StylesGroup
Acoustics & Vibration Consultants

ASSESSMENT OF ACOUSTIC MITIGATION REQUIREMENTS

332 WAINUI ROAD – RESIDENTIAL SUBDIVISION WAINUI

PREPARED FOR

WFH Properties Ltd.

DATE

5 March 2020

Acoustic assessment prepared by Styles Group for WFH Properties Ltd..

REVISION HISTORY

Rev:	Date:	Comment:	Version:	Prepared by:
1	5/03/20		Final	Jon Styles, MASNZ Director and Principal Styles Group

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Appendices

1.0 Introduction

WFH Properties Ltd. has engaged Styles Group to identify and assess the State Highway 1 (SH1) traffic noise levels that will be received across a proposed residential subdivision at 332 Wainui Road (the Site).

This assessment identifies the traffic noise exposure across the Site and provides construction recommendations to ensure the noise sensitive spaces of the future dwellings are designed to achieve a level of 40dB $L_{Aeq(24hr)}$ indoors. This internal design criteria will adequately provide for the acoustic comfort of future occupants and is consistent with the New Zealand Transport Agency's guidelines on managing state highway noise effects on noise sensitive land use.

The indicative acoustic insulation requirements are based on the proposed subdivision layout and design, including the effect of a purpose-built bund along part of the SH1 boundary.

By adequately mitigating the effects of traffic noise on the future occupants of the Site, the potential for reverse sensitivity effects to arise on the New Zealand Transport Agency (NZTA) will be avoided.

This report should be read in conjunction with the application site plans and the Assessment of Environmental Effects (AEE). A glossary of acoustical terms used within this document is attached as Appendix A.

2.0 The proposal

The Site of approximately 2.5Ha is zoned Residential- Mixed Housing Suburban under the Auckland Unitary Plan (AUP). WFH propose to subdivide the Site into 30 residential allotments.

Figure 1 displays the site boundaries and location in relation to the adjacent SH1 corridor and Wainui Road off-ramp. The closest part of the Site is approximately 16m from the north-bound traffic lane. Figure 2 provides a copy of the proposed scheme plan of subdivision.

Figure 1 The Site and SH1 Source: Woods

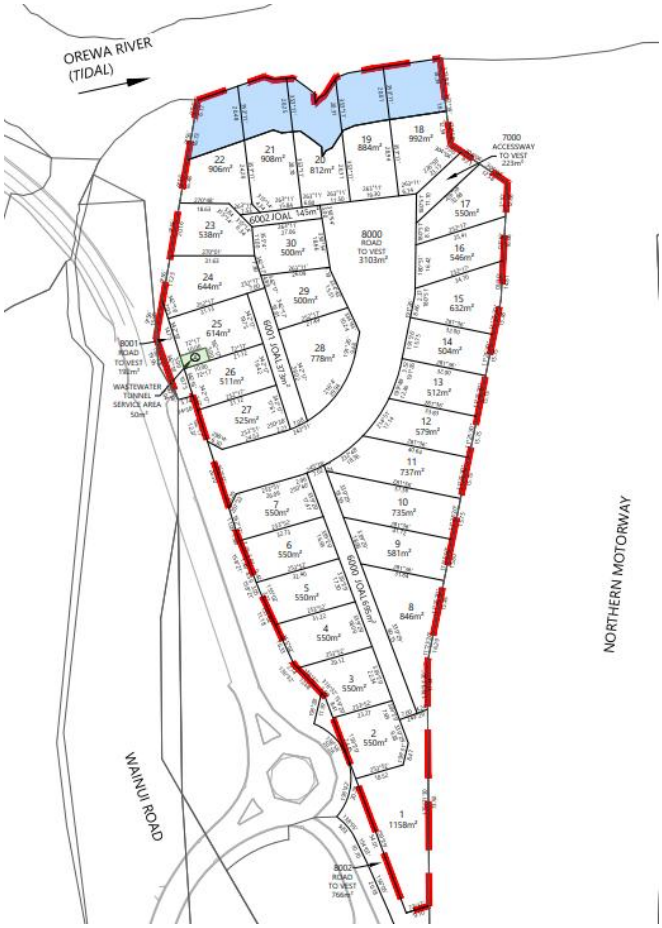


Figure 2 Indicative scheme plan of subdivision Source: Woods

3.0 Criteria

3.1 Auckland Unitary Plan

The AUP defines *activities sensitive to noise* in Chapter J1 as:

> **Any dwelling,** visitor accommodation, boarding house, marae, papakāinga, integrated residential development, retirement village, supported residential care, care centres, lecture theatres in tertiary education facilities, classrooms in education facilities and healthcare facilities with an overnight stay facility.

Dwellings are included within this definition. The AUP definition of a *noise sensitive space* includes:

> Any indoor space within an activity sensitive to noise excluding any bathroom, water closet, laundry, pantry, walk in wardrobe, corridor, hallway, lobby, stairwell, clothes drying area, kitchens not part of a dwelling, garage or other space of a specialised nature occupied neither frequently nor for extended periods.

The AUP does not identify any controls requiring acoustic insulation measures to be implemented within noise sensitive activities constructed in proximity to high traffic noise environments.

3.2 NZTA guidelines on managing reverse sensitivity effects

The NZTA *Guide to the management of effects on noise sensitive land use near to the state highway network*[1] recommends that new or altered buildings containing noise sensitive activities exposed to state highway noise should be designed, constructed and maintained to meet a maximum indoor noise level of 40 dB $L_{Aeq(24h)}$.

The NZTA guidelines also provides specifications for ventilation and cooling systems to allow windows and doors to be closed to meet the targeted internal noise levels.

3.3 Summary

Although there are no controls in the AUP regarding the insulation of buildings against traffic noise, we consider that providing sufficient insulation to meet an internal noise level of 40dB L_{Aeq} is appropriate. Insulating to achieve the internal noise level will avoid potentially significant annoyance effects on buildings occupants, and will avoid the potential for reverse sensitivity effects to arise on the road controlling authority.

This report sets out recommendations for acoustic mitigation to ensure the future dwellings are designed to ensure that the occupants will be exposed to noise levels which are no greater than reasonable.

[1] https://www.nzta.govt.nz/resources/effects-on-noise-sensitive-land/

4.0 Noise modelling and predictions

To understand the level and spatial propagation of traffic noise across the Site, Styles Group has used Brüel & Kjær Predictor computer noise modelling software to prepare noise level predictions based on the International Standard ISO 9613-1/2. The noise level predictions assume meteorological conditions that slightly enhance propagation in all directions in accordance with NZS 6802:2008. The Brüel & Kjær Predictor software is globally recognised and has been successfully implemented on a large number of projects throughout New Zealand.

This section sets out the information which has been integrated into the project noise model, including the noise sources, cadastral data, mitigation measures, model input parameters and any calculation adjustments applied to the predicted noise levels in accordance with the relevant New Zealand acoustics standards.

4.1 Noise model parameters

Noise predictions have been calculated based on the International Standard ISO 9613-1/2 Attenuation of sound during propagation outdoors. Terrain contours were imported from the Auckland Council Geomaps service while the scheme plan and finished site contours were provided by the project team. The topographical contours encompass the entire site and a large area of the surrounding land. We have ensured the integrity of the noise model by careful scrutiny of the final three-dimensional model.

The input parameters for the noise model are set out in Table 1.

Table 1 Predictor noise model input parameters

Parameters/calculation settings	Details
Software	Brüel & Kjær Predictor
Calculation method	ISO 9613.1/2
Meteorological parameters	Single value, C0 = 0
Ground attenuation over land	General method, ground factor: 1
Air temperature	293.15K
Atmospheric pressure	101.33kPa
Air humidity	60%
Receiver heights (relative)	1.5m above ground
Building heights (nominal)	10m

Parameters/calculation settings	Details
Traffic noise	Noise levels have been adjusted by +1 dB to account for future traffic flows. This accounts for 3% growth per year (non – compounding) over the next 10 years.

5.0 Noise modelling results

The traffic noise level contours across the indicative scheme plan are provided within Appendix B. Based on available traffic flow data, the contour maps depict the future (2032) traffic noise levels (received at 1.5m above ground level, 1.5m above the first floor level and 1.5m above the second floor level) across the development (1.5m, 4.5m and 7.5m respectively).

The future noise levels across the Site range from approximately 68-69 dB $L_{Aeq(24hr)}$ along the (most exposed) eastern part of the site, reducing to less than 46dB $L_{Aeq(24hr)}$ in the western part of the site.

The maximum noise level reduction required from outside to inside is 29 dB (69 dB $L_{Aeq(24hr)}$ predicted external level minus 40dB $L_{Aeq(24hr)}$ internal design level).

6.0 Acoustic insulation requirements

At this point in time, the design and layouts of the future dwellings on the Site have not yet been confirmed. We understand that the future dwellings will be constructed in accordance with the bulk and location controls of the AUP, which may provide for dwellings up to 11-12m in height.

While it is not possible to specify the precise nature of facade constructions or upgrades at this point in time, we have provided recommendations for facade upgrades and mechanical ventilation/ cooling based on our experience with lightweight affordable housing designs commonly used in New Zealand. With reference to the noise zones depicted in the contour maps in Appendix B, Appendix C provides a schedule of the typical construction requirements for future dwellings constructed within the respective noise zones on the Site.

The maximum noise level reduction required from outside to inside is 29 dB (69 dB $L_{Aeq(24hr)}$ predicted external level minus 40dB $L_{Aeq(24hr)}$ internal design level). Most well constructed modern buildings will achieve a noise level reduction of around 25dB without any specific acoustic upgrades. Some upgrades will be required to ensure that the rooms most exposed to traffic noise will receive indoor noise levels no greater than 40dB $L_{Aeq(24hr)}$. Such upgrades may include minor glazing improvements, ensuring the windows and doors are framed in good quality, well-fitting joinery with compressible rubber seals, and making sure that any openings to the outside (e.g. kitchen extracts) are routed away from direct exposure to traffic

noise, or are silenced. For the top storey, the ceilings may require minor upgrades as well, depending on the roof constructions and materials selected for the final design.

For those parts of the building that are exposed to noise levels greater than 55dB $L_{Aeq(24hr)}$, it will be necessary to ensure that windows and doors of the rooms on the relevant levels are closed in order to meet the target internal noise levels. To ensure that the occupants do not need to open those windows and doors for ventilation and cooling, the rooms must be cooled by provision of mechanical cooling (or alternative solutions) to ensure thermal comfort for the occupants, particularly in the warmer months. This can typically be achieved using a ducted air conditioning system, or a traditional split cycle domestic heatpump with a small fresh air supply to ensure that the fresh air requirements of clause G4 of the Building Code are also met.

7.0 Conclusion

Styles Group have modelled the SH1 traffic noise levels across the Site, to determine the degree of acoustic mitigation that will be required to ensure future dwellings are constructed to achieve an internal noise level of 40dB $L_{Aeq(24h)}$. This design criteria aligns with NZTA's guidance on the management of traffic noise effects on noise sensitive land use near to the State Highway network.

Our assessment has shown that the noise effects of SH1 can be adequately mitigated through minor acoustic treatment to the dwellings affected by traffic noise, and the provision of mechanical cooling and ventilation to affected spaces to ensure that those windows and doors do not need to be opened to provide for the adequate thermal comfort for the occupants.

It is our opinion that providing this mitigation will ensure that the future occupants of the Site will be exposed to traffic noise levels which are no greater than reasonable and will avoid any potential reverse sensitivity effects from arising on NZTA as the road controlling authority.

Appendix A Glossary of terms

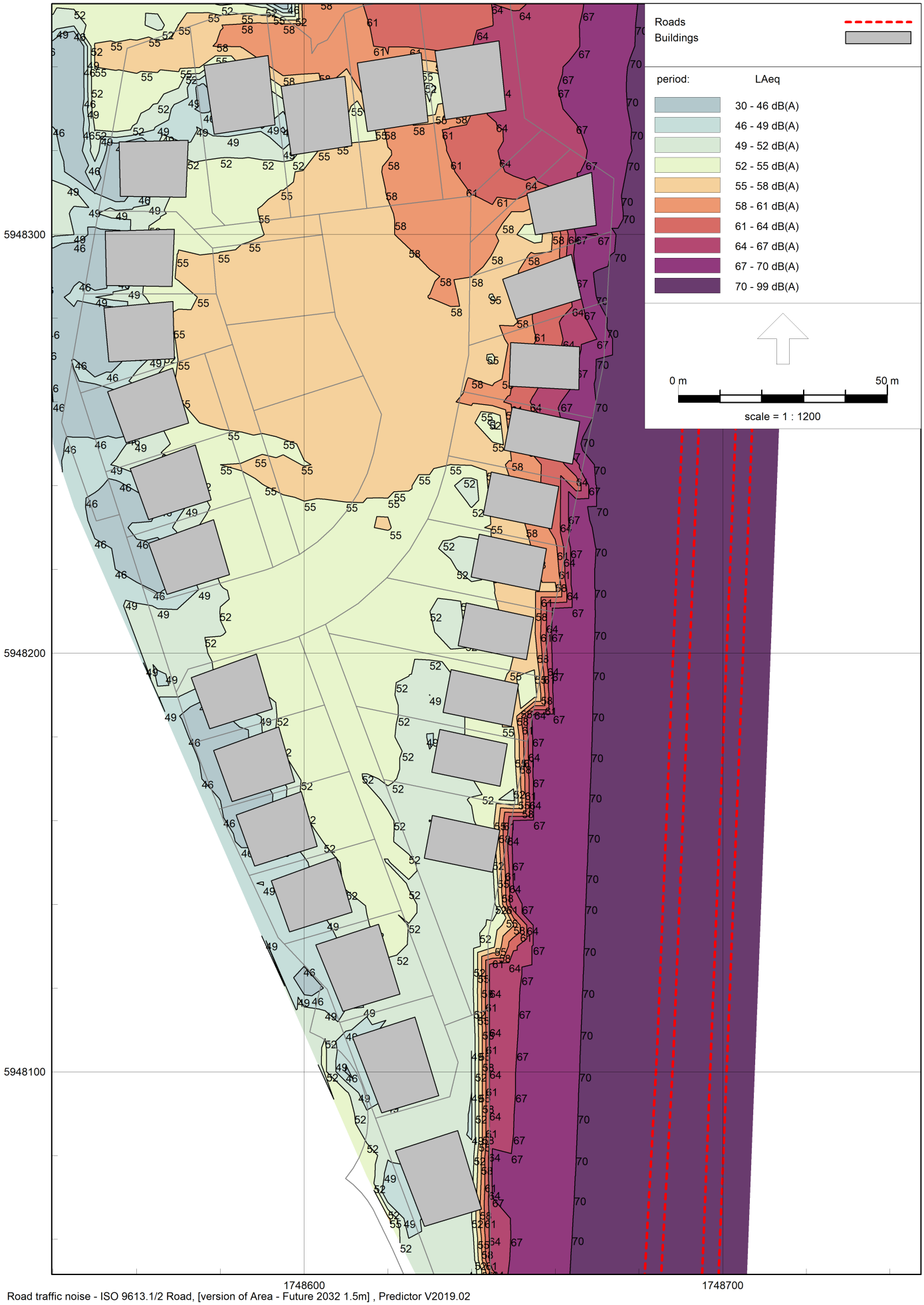
Noise	A sound which serves little or no purpose for the exposed persons and is commonly described as 'unwanted sound'. The definition of noise includes vibration under the Resource Management Act.
dB (decibel)	The basic measurement unit of sound. The logarithmic unit used to describe the ratio between the measured sound pressure level and a reference level of 20 micropascals (0 dB).
A-weighting	A frequency filter applied to the full audio range (20 Hz to 20 kHz) to approximate the response of the human ear at lower sound pressure levels.
$L_{Aeq(t)}$ (dB)	The A-weighted equivalent sound pressure level with the same energy content as the measured varying acoustic signal over a sample period (t). The preferred metric for sound levels that vary over time because it takes into account the total sound energy over the time period of interest.
The Act	The Resource Management Act 1991.
s16	Section 16 of the Act states that "every occupier of land (including any premises and any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level".

Appendix B Traffic noise contours

Future 2032 1.5m

4 Mar 2020, 09:35

Styles Group, NZ

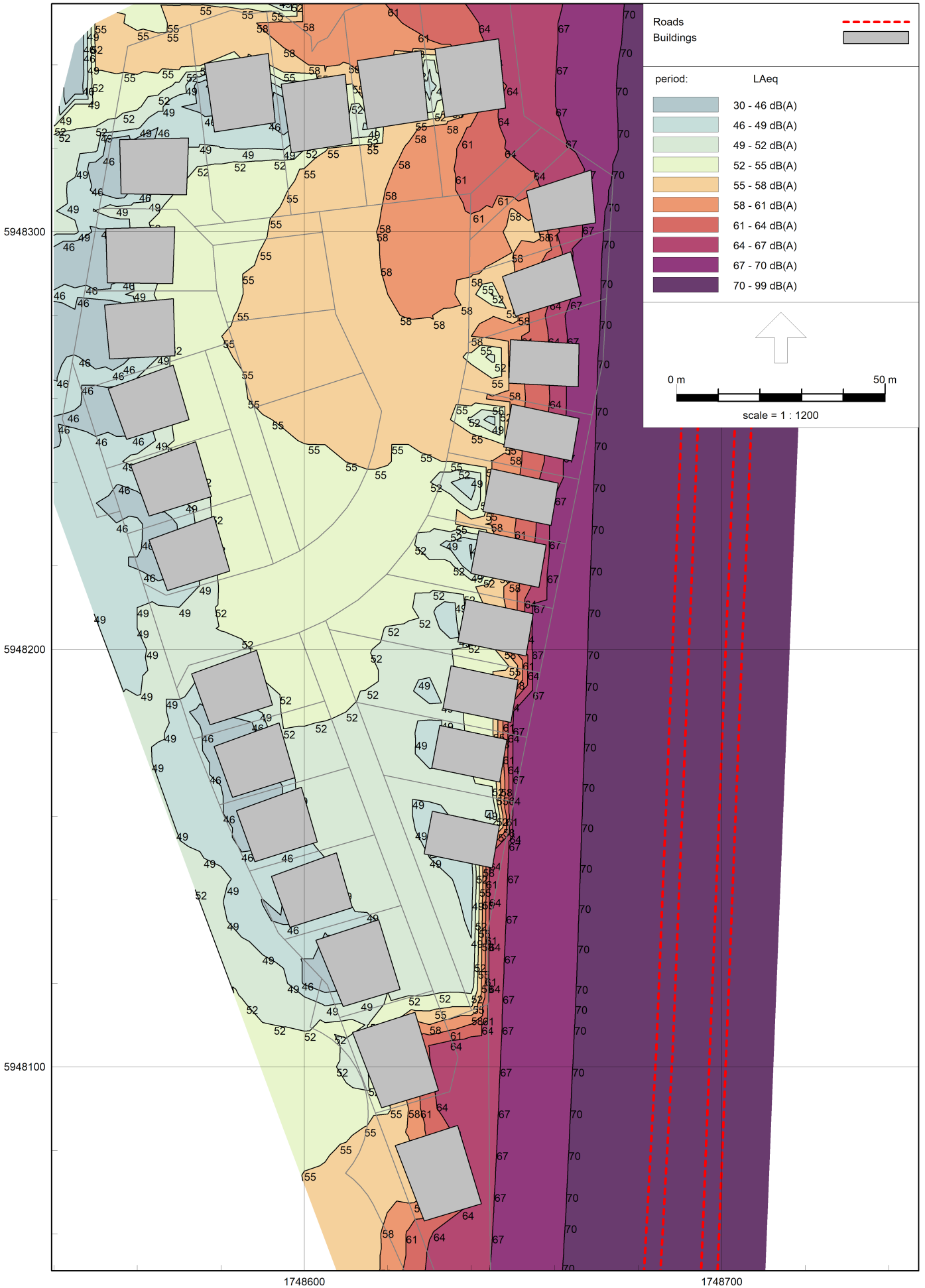


Road traffic noise - ISO 9613.1/2 Road, [version of Area - Future 2032 1.5m] , Predictor V2019.02

Future 2032 - 4m

4 Mar 2020, 09:37

Styles Group, NZ

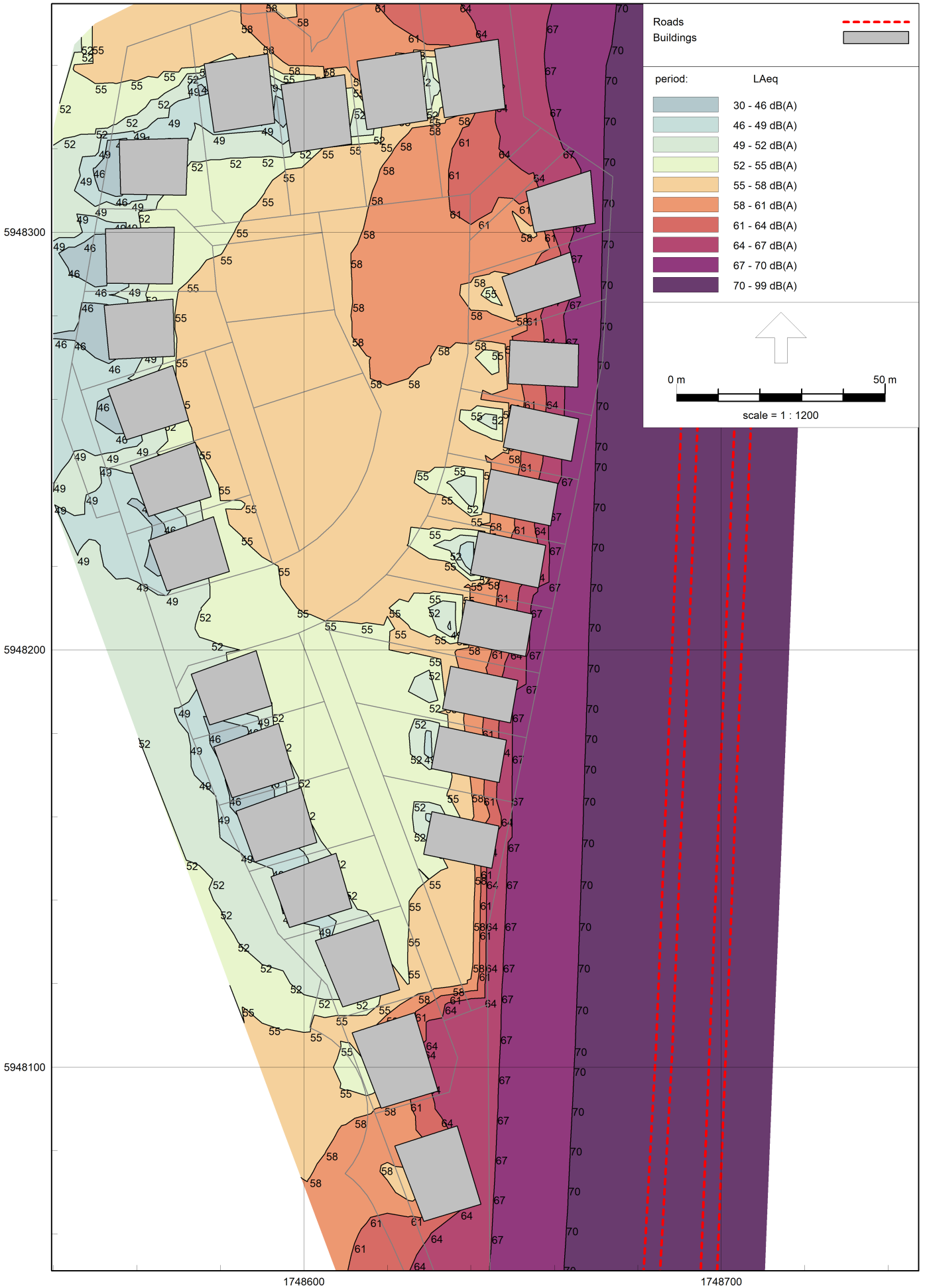


Road traffic noise - ISO 9613.1/2 Road, [version of Area - Future 2032 - 4m] , Predictor V2019.02

Future 2032 - 7.5m

4 Mar 2020, 09:37

Styles Group, NZ



Road traffic noise - ISO 9613.1/2 Road, [version of Area - Future 2032 - 7.5m] , Predictor V2019.02

Appendix C Typical construction requirements

The table below identifies the facade upgrades and mechanical ventilation / cooling requirements required for future residential dwellings constructed on the Site, based on the level of noise exposure across the Site. The requirements for each Noise Zone correspond to the colour of each noise band, as identified on the Noise Contour Plans provided in Appendix B.

Because there is no specimen design available at this early stage, it is not possible to specify the nature of facade constructions required, or any upgrades. We have based our recommendations of whether upgrades might be required based on our experience with lightweight affordable housing designs used elsewhere in New Zealand.

Noise Zone (Refer to Noise Contours in Appendix B)	**Upgrades**	
	Facade Upgrades	**Ventilation and Cooling**
Noise Zone 1 (67-70 dB)	Double glazing or single-pane laminate will likely be required. Ceiling upgrades may be required for top storey bedrooms. 13mm dense plasterboard would be likely, with sarking possible depending on roofing materials. Facades may require upgrades to increase the mass of the walls, depending on the external cladding. Brick or brick veneer, masonry or heavy cladding systems will not likely require any upgrades. Lightweight cladding systems may not be appropriate unless a heavier lining or sarking can be added, such as compressed fibre cement board, RAB or additional internal plasterboard linings.	Mechanical ventilation and cooling for all bedrooms and habitable rooms

Noise Zone (Refer to Noise Contours in Appendix B)	Upgrades	
	Facade Upgrades	**Ventilation and Cooling**
Noise Zone 2 (64-67 dB)	Glazing systems may require upgrades and joinery systems will need to be well fitted with compressible rubber seals fitted. Ceilings may require some upgrades depending on roofing materials Lightweight facades may require some upgrades to add mass. Very lightweight facades may not be acceptable.	Mechanical ventilation and cooling for all bedrooms and habitable rooms
Noise Zone 3 (61-64 dB)	Minor upgrades may be required to glazing and light weight cladding systems, but not likely.	Mechanical ventilation and cooling for all bedrooms and habitable rooms
Noise Zone 4 (58-61 dB)	No upgrades required.	Mechanical ventilation and cooling for all bedrooms and habitable rooms
Noise Zone 5 (55-58 dB)	No upgrades required.	Mechanical ventilation and cooling for all bedrooms and habitable rooms.
Noise Zone 6 (52-55 dB)	No upgrades required.	Mechanical ventilation and cooling for bedrooms and habitable rooms unless passive ventilation options are available that are not directly exposed to traffic noise.

Noise Zone (Refer to Noise Contours in Appendix B)	Upgrades	
	Facade Upgrades	Ventilation and Cooling
Noise Zone 6 (49-52 dB)	No upgrades required.	Passive.