
| 73 <= | < 74 |
| 74 <= | |

A3 Scale 1:750

0 5 10 20 30 40 50 m

Acoustics RB Pty Ltd

Report No. 11-291.R21.Rev1 Figure 5A

Facade-Corrected 55dBA & 63dBA $L_{A10(18hour)}$ Noise Levels due to Road Traffic on Market Drive

First Floor Level of Highset Residences

N

MARKET DRIVE

MARKET DRIVE

STAGE 22A

STAGE 19A

STAGE

No.60 16m Wide New Road

No. 63 14m Wide New Road

16.5m Wide New Road

1508 1509 1510 1511 1512 1513 1514 1515 1516 1517 1518 1547

1507 1506 1505

1522 1521 1520 1519 1523 1524 1525 1526 1527 1528

9 CP827035

956 SP308276 955 SP308276 954 SP308276 953 SP308276 952 SP308276 951 SP308276 950 SP308276 949 SP308276 948 SP308276

957 SP308276 958 SP308276 959 SP308276 960 SP308276 961 SP308276 962 SP308276 963 SP308276 964 SP308276 965 SP308276

974 SP315945 973 SP315945 972 SP315945 971 SP315945 970 SP315945 969 SP315945 968 SP315945 967 SP315945 966 SP315945

918 SP315945 917 SP315945 916 SP315945 915 SP315945 919 SP315945

A3 Scale 1:750

0 5 10 20 30 40 50 m

Facade-Corrected $L_{A10(18hour)}$ Noise Level (dBA)

<= 55.5

55.5 < <= 63.5

63.5 <

# Figures 6-10B

# Rail Noise Levels and Alignment of Stepped 2.0m-4.0m High Barrier to Rail Boundary of Stages 22A and 22B

Acoustics RB Pty Ltd

Report No. 11-291.R21.Rev1 Figure 6

Free Field $L_{Amax\ passby}$ Noise Levels

North Coast Rail Line
Stages 21, 22A & 22B

No Acoustic Barriers to Stages 22A & 22B

Private Open Spaces

N

North Coast Rail Line

STAGE 22A

STAGE 19A

STAGE 22B

STAGE 19B

No.60 16m Wide New Road

No. 63 14m Wide New Road

No. 60 16m Wide New Road

16.5m Wide New Road

Extent of TNC

Free Field $L_{Amax\ passby}$ Noise Level (dBA)

< 56
56 <= < 57
57 <= < 58
58 <= < 59
59 <= < 60
60 <= < 61
61 <= < 62
62 <= < 63
63 <= < 64
64 <= < 65
65 <= < 66
66 <= < 67
67 <= < 68
68 <= < 69
69 <= < 70
70 <= < 71
71 <= < 72
72 <= < 73
73 <= < 74
74 <= < 75
75 <= < 76
76 <= < 77
77 <= < 78
78 <= < 79
79 <= < 80
80 <= < 81
81 <= < 82
82 <= < 83
83 <= < 84
84 <= < 85
85 <=

A3 Scale 1:1250

0 5 10 20 30 40 50 60 70 80 90 100 m

Acoustics RB Pty Ltd

Report No. 11-291.R21.Rev1 Figure 7

Free Field $L_{Amax\ passby}$ Noise Levels

North Coast Rail Line
Stages 21, 22A & 22B

2.0m-4.0m High Acoustic Barriers to Stages 22A & 22B
(Refer Figures 10A and 10B for Barrier Arrangement)

Private Open Spaces

N

North Coast Rail Line

STAGE 22A

STAGE 22B

STAGE 19A

STAGE 19B

STAGE 21

No.60 16m Wide New Road

No. 63 14m Wide New Road

No. 62 14m Wide New Road

No. 60 16m Wide New Road

16.5m Wide New Road

Extent of TNC

A3 Scale 1:1250

0 5 10 20 30 40 50 60 70 80 90 100 m

Free Field $L_{Amax\ passby}$ Noise Level (dBA)

<= 84 Compliant

84 < Non-Compliant

Acoustics RB Pty Ltd

Report No. 11-291.R21.Rev1 Figure 8

Facade-Corrected $L_{Amax\ passby}$ Noise Levels
and QDC MP 4.4 Noise Categories

North Coast Rail Line
Stages 21, 22A & 22B

2.0m-4.0m High Acoustic Barriers to Stages 22A & 22B
(Refer Figures 10A and 10B for Barrier Arrangement)

Lowset and Ground Floor Level of Highset Residences

N

North Coast Rail Line

STAGE 22A

STAGE 22B

STAGE 19A

STAGE 19B

STAGE 21

No.60 16m Wide New Road

No. 63 14m Wide New Road

No. 62 14m Wide New Road

No. 60 16m Wide New Road

16.5m Wide New Road

Extent of TNC

A3 Scale 1:1250

0 5 10 20 30 40 50 60 70 80 90 100 m

Facade-Corrected $L_{Amax\ passby}$ 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. 11-291.R21.Rev1 Figure 9

Facade-Corrected $L_{Amax\ passby}$ Noise Levels
and QDC MP 4.4 Noise Categories

North Coast Rail Line
Stages 21, 22A & 22B

2.0m-4.0m High Acoustic Barriers to Stages 22A & 22B
(Refer Figures 10A and 10B for Barrier Arrangement)

First Floor Level of Highset Residences

N

North Coast Rail Line

STAGE 22A

STAGE 22B

STAGE 19A

STAGE 19B

STAGE 21

Extent of TNC

No.60 16m Wide New Road

No. 63 14m Wide New Road

No: 62 14m Wide New Road

No. 60 16m Wide New Road

No. 64 14m Wide New Road

No. 51 16m Wide New Road

16.5m Wide New Road

16.5m Wide New Road

CHESTNUT CRESCENT

DAVID STREET

OXLEY STREET

BEN CRESCENT

PINE STREET

A3 Scale 1:1250

0 5 10 20 30 40 50 60 70 80 90 100 m

Facade-Corrected $L_{Amax\ passby}$ 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. 11-291.R21.Rev1 Figure 10A

N

Alignment of Acoustic Barriers
to Stage 22A and 22B
Shown in Bold Green

Height (in metres) of Acoustic Barriers
as Shown in Dark Blue

Heights are Relative to Top of Retaining Wall

North Coast Rail Line

3.0m
3.4m
3.0m
3.0m - 2.0m
3.4m
3.4m - 2.0m
3.8m
4.0m
3.8m
3.6m

1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1547
1548
1522
1523
1524
1525
1528
1530
1521

9
CP827035

New Road

16.5m Wide

974
SP315945
973
SP315945

STAGE 22A

CHESTNUT CRESCENT

STAGE

A3 Scale 1:500

0 5 10 20 30 40 50 m

All acoustic barrier heights are relative to the top of the retaining wall.

Indicative step changes between barrier elements are shown at the lot boundary (ie as indicated with dark blue tick marks). Derivation of change in barrier height should be made by reference to height annotations that are immediately adjacent to one another (ie from one lot to the next).

Notwithstanding, it should be noted that the details of the barrier, notably the heights of individual barrier elements along the NW boundary of individual lots will be sensitive to the detailed design of the retaining wall and any subsequent changes to the earthworks levels across Stage 22A and Stage 22B made during the detailed design phase.

As required by DTMR, the barrier will need to be designed and constructed in accordance with QR Civil Engineering Technical Requirement CIVIL-SR-014 *Design of Noise Barriers Adjacent to Railways*.

Acoustics RB Pty Ltd

Report No. 11-291.R21.Rev1 Figure 10B

Alignment of Acoustic Barriers
to Stage 22A and 22B
Shown in Bold Green

Height (in metres) of Acoustic Barriers
as Shown in Dark Blue

Heights are Relative to Top of Retaining Wall

N

4.0m
3.8m
3.6m
3.6m
3.0m
2.6m
2.2m
2.0m
2.2m
2.4m
2.8m
3.2m
3.4m
3.8m
4.0m
4.0m

North Coast Rail Line

STAGE 22B

No. 62

14m

3
SP134326

906
SP315960

895
SP315960

894
SP315960

893
SP315960

1518 16.5 1527 1547 1528 1548 1530 1549 1531 1550 1529 1551 1552 1533 1532 1553 1534 1554 1535 1555 1536 1556 1537 1538 1557 1558 1559 1560 1543 1542 1541 1540 1539 1561 1562 1563 1546 1545 1544 1564 1504 1503 1502 1501 1500 1565 1566

All acoustic barrier heights are relative to the top of the retaining wall.

Indicative step changes between barrier elements are shown at the lot boundary (ie as indicated with dark blue tick marks). Derivation of change in barrier height should be made by reference to height annotations that are immediately adjacent to one another (ie from one lot to the next).

Notwithstanding, it should be noted that the details of the barrier, notably the heights of individual barrier elements along the NW boundary of individual lots will be sensitive to the detailed design of the retaining wall and any subsequent changes to the earthworks levels across Stage 22A and Stage 22B made during the detailed design phase.

As required by DTMR, the barrier will need to be designed and constructed in accordance with QR Civil Engineering Technical Requirement CIVIL-SR-014 *Design of Noise Barriers Adjacent to Railways*.

A3 Scale 1:750

0 5 10 20 30 40 50 60 70 80 90 100 m