



MARSHALL DAY  
Acoustics



160 BANGOR ROAD  
SOUND LEVEL ASSESSMENT

Rp 001 R04 20260246 | 2 July 2026

Project: **160 BANGOR ROAD**

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## SUMMARY

We have assessed the potential sound and vibration at the proposed subdivision development at 160 Bangor Road, Darfield (the Project). The site for the Project is adjoined by State Highway 77 (Bangor Road) and State Highway 73 (West Coast Road). The Midland Rail Line runs alongside SH73.

Rule NOISE R3 of the Partially Operative Selwyn District Plan includes sound level requirements for residential buildings located near State Highways (SH) or the railway line. Please refer to Table 2 for a summary of the applicable noise rules.

### Noise control barriers will be provided around the site

A 3 m high bund will be provided along the northwest boundary along SH 73 (West Coast Road). For the majority of lots along SH 73, this bund will ensure that compliance can be achieved with the *outdoor* sound requirements.

Along SH 77 (Bangor Road), a 3 m high closed boarded timber fence is proposed. As along SH 73, this barrier, even with the gaps where road access is required, will ensure that compliance can be achieved with the *outdoor* sound requirements for the majority of the lots.

1.8 m timber fences will also be provided between lots.

Along both SH 73 and SH 77, compliance with the *indoor* sound requirements will depend on whether future dwellings:

1. will be set back 50 m from the state highway or rail network and with line of sight to the road/rail blocked, or
2. whether the indoor design noise levels in NOISE-TABLE1 (summarised in Table 3 of this report) can be met.

### Calculated road traffic sound levels are typically below 60 dB $L_{Aeq, 24hr}$

Using SoundPlan we have prepared sound level contours, illustrating the calculated road traffic sound levels on lots within the State Highway Noise Control Overlay. These sound level contours indicate that sound levels will generally be below 60 dB  $L_{Aeq}$  across the lots on both the SH77 and SH73 boundaries. There are small portions of the lots immediately adjacent the roads where higher sound levels could occur. These are generally where there are openings in the noise control barriers required for site access or at the transition between the earth bund and the timber fencing.

### Calculated rail sound levels are typically below 53 dB $L_{Aeq, 1hr}$

As the lots will be beyond 40 m from the railway line, we can assess the sound levels across the site as a point source. We have calibrated our rail source level against the calculated level of 65 dB  $L_{Aeq, 1hr}$  at 40 m from the railway line. We have assumed a rail source height of 3.8 m.

We have then determined the range of sound levels on each site within the Rail Network Noise Control Overlay inclusive of the sound attenuation offered by the noise control barriers. Our calculations indicate that the sound level will typically be in the range of 50 – 53 dB  $L_{Aeq, 1hr}$ .

### **Outdoor sound levels are not expected to noticeably reduce the residential amenity**

For the majority of the lots within the State Highway Noise Control Overlay, compliance with the outdoor sound requirements (Noise R3.1 Outdoor environment) will be achieved either through the establishment of the 3 m noise control barriers or because the sound levels would be  $< 57 \text{ dB } L_{Aeq, 24hr}$ . However, for some of the lots immediately adjacent to the road, where the noise control barriers do not fully block line of sight to the State Highway, there will be areas within the anticipated notional boundary of a potential future dwelling that would exceed  $57 \text{ dB } L_{Aeq, 24hr}$ .

We do not consider that non-compliance with the  $57 \text{ dB } L_{Aeq, 24hr}$  limit on those lots would negatively impact the outdoor amenity principally as there would still be potential for a significant area within the lots where sound levels would be below  $57 \text{ dB } L_{Aeq, 24hr}$ . We consider that the proposed noise mitigation is appropriate at this stage of the Project to ensure that adverse effects of outdoor sound on residential amenity would be acceptable on all lots.

### **Compliance with the indoor noise limits or setback distances addresses indoor effects**

Compliance with the indoor sound levels can be achieved either through either:

- positioning of the dwellings within the 50m setback and where the noise control barrier blocks the line of sight to the road and rail, or
- through designing and constructing the dwellings to meet the indoor noise limits in NOISE-TABLE1 (summarised in Table 3 of this report).

We consider that compliance with either of these requirements would ensure that adverse effects of indoor sound on residential amenity are acceptable. Based on this, we expect that any noise related reverse sensitivity effects on the operation of the State Highway and Railway network would be avoided.

Where compliance is to be demonstrated by achieving the indoor noise limits, we anticipate that Council will require a report from a suitable qualified acoustic engineer, having assessed the proposed building arrangement, calculating the indoor sound levels and highlighting any rooms requiring mechanical ventilation. This report should be provided prior to issuing Building Consent.

### **Vibration from both road and rail are expected to comply at all receivers**

Provided that the road surfaces of SH 77 and SH 73 are well maintained, we fully expect that any vibration received at residential dwellings constructed within 30 m of the roads will comply with the vibration limit of  $0.3 \text{ mm/s } V_{w,95}$ . No dwellings will be constructed within 60 m of the railway line.

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## 1.0 INTRODUCTION

We have been engaged to provide a sound and vibration level assessment for the proposed subdivision development at 160 Bangor Road, Darfield (the Project). The Project is described in the Section 2.0 and includes the subdivision of the Site to create allotments that will accommodate residential dwellings.

The Site is zoned Large Lot Residential Zone (LLRZ) and is bordered by SH 77 and SH 73 as well as the main Midland Railway Line running parallel to the northern site boundary.

The Partially Operative Selwyn District Plan (SDP) has noise control overlays for both state highways and the rail network. Developments within these noise control overlays are subject to sound level – both external and internal to a building - and vibration level requirements.

In this report we provide an overview of the Project (including noise control measures), summarise the calculated sound levels within lots inside the noise control overlays and assess the sound and vibration levels against the requirements of the SDP.

We have provided figures within this report illustrating the noise control measures, calculated sound levels and effected area. These are presented to assist when reading the report, but larger scaled copies of these figures are attached in Appendix D.

Appendix A provides a glossary of the acoustic terminology used in this report.

### 1.1 Authors experience and code of conduct

This is not an Environment Court proceeding. Nonetheless, I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2023 and agree to comply with it. My qualifications are set out below. The issues I address in this assessment are within my area of expertise, except where I state that I am relying on the advice of another person. I have considered all material facts known to me, including any that might alter or detract from my conclusions.

#### Michael Morrow



I attended the University of Salford, graduating with a Bachelor of Science in Electroacoustics. Before joining Marshall Day Acoustics in 2008, I worked in the UK as a consultant with both Sandy Brown Associates (2001—2002) and Bickerdike Allen Partners (2003—2007).

I have extensive experience in building and environmental acoustics including room acoustic design, sound insulation, mechanical services noise control and environmental noise emissions.

I have advised on a broad range of projects, most relevantly, residential developments and road traffic and rail noise assessments, many of which are within the Selwyn District.

#### Qualifications

- BSc(Hons) Electroacoustics with professional experience
- Member of the Institute of Acoustics
- Member of the Acoustical Society of New Zealand

## 2.0 THE PROJECT

### 2.1 The Site will be subdivided to accommodate 741 new dwellings

The Project comprises:

- The subdivision of the Site to create:
  - o 741 allotments to accommodate 741 new dwellings.
  - o Other allotments for the purposes of recreation reserves and supporting infrastructure and utilities.
- The construction of noise control barriers along the southern and eastern boundaries of the Site.
- Extensive landscaping and the enhancement of the waterways currently traversing the Site.
- Construction of roading and infrastructure, including a new pumpstation and various transport upgrades.

A subdivision layout plan for the Project is provided in Figure 1.

### 2.2 69 lots are within the SDP Noise Control Overlays

Rule NOISE R3 of the SDP includes sound level requirements for residential buildings located within road and rail overlays. The State Highway Noise Control Overlay extends into the Site along the southern and eastern boundary. The Railway Network Noise Control Overlay extends into the Site along the eastern boundary. The Project contains:

- 69 lots that are inside the State Highway Noise Control Overlay and
- 11 lots that are inside both the Rail Network Noise Control Overlay and the State Highway Noise Control Overlay

Figure 1 shows the extent of these overlays within the Project and Table 1 lists the lots which fall within the overlays. It is only these affected lots which form part of our assessment – when referring to lots in other sections of this report, we are only considering those within the Noise Control Overlays.

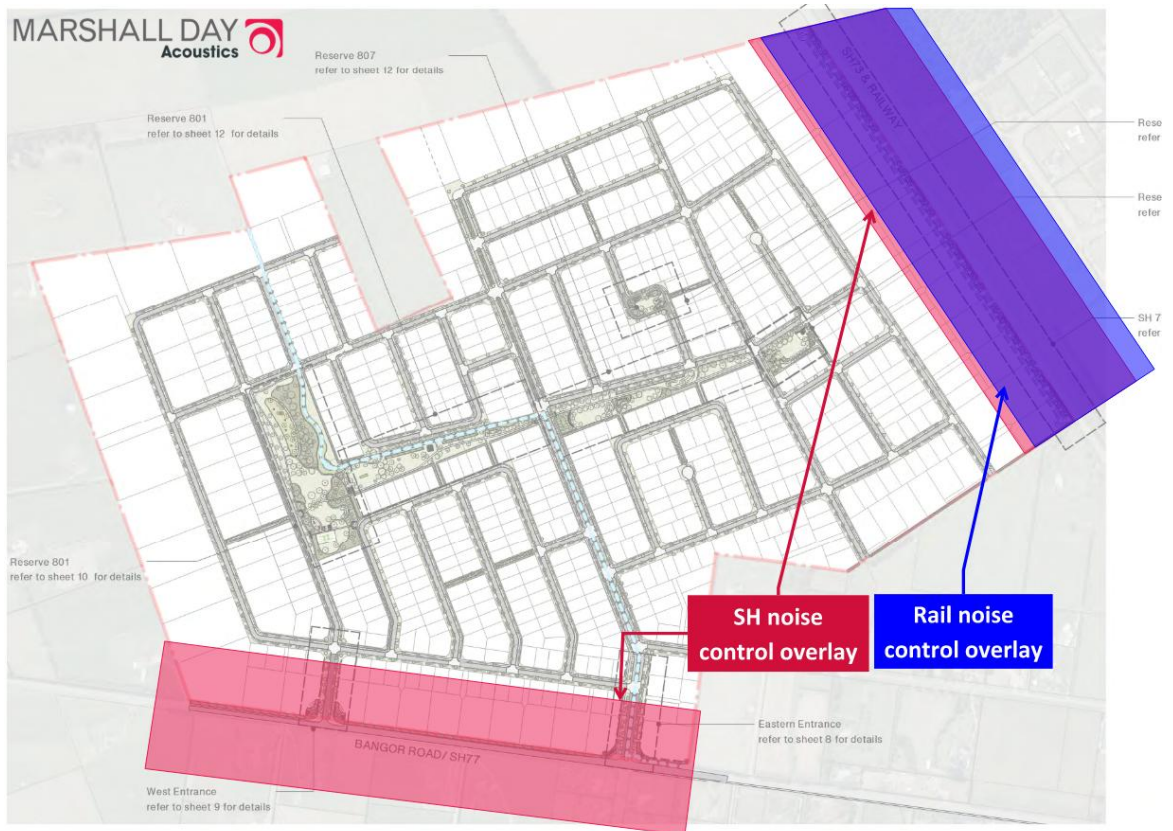
**Table 1: Lots which fall in noise control overlays**

| Overlay type                   | Lot number                                            | Total |
|--------------------------------|-------------------------------------------------------|-------|
| State highway                  | 1 – 31, 212 – 216, 676 – 705, 740, 741                | 69    |
| Rail Network and State highway | 677, 678, 682, 683, 688, 689, 694, 695, 700, 701, 704 | 11    |

### 2.3 Only single storey dwellings are envisaged within the Noise Control Overlays

Construction of residential dwellings on the site will be subject to the maximum building height limit of 8m in the LLRZ. Consistent with this requirement, we understand that only single storey dwellings are envisaged on the affected lots within the Noise Control Overlays.

**Figure 1: Subdivision layout plan and noise control overlays**



## 2.4 Noise control barriers are proposed along the site boundaries and between lots

The following noise control barriers are proposed to mitigate noise received from the State Highways and the Railway line:

- A 3 m high bund along the north-east boundary of the Site adjoining SH 73 and at the access points to the Site along the southern boundary.
- A 3 m close boarded timber fence along the southern boundary of the Site adjoining SH 77, with gaps in two locations where road access is required.
- 1.8 m closed boarded timber fencing between each of the lots adjoining the southern and north-eastern boundary.

The extent of the proposed noise control fences is illustrated in Figure 2. This landscape drawing does not note the extent of the bunds in the legend, but they are illustrated with a dashed line and shown on Kamo Marsh drawing 21. For clarification we have provided a typical construction detail for an effective noise control barrier in Appendix B. This construction arrangement would apply to the 'timber paling' and 'acoustic' fences noted on the Kamo Marsh drawings.

**Figure 2: Noise control barriers**



### 3.0 PERFORMANCE REQUIREMENTS

#### 3.1 Noise and vibration limits apply from both road and rail activities

Rule NOISE R3 of the SDP outlines the applicable noise rules. These are summarised in Table 2 and Table 3. There are options to comply with the noise rules using noise control barriers that block line of sight to the buildings. However, the proposed noise control barriers, while offering significant noise reduction, will not be able to fully comply with the blocking line of sight requirements on all Lots. We will identify lots where we consider this can be achieved. For other lots, we have carried out our assessment against the noise limit options provided in NOISE R3.

**Table 2: Summary of noise rules**

| NOISE-R3                                                                                                                                                                                                                                                                                                                                                                                        | State Highway Noise Control Overlay (SH73 & 77) and Rail Network Noise Control Overlay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Outdoor environment R3.1                                                                                                                                                                                                                                                                                                                                                                        | <p><i>The SDP does not impose any outdoor noise environment controls for the Railway Network Noise Control Overlay, so only the State Highway Noise Control Overlay standard applies.</i></p> <p><i>EITHER:</i></p> <p>(a)(i) 3m noise barrier which blocks the line-of-sight to the state highway road surface from all points 1.5m above ground level within the notional boundary of any new building and/or addition to any existing building.</p> <p><i>OR:</i></p> <p>(a)(ii) Levels are less than 57 dB <math>L_{Aeq(24h)}</math> at all points 1.5m above ground level within the notional boundary of any new building and/or addition to any existing building.</p> <p><i>The SDP defines the notional boundary as "20 metres from any side of a residential unit or ... the legal boundary where this is closer to such a building".</i></p> |
| Indoor environment R3.4                                                                                                                                                                                                                                                                                                                                                                         | <p><i>EITHER:</i></p> <p>(a)(i) building is setback 50m from the State Highway or rail network and is designed so that a noise barrier consisting of a solid building, fence, wall or landform blocks the line-of-sight from all parts of doors and windows to the state highway road surface and/or to all points above 3.8m of the railway tracks</p> <p><i>OR:</i></p> <p>(a)(ii) the building is designed, constructed and maintained to achieve indoor design noise levels not exceeding the maximum values in NOISE-TABLE1 Road and Railway Indoor Design Noise Levels.</p>                                                                                                                                                                                                                                                                       |
| Ventilation R3.4                                                                                                                                                                                                                                                                                                                                                                                | (b) (v) if windows must be closed to achieve the design noise levels in NOISE-TABLE1, the building shall be designed, constructed and maintained with a mechanical ventilation system that does not generate more than 35 dB $L_{Aeq(30s)}$ when measured 1m away from any grille or diffuser                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Vibration R3.4                                                                                                                                                                                                                                                                                                                                                                                  | (d) any building that is closer than 30 m to any state highway boundary or closer than 60 m to any railway network, shall be designed, constructed and maintained to achieve road and rail vibration limits not exceeding 0.3mm/s (Class C criterion Maximum Weighted Velocity, $V_{w,95}$ );                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Sound level assessments carried out against R3.1(a)(ii) and R3.4(a)(ii) must include:                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <ul style="list-style-type: none"> <li>External road noise levels based on measured or predicted noise levels plus 3 decibels to account for future traffic growth</li> <li>Railway noise of 70 <math>L_{Aeq(1h)}</math> at a distance of 12m from the railway network, reducing at a rate of 3 dB per doubling of distance up to 40 m and 6 dB per doubling of distance beyond 40 m</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

**Table 3: NOISE-TABLE1 - Road and railway indoor design noise levels for residential activity**

|                           | Maximum Road Noise Limit $L_{Aeq(24h)}$ | Maximum Railway Noise Limit $L_{Aeq(1h)}$ |
|---------------------------|-----------------------------------------|-------------------------------------------|
| Bedrooms                  | 40 dB                                   | 35 dB                                     |
| All other habitable rooms | 40 dB                                   | 40 dB                                     |

## 4.0 CALCULATED SOUND LEVELS

### 4.1 State Highway sound levels on the lots will be below 60 dB $L_{Aeq,24hr}$

Sound level measurements were recorded along the site boundary adjacent SH 73 and SH 77. Details of our measurement survey are provided in Appendix C.

We acknowledge that these sound level measurements were recorded during the easter school holidays when a lower than typical traffic sound level can be expected. To address this potential low vehicle flow, we counted the number of vehicles during our measurements and compared it against the hourly traffic flow data available from NZTA to determine an appropriate correction to our measured levels to account for the typical average daily traffic flow.

Additionally, we have reviewed the annual traffic flow and road typology data available for SH 77 and SH73 using:

- [NZTA traffic data](#)
- [mobileroad.org](http://mobileroad.org)

Table 4 summarises the relevant information necessary to calculate the traffic sound levels.

**Table 4: Traffic flow and road typology**

| Road                                 | AADT <sup>1</sup> | %HGV | Speed         | Road surface      |
|--------------------------------------|-------------------|------|---------------|-------------------|
| West Coast Road                      | 3888              | 26   | 100 km/h      | Grade 3 (+6 dB)   |
| Bangor Road                          | 2529              | 8    | 80 – 100 km/h | Grade 3/5 (+6 dB) |
| AADT    Average Annual Daily Traffic |                   |      |               |                   |
| HGV    Heavy Goods Vehicle           |                   |      |               |                   |

Using our measured levels and the available information for the roads, we calculated the 24-hour level using the Calculation of Road Traffic Noise (CRTN) procedures and our knowledge of the variation in traffic sound levels across a 24-hour period and the sound attenuation offered by the proposed noise control barriers.

Using SoundPlan we have prepared sound level contours, inclusive of a 3-decibel addition for future traffic growth – which we have assumed would capture any increase in traffic volumes associated with the Project – illustrating the calculated variation in road traffic sound levels on lots within the State Highway Noise Control Overlay. These are presented in Figure 3.

These sound level contours indicate that sound levels will generally be below 60 dB  $L_{Aeq}$  across the lots. There would be small portions of the site immediately adjacent the State Highways where higher sound levels could occur. These are generally where there are openings in the noise control barriers required for site access or at the transition between the earth bund and the timber fencing.

We have only shown sound levels down to a level of 56 dB  $L_{Aeq}$ . We have done this as it best visually illustrates the location at which compliance with both the indoor and outdoor sound level requirements in NOISE-R3 can be achieved, i.e.

- a level of less than 57 dB  $L_{Aeq, 24 hr}$  is acceptable within outdoor areas
- an internal sound level of 40 dB  $L_{Aeq,24hr}$  can be achieved within rooms with open windows where the incident sound level is  $\leq$  56 dB  $L_{Aeq, 24 hr}$ .

As the SDP considers level of < 57 dB  $L_{Aeq, 24 hr}$  acceptable outside of a building, we assume that the internal sound level requirement would also be acceptable where levels incident on the building are also < 57 dB  $L_{Aeq, 24 hr}$ . This concludes that an open window, sufficient for fresh air ventilation purposes, offers a sound reduction of 16 decibels.

Figure 3: Road sound level contours



#### 4.2 Rail sound levels on the lots will generally be below 53 dB $L_{Aeq,1hr}$

We have carried out point source calculations for the rail sound level assessment. The assessment methodology outlined in the SDP requires trains to be assessed as a line source (reduction of 3 dB per doubling in distance) up to 40 m and then as a point source (reduction of 6 dB per doubling in distance) beyond. SoundPlan does not have the capabilities to assess this differentiation in distance attenuation and prepare sound contour plots as we have carried out for the State Highways.

However, as the lots created by the Project will be beyond 40 m from the railway line, we can assess the sound levels across the Site as a point source.

We have calibrated our source level against the calculated level at 40 m from the railway line based on a level of 70 dB  $L_{Aeq,1hr}$  at 12 m and assuming distance attenuation of 3 dB per doubling – when the distance doubles, e.g. 40 m to 80 m, there would be a 3 decibel reduction in sound level.

In accordance with the SDP requirements, we have assumed a rail source height of 3.8 m (this is the height at which all buildings are to be shielded from the railway - NOISE-R3.4.a. - and we assume that this is to be used as the rail source height when assessing the calculated sound levels). This results in a rail sound level at 40 m of 65 dB  $L_{Aeq,1hr}$ .

We have then determined the range of sound levels on each site within the Rail Network Noise Control Overlay inclusive of the sound attenuation offered by the noise control barriers. Our calculations indicate that sound levels will typically be in the range of 50 – 53 dB  $L_{Aeq,1hr}$ .

## 5.0 OUTDOOR SOUND LEVEL ASSESSMENT

### 5.1 The majority of the lots can comply with the outdoor sound levels of Rule NOISE R3.1

*The outdoor noise rule only applies within the State Highway Noise Control Overlay. There is no outdoor noise rule within the Railway Network Noise Control Overlay.*

The Project proposes a 3 m high landform bund at the SH 73 boundary. We expect that this barrier will block the line of sight between the lot boundaries or anticipated notional boundary of a dwelling and the SH 73 road surface on the lots listed in Table 5. Residential dwellings on these listed lots would comply with the NOISE-R3.1(a)(i) permitted standard for the outdoor noise environment.

Furthermore, our calculations indicate that there will be a large number of lots where compliance with NOISE-R3.1(a)(ii) – sound levels less than 57 dB  $L_{Aeq,24hr}$  – can be readily achieved. These lots are also listed in Table 5.

We have considered a ‘worst case’ positioning of future dwellings on the lots i.e. assuming that the position of the dwelling on the lot has line of sight to the road, if that is possible. It may be possible to locate dwellings on the second row of lots away from the roads to comply with NOISE-R3.1(a)(i). Regardless, on all these lots we calculate that sound levels across the lots will be less than 57 dB  $L_{Aeq,24hr}$  and would therefore comply with NOISE-R3.1(a)(ii).

**Table 5: Lots where compliance with NOISE-R3.1(a)(i) or NOISE-R3.1(a)(ii) can be achieved**

| Nearest road           | Compliance method | Lots                                                                                          | Total |
|------------------------|-------------------|-----------------------------------------------------------------------------------------------|-------|
| SH73 - West Coast Road | NOISE-R3.1(a)(i)  | 682, 683, 688, 689, 694, 695, 700                                                             | 7     |
|                        | NOISE-R3.1(a)(ii) | 676, 679, 680, 681, 684, 685, 686, 687, 690, 691, 692, 693, 696, 697, 698, 699, 702, 703, 705 | 19    |
| SH77 - Bangor Road     | NOISE-R3.1(a)(i)  | 22 – 26, 214                                                                                  | 6     |
|                        | NOISE-R3.1(a)(ii) | 2 – 19, 212 – 216, 29 – 31, 740                                                               | 26    |

For the remaining lots, as summarised in Table 6, compliance with NOISE-R3.1(a)(i) cannot be achieved as line of site to the state highways will not be fully blocked. However, on some of these lots it may be possible for the future dwellings to comply with the outdoor noise limit requirement of Rule NOISE-R3.1(a)(ii), depending on their location within the lots.

The location of dwellings on these lots (and their notional boundaries) will need to be confirmed before we can determine if the outdoor sound levels set out in NOISE-R3.1(a)(ii) can be achieved. Nonetheless, we expect that dwellings on Lots 20, 21, 27, 211, 678 & 701 could be positioned so that levels within the notional boundary comply with the outdoor noise limit in Rule NOISE-R3.1(a)(ii). On the remaining lots (4 in total), it is unlikely that compliance with Rule NOISE-R3.1(a)(ii) would be achievable regardless of dwelling position on the site.

We have discussed the potential impact on outdoor amenity within these lots in Section 8.0.

**Table 6: Lots where outdoor sound levels may exceed 57 dB  $L_{Aeq,24hr}$**

| Nearest road           |                                                         | Lots                      | Total |
|------------------------|---------------------------------------------------------|---------------------------|-------|
| SH77 - West Coast Road | Compliance achievable depending on location of dwelling | 678, 701                  | 2     |
|                        | Cannot comply                                           | 677, 704                  | 2     |
| SH77 - Bangor Road     | Compliance achievable depending on location of dwelling | 20, 21, 27, 211, 214, 741 | 6     |
|                        | Cannot comply                                           | 1, 28                     | 2     |

## 6.0 INDOOR SOUND LEVEL ASSESSMENT

### 6.1 Dwellings could be located to comply with the setback provisions of Rule NOISE R3.4(a)(i)

The requirements of NOISE R3.4(a)(i) can be achieved by locating the dwellings at least 50 m from the State Highway or railway network and ensuring that line of sight is blocked – refer to Table 2 for specific requirements.

At this stage the location of the dwellings on the lots created by the Project has not been confirmed. It is possible that the dwellings could be located and orientated to achieve compliance with these requirements.

However, if dwellings are located within 50 m of the State Highway or rail network and/or the noise barrier does not block the line of site from the dwellings to that infrastructure, compliance could be demonstrated through designing and constructing the dwellings to achieve the indoor noise limit provisions of Rule NOISE R3.4(a)(ii) as discussed in Section 6.2.

### 6.2 Conventional buildings could achieve the indoor noise limits of Rule NOISE R3.4(a)(ii)

If future dwellings do not comply with NOISE R3.4(a)(i), then compliance with the indoor sound levels may still be achieved where the dwellings are constructed to achieve the internal noise limits summarised in Table 3.

Based on our experience on similar projects and the calculated sound levels across the lots, we expect that conventional building constructions and glazing arrangements will provide sufficient sound insulation to comply with the internal sound level limit with windows closed.

With windows open, the internal noise limits would only be achieved where incident sound levels on the future dwellings are:

- For noise from the State Highway:
  - o  $\leq 56$  dB  $L_{Aeq, 24hr}$  on all habitable spaces
- For noise from the Railway Network:
  - o  $\leq 51$  dB  $L_{Aeq, 1hr}$  on bedrooms
  - o  $\leq 56$  dB  $L_{Aeq, 1hr}$  on all habitable other spaces

This would likely be achievable for rooms orientated away from the State Highways as the dwellings themselves will offer further shielding from road and rail noise. However, for rooms overlooking the State Highways or railway line, incident sound levels may be higher and windows would have to remain closed to comply with the internal noise limits.

Table 7 summarises the lots where sound levels on the lots are such that further assessment of the internal sound levels would be required (if compliance with NOISE R3.4(a)(i) cannot be achieved).

**Table 7: Lots where internal sound level assessment is likely required**

| Nearest road           | Lots                                                  | Total |
|------------------------|-------------------------------------------------------|-------|
| SH77 - West Coast Road | 677, 678, 682, 386, 688, 689, 694, 695, 700, 701, 704 | 11    |
| SH77 - Bangor Road     | 1, 20 – 28, 211, 214, 741                             | 13    |

### 6.3 Mechanical fresh air ventilation may be required to rooms overlooking the State Highways

For dwellings that:

1. do not comply with the setback and line of sight provisions of Rule NOISE R3.4(a)(i), and
2. where the internal noise limits can only be achieved with windows closed (as discussed in Section 6.2)

it would be necessary to incorporate alternative means of fresh air ventilation so that the sound level and ventilation requirements can be achieved simultaneously.

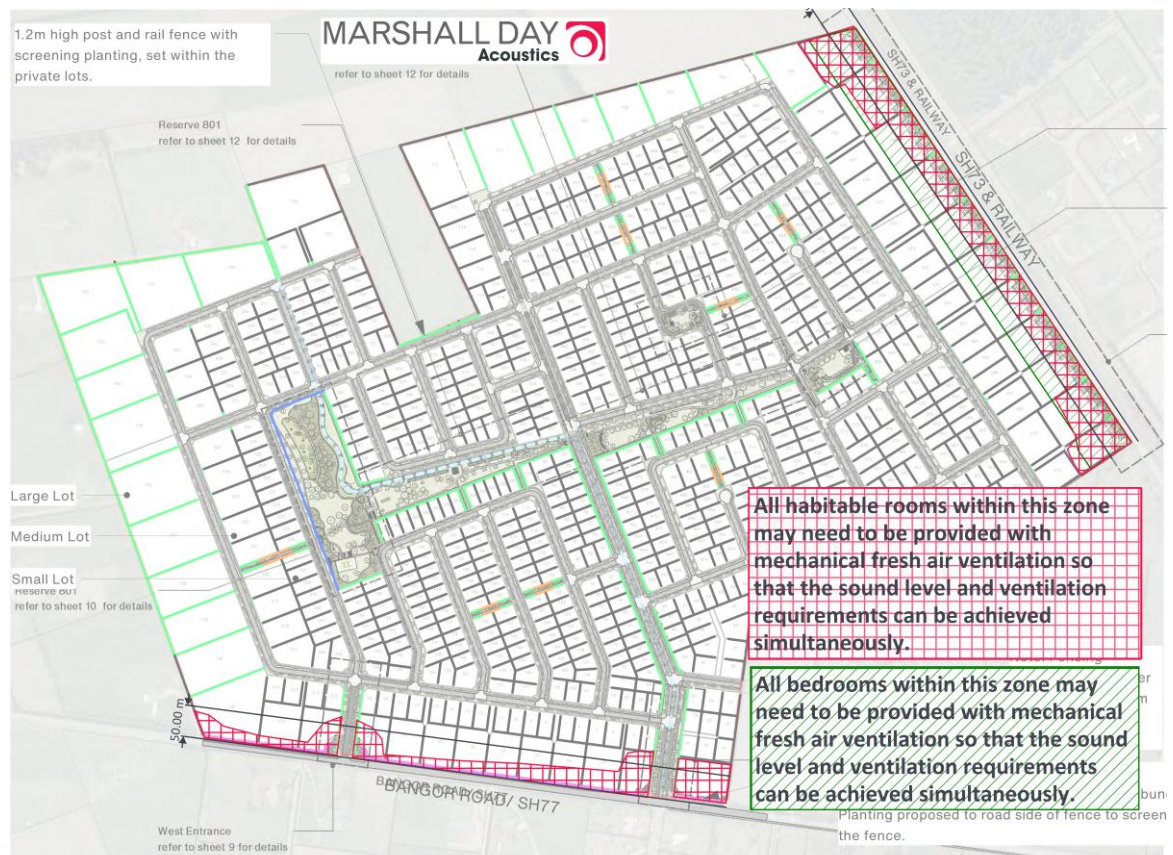
Figure 4 indicates a zone on the affected lots where mechanical fresh air ventilation would be required to dwellings constructed within this zone. Dwellings could be developed on other parts of the affected lots, outside of this zone, without the need for mechanical ventilation as they would either:

1. Comply with the setback and barrier provisions of Rule NOISE R3.4(a)(i), or
2. The incident sound levels on the dwelling would be of a level that would allow the internal sound level requirements of Rule NOISE R3.4(a)(ii) to be achieved with open windows

The establishment of buildings on the lots (which we have not considered), will alter the sound levels incident on each building elevation. It is possible that the layout of the building would provide additional screening to some rooms resulting in lower incident levels, and consequently compliance with the indoor sound level may be achievable without the need for mechanical ventilation.

We recommend that an assessment of the proposed building layouts is undertaken at building consent stage for each dwelling to best determine the incident sound levels and identify exactly which rooms would require mechanical fresh air ventilation.

**Figure 4: Dwellings constructed with these zones would require mechanical fresh air ventilation**



## **7.0 VIBRATION LEVEL ASSESSMENT**

### **7.1 Vibration from the roads are expected to comply at all receivers**

Provided that the road surfaces of SH 77 and SH 73 are well maintained, we fully expect that any vibration received at residential dwellings constructed within 30 m of the roads will comply with the vibration limit of 0.3 mm/s  $V_{w,95}$ . No dwellings will be constructed within 60 m of the railway line.

Typically, vibration from road traffic at a distance of around 20 m of the nearest roadway edge is below 0.1 mm/s  $V_{w,95}$  for a well maintained road surface.

## **8.0 ASSESSMENT OF NOISE EFFECTS**

### **8.1 Outdoor sound levels are not expected to noticeably reduce the residential amenity**

Our sound level assessment indicates that:

1. The proposed establishment of a 3 m bund along the boundary of the Site with SH73 and the 3 m high fence along the boundary of the Site with SH77 will ensure that the majority of future residential dwellings along these boundaries will comply with the outdoor environment requirements set out in NOISE-R3.1(a)(i) or NOISE-R3.1(a)(ii). The compliant lots are listed in Table 5.
2. For the majority of the remaining lots – 8 in total – future residential dwellings could be positioned to comply with the outdoor noise limit requirements of NOISE-R3(1)(a)(ii).
3. For the final 4 lots, as identified in Table 6, compliance with either NOISE-R3.1(a)(i) or NOISE-R3.1(a)(ii) cannot to be achieved.

Establishment of dwellings on all lots as part of the Project will impact the sound levels across the site as the buildings will provide additional shielding from road noise, assuming that visual screening of the outdoor entertaining areas from the roads is the desired outcome. It is therefore likely that, once these buildings have been constructed, there will be increased areas of the lots where levels will be below the outdoor noise limit of 57 dB  $L_{Aeq,24hr}$ . Though, it is still possible within portions of the notional boundary of the dwelling, that levels could be higher. Nonetheless, we do not expect that this will negatively impact the outdoor amenity.

We consider that the outdoor sound levels on the two lots which are unlikely to comply with NOISE-R3.1 will not noticeably affect the residential amenity of those lots as:

- There are still areas within those lots where sound levels would be less than 57 dB  $L_{Aeq,24hr}$  and can be used for outdoor enjoyment
- The lots are sufficiently sized to enable the creation and use of outdoor areas which are screened to further reduce sound levels.

Consequently, we consider that the proposed noise mitigation is appropriate to ensure that adverse effects of outdoor sound on residential amenity would be acceptable on all lots.

## 8.2 Compliance with the indoor noise limits or setback distances addresses indoor effects

As discussed in Section 6.2 and Section 0, we expect that dwellings can be designed to comply with the requirements of NOISE-R3.4 by:

- compliance with the indoor noise limits in NOISE-TABLE 1 or
- by achieving the 50 m setback and blocking line of sight to the road and rail

We consider that compliance with either of these requirements would ensure that adverse effects of indoor sound on residential amenity are considered acceptable. And we expect that any reverse sensitivity effects on the operation of the State Highway and Railway network would be avoided.

Where compliance is to be demonstrated by achieving the indoor noise limits, we anticipate that Council will require a report from suitable qualified acoustic engineer, having assessed the proposed building arrangement, calculating the indoor sound levels and highlighting any rooms requiring mechanical ventilation. This report should be provided prior to issuing Building Consent.

## 9.0 CONCLUSIONS

We consider that the Project proposes appropriate noise mitigation to ensure that outdoor residential amenity is not adversely impacted. Therefore, we consider that further assessment of outdoor noise against the requirements of NOISE R3.1 is not required for individual lots within the Noise Control Overlay areas.

Where future dwellings are proposed within 50 m of the State Highways and the noise control barrier does not block the line of site from these dwellings in accordance with NOISE R3.4(a)(i), then further assessment of the internal sound levels and ventilation requirements is necessary.

In summary, we consider:

- Further assessment against the outdoor environment requirements of NOISE-R3.1 is not required  
For the small number of lots (677, 704, 1 and 28) where compliance cannot be achieved, we consider that dwellings on these lots can be positioned such that sound levels within outdoor areas, would not negatively impact their residential amenity.
- Further assessment of the indoor environment requirements of NOISE-R3.4 is only required for the lots summarised in the table below where the future dwellings on those lots do not comply with the setback and line of site requirements in NOISE R3.4(a)(i).

The design and construction of the future dwellings must then achieve the indoor noise limits in NOISE-R3.4(a)(ii). A suitably qualified acoustic engineer must prepare a report demonstrating this outcome, which can be submitted to the Council with the Building Consent application.

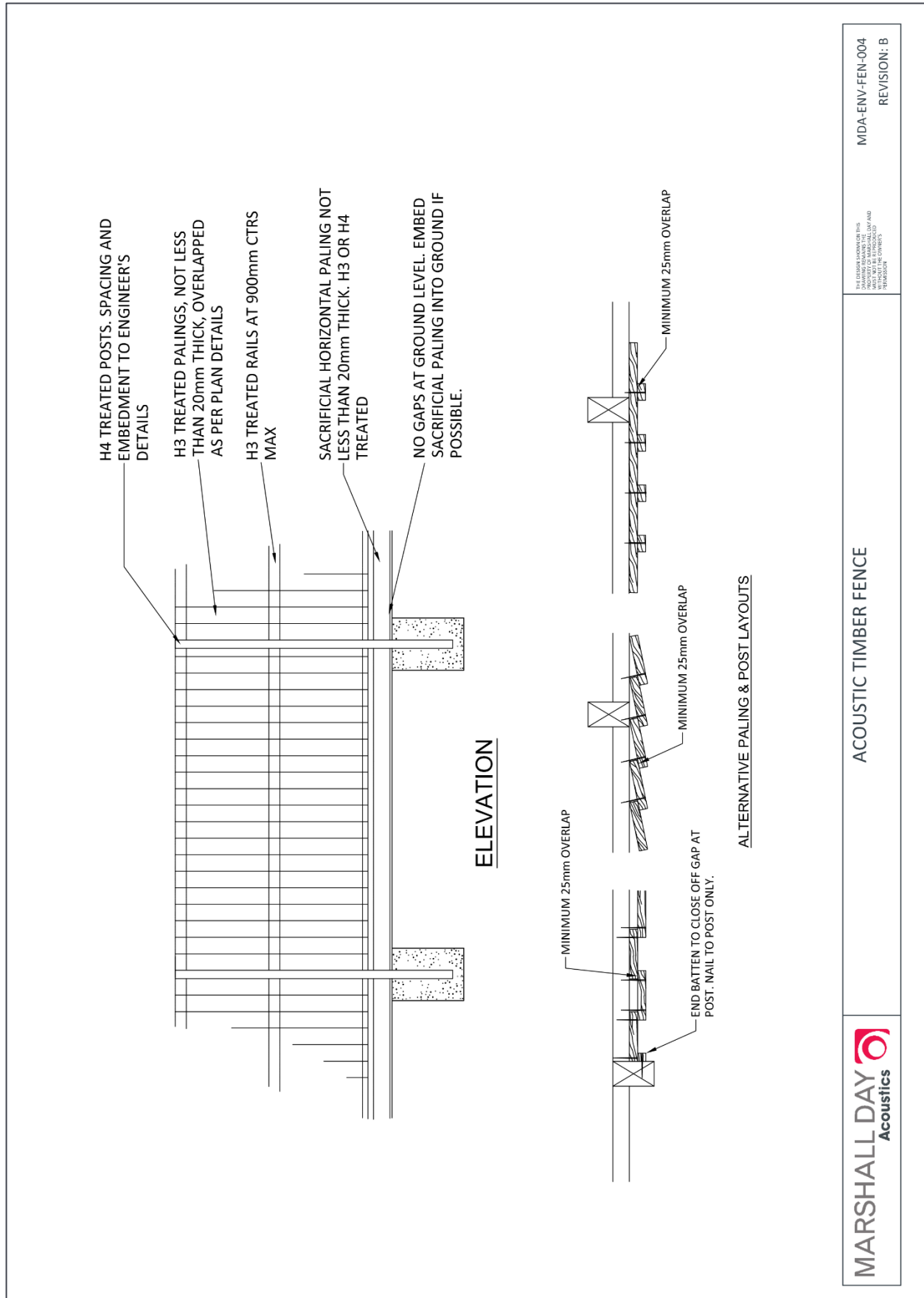
| Nearest road           | Lots                                                  |
|------------------------|-------------------------------------------------------|
| SH77 - West Coast Road | 677, 678, 682, 386, 688, 689, 694, 695, 700, 701, 704 |
| SH77 - Bangor Road     | 1, 20 – 28, 211, 214, 741                             |

- Where the indoor noise limit requirements can only be achieved with windows closed, compliance with the requirements of NOISE-R3.4(b) must also be demonstrated
- Further assessment against the vibration requirements of NOISE-R3.4(d) is not required

## APPENDIX A GLOSSARY OF TERMINOLOGY

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Noise</b>               | A subjective term used to describe sound that is unwanted by, or distracting to, the receiver.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Notional boundary</b>   | <p>A line 20 metres from any side of a dwelling, or the legal boundary where this is closer to the dwelling.</p> <p>This definition is from NZS 6802:2008.</p>                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>A-weighting</b>         | <p>A set of frequency-dependent sound level adjustments that are used to better represent how humans hear sounds. Humans are less sensitive to low and very high frequency sounds.</p> <p>Sound levels using an “A” frequency weighting are expressed as dB LA. Alternative ways of expressing A-weighted decibels are dBA or dB(A).</p>                                                                                                                                                                                                              |
| <b>dB</b>                  | Decibel. The unit of sound level.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>L<sub>Aeq</sub></b>     | The equivalent continuous A-weighted sound level. Commonly referred to as the average sound level and is measured in dB.                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>L<sub>Aeq,24h</sub></b> | The LAeq sound level averaged over a 24-hour period from midnight to midnight.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Sound insulation</b>    | The ability of a material or construction to reduce sound travelling through it.                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>PPV</b>                 | Peak Particle Velocity. The measure of the vibration aptitude, zero to maximum. Used for building structural damage assessment.                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Vibration</b>           | <p>When an object vibrates, it moves rapidly up and down or from side to side. The magnitude of the sensation when feeling a vibrating object is related to the vibration velocity.</p> <p>Vibration can occur in any direction. When vibration velocities are described, it can be either the total vibration velocity, which includes all directions, or it can be separated into the vertical direction (up and down vibration), the horizontal transverse direction (side to side) and the horizontal longitudinal direction (front to back).</p> |

**APPENDIX B NOISE CONTROL FENCE CONSTRUCTION**



## APPENDIX C MEASUREMENT SURVEY DETAILS

Table C-1: Survey details

|                    |                                                                                                                                             |                               |                                              |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------------------------------------------|
| Date & Time        | 8 April 2026, 12:00 – 15:00                                                                                                                 |                               |                                              |
| Personnel          | A Wesley and A Gréciet of Marshall Day Acoustics                                                                                            |                               |                                              |
| Methodology        | Measurements were undertaken in general accordance with New Zealand Standard NZS 6801:2008 “Acoustics – Measurement of environmental sound” |                               |                                              |
| Calibration        | A calibration check was carried out prior to and post the survey period with no notable change in level.                                    |                               |                                              |
| Weather            | Weather conditions were fine with 1/8 oktas cloud cover, a temperature of 22 °C and winds gusting up to 8 m/s.                              |                               |                                              |
| Instrumentation    |                                                                                                                                             |                               |                                              |
| Sound Level Meter: | Brüel & Kjær Type 2250 and NTI XL3                                                                                                          | SN 3010261<br>SN A3A-02228-F0 | Calibration due 29/05/2027<br>and 08/01/2028 |
| Calibrator:        | Brüel & Kjær Type 4231                                                                                                                      | SN 3004051<br>SN 2574264      | Calibration due 11/09/2026<br>and 23/09/2026 |

Figure C-5: Measurement locations on West Coast Rd and Bangor Rd



Table C-2: Measured traffic sound levels along West Coast Road

| Measurement Number and Location | Measured Noise Levels (dB) |                  |                   | Vehicle counts |     | Noise Sources and Comments |
|---------------------------------|----------------------------|------------------|-------------------|----------------|-----|----------------------------|
|                                 | L <sub>A10</sub>           | L <sub>Aeq</sub> | L <sub>Amax</sub> | Cars           | HGV |                            |
| 1 MP1                           | 75                         | 74               | 94                | 43             | 8   | Traffic noise dominant     |
| 2 MP1                           | 73                         | 74               | 94                | 40             | 8   |                            |
| 3 MP1                           | 73                         | 74               | 94                | 32             | 11  |                            |
| 4 MP1                           | 74                         | 73               | 93                | 46             | 10  |                            |
| 5 MP1                           | 74                         | 75               | 95                | 30             | 12  |                            |
| 6 MP1                           | 80                         | 76               | 94                | 60             | 16  |                            |
| 7 MP1                           | 75                         | 74               | 94                | 50             | 6   |                            |
| 8 MP1                           | 78                         | 76               | 95                | 50             | 19  |                            |
| 9 MP1                           | 77                         | 76               | 100               | 52             | 12  |                            |
| 10 MP1                          | 74                         | 75               | 95                | 39             | 6   |                            |
| 11 MP1                          | 74                         | 74               | 93                | 43             | 10  |                            |

Table C-3: Calculation of Future L<sub>Aeq,24hr</sub> along West Coast Road

| Parameter                                                                                                   | Procedure                                           | Level (dB) |
|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------|
| Calculated L <sub>A10,3hr</sub>                                                                             | Arithmetically average the measured levels          | 75         |
| Calculated L <sub>A10,18hr</sub>                                                                            | L <sub>A10,3hr</sub> - 1                            | 74         |
| Calculated L <sub>Aeq,24hr</sub>                                                                            | L <sub>A10,18hr</sub> - 3                           | 71         |
| Calculated Future L <sub>Aeq,24hr</sub>                                                                     | L <sub>Aeq,24hr</sub> + 3                           | 74         |
| Adjustment for current AADT <sup>1</sup>                                                                    | L <sub>Aeq,24hr</sub> + 3 + traffic flow adjustment | 75         |
| 1 Calculated based on comparison of NZTA hourly traffic flow data available against recorded traffic counts |                                                     |            |

Table C-4: Measured traffic sound levels along Bangor Road

| Measurement number and Location | Measured Noise Levels (dB) |                  |                   | Vehicle counts |     | Noise Sources and Comments              |
|---------------------------------|----------------------------|------------------|-------------------|----------------|-----|-----------------------------------------|
|                                 | L <sub>A10</sub>           | L <sub>Aeq</sub> | L <sub>Amax</sub> | Cars           | HGV |                                         |
| 1 MP2                           | 72                         | 70               | 92                | 32             | 5   | Traffic noise dominant<br>Wind in trees |
| 2 MP2                           | 73                         | 70               | 91                | 36             | 2   |                                         |
| 3 MP2                           | 71                         | 69               | 88                | 30             | 3   |                                         |
| 4 MP2                           | 70                         | 70               | 91                | 28             | 3   |                                         |
| 5 MP2                           | 76                         | 72               | 91                | 57             | 1   |                                         |
| 6 MP2                           | 73                         | 71               | 91                | 34             | 6   |                                         |
| 7 MP2                           | 69                         | 68               | 90                | 26             | 0   |                                         |
| 8 MP2                           | 67                         | 67               | 87                | 22             | 2   |                                         |
| 9 MP2                           | 71                         | 68               | 86                | 36             | 3   |                                         |
| 10 MP2                          | 67                         | 67               | 90                | 31             | 1   |                                         |
| 11 MP2                          | 72                         | 69               | 90                | 46             | 3   |                                         |
| 12 MP2                          | 71                         | 77               | 111               | 37             | 2   |                                         |

Table C-5: Calculation of Future L<sub>Aeq,24hr</sub> along Bangor Road

| Parameter                                                                                                   | Procedure                                           | Level (dB) |
|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|------------|
| Calculated L <sub>A10,3hr</sub>                                                                             | Arithmetically average the measured levels          | 71         |
| Calculated L <sub>A10,18hr</sub>                                                                            | L <sub>A10,3hr</sub> - 1                            | 70         |
| Calculated L <sub>Aeq,24hr</sub>                                                                            | L <sub>A10,18hr</sub> - 3                           | 67         |
| Calculated Future L <sub>Aeq,24hr</sub>                                                                     | L <sub>Aeq,24hr</sub> + 3                           | 70         |
| Adjustment for current AADT <sup>1</sup>                                                                    | L <sub>Aeq,24hr</sub> + 3 + traffic flow adjustment | 71         |
| 1 Calculated based on comparison of NZTA hourly traffic flow data available against recorded traffic counts |                                                     |            |

## APPENDIX D SCALABLE VERSIONS OF FIGURES

# SITEWIDE MASTERPLAN

SCALE: 1:6000

1.2m high post and rail fence with screening planting, set within the private lots.

**MARSHALL DAY**  
Acoustics

refer to sheet 12 for details

Reserve 801  
refer to sheet 12 for details

Reserve 810  
refer to sheet 13 for details

Reserve 811  
refer to sheet 14 for details

SH 73 typical boundary treatment  
refer to sheet 21 for details

Large Lot

Medium Lot

Small Lot  
Reserve 801  
refer to sheet 10 for details

**SH noise  
control overlay**

**Rail noise  
control overlay**

the water  
race is set back from  
the boundary.

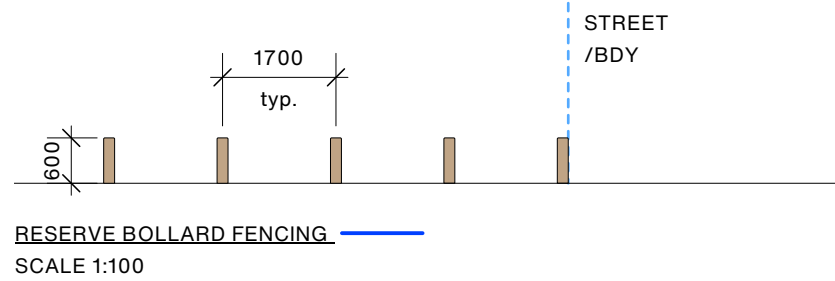
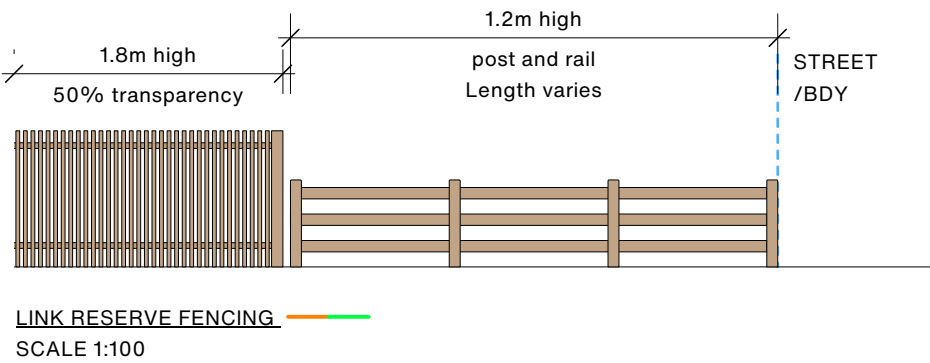
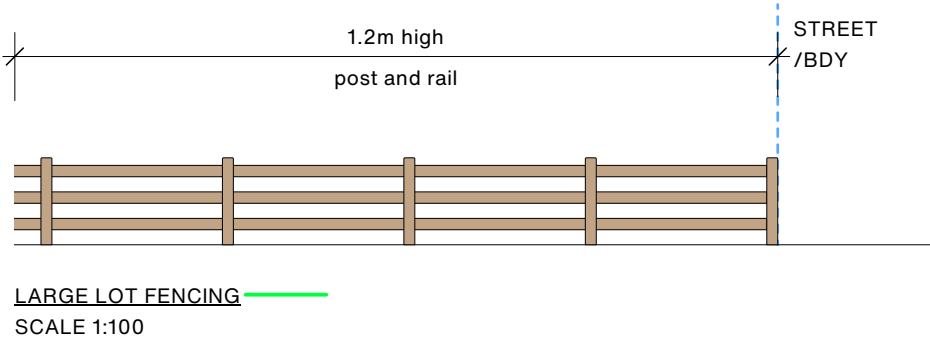
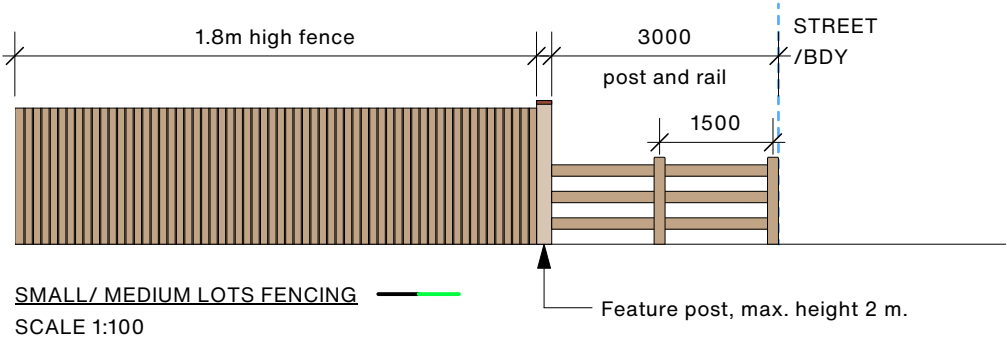
Eastern Entrance  
refer to Lot 26 fencing

1.8m high acoustic fence on top of 1.2m high bund  
Planting proposed to road side of fence to screen  
the fence.

West Entrance  
refer to sheet 9 for details

- Stage boundary
- Proposed Lot boundary
- Roading
- Path
- Exposed Aggregate
- Pavers
- Grass
- Garden bed
- Specimen Tree
- Water race (realigned)

SITE WIDE FENCING PLAN



- 1.8m High solid timber paling fence
- 1.2m High post and rail fence
- 1.8m High 50% transparent timber batten fence
- 600mm high timber bollard fence
- 1.2m High open style pool fence(with accessible gate)
- 3.0m High acoustic fence
- 1.8m High acoustic fence (on bund)



- 1.8m High solid timber paling fence
- 1.2m High post and rail fence
- 1.8m High 50% transparent timber batten fence
- 600mm high timber bollard fence
- 1.2m High open style pool fence(with accessible gate)
- 3.0m High acoustic fence
- 1.8m High acoustic fence (on bund)



Version: SoundPLAN 9.1

Prediction method: ISO9613-2:2024

Prediction Height: 1.5 m

Project: 160 Bangor Road TNC

Project number: 20260246

Client name: Hughes Developments Limited

SCALE

0 50 100 200 300 400 m

**Bangor Rd Subdivision Traffic Contours**

With 1.8m and 3m fencing and 3m bund

**MARSHALL DAY**  
Acoustics

# SITEWIDE MASTERPLAN

SCALE: 1:6000

1.2m high post and rail fence with screening planting, set within the private lots.

**MARSHALL DAY**  
Acoustics

refer to sheet 12 for details

Reserve 801  
refer to sheet 12 for details

Reserve 810  
refer to sheet 13 for details

Reserve 811  
refer to sheet 14 for details

SH 73 typical boundary treatment  
refer to sheet 21 for details

Large Lot

Medium Lot

Small Lot  
Reserve 801  
refer to sheet 10 for details

**All habitable rooms within this zone may need to be provided with mechanical fresh air ventilation so that the sound level and ventilation requirements can be achieved simultaneously.**

**All bedrooms within this zone may need to be provided with mechanical fresh air ventilation so that the sound level and ventilation requirements can be achieved simultaneously.**

Planting proposed to road side of fence to screen the fence.

West Entrance  
refer to sheet 9 for details

- Stage boundary
- Proposed Lot boundary
- Roading
- Path
- Exposed Aggregate
- Pavers
- Grass
- Garden bed
- Specimen Tree
- Water race (realigned)