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File Ref: AC23024 – 02 – R2

11 September 2023

Mr. S Cornwall
Veros
78 Second Avenue
TAURANGA 3110

Email: stephenc@veros.co.nz

Dear Stephen,

Re: Wooing Tree Estate Development, Cromwell
State Highway traffic noise review

Acoustic Engineering Services (AES) has been engaged to provide acoustic engineering advice in relation to a Resource Consent application for a number of residential lots in the Wooing Tree Estate Development in Cromwell that are in close proximity to State Highways 6 and 8B. Our review is with regard to reverse sensitivity effects from traffic for the new noise sensitive receivers to be established within the proposed subdivision and the requirements set out in Resource Consent Condition 84 and the Central Otago District Plan Rule 7.3.6.xii.b.

Our analysis is based on our correspondence to date and the following documentation:

- Masterplan for Resource Consent titled *Wooing Tree Masterplan*, Revision Z, Drawing Number 2002_002, as prepared by Adapt Studio Limited, and dated the 13th of April 2023.
- Buffer zone drawing titled *Vine Buffer – Long Section Wooing Tree Estate*, as prepared by Baxter Design, and dated the 25th of August 2022.
- Letter titled *EPA RFI Response – Acoustics*, as prepared by Marshall Day Acoustics and dated the 5th of July 2021.

We have updated our review to address selected aspects according to emails titled *Wooing Tree Estate – Acoustic Report Condition 111*, and *Wooing Tree – Generic Acoustic Report*, received on the 8th of September 2023.

Please find our analysis below.

1.0 BACKGROUND

The proposed development, known as the Wooing Tree Estate Development, is located in Cromwell. State Highway 6 (SH6) being Luggate-Cromwell Road, is to the west of the site. State Highway 8B (SH8B) is located to the south of the development, as shown in figure 1.1 below.

We note that along the edge of both of the State Highways a 1.8-metre-high bund is proposed to the south and west of the site. A 1.8-metre-high acoustic fence is proposed to the northwest of the site. Both of these noise mitigation measures are also shown in figure 1.1.

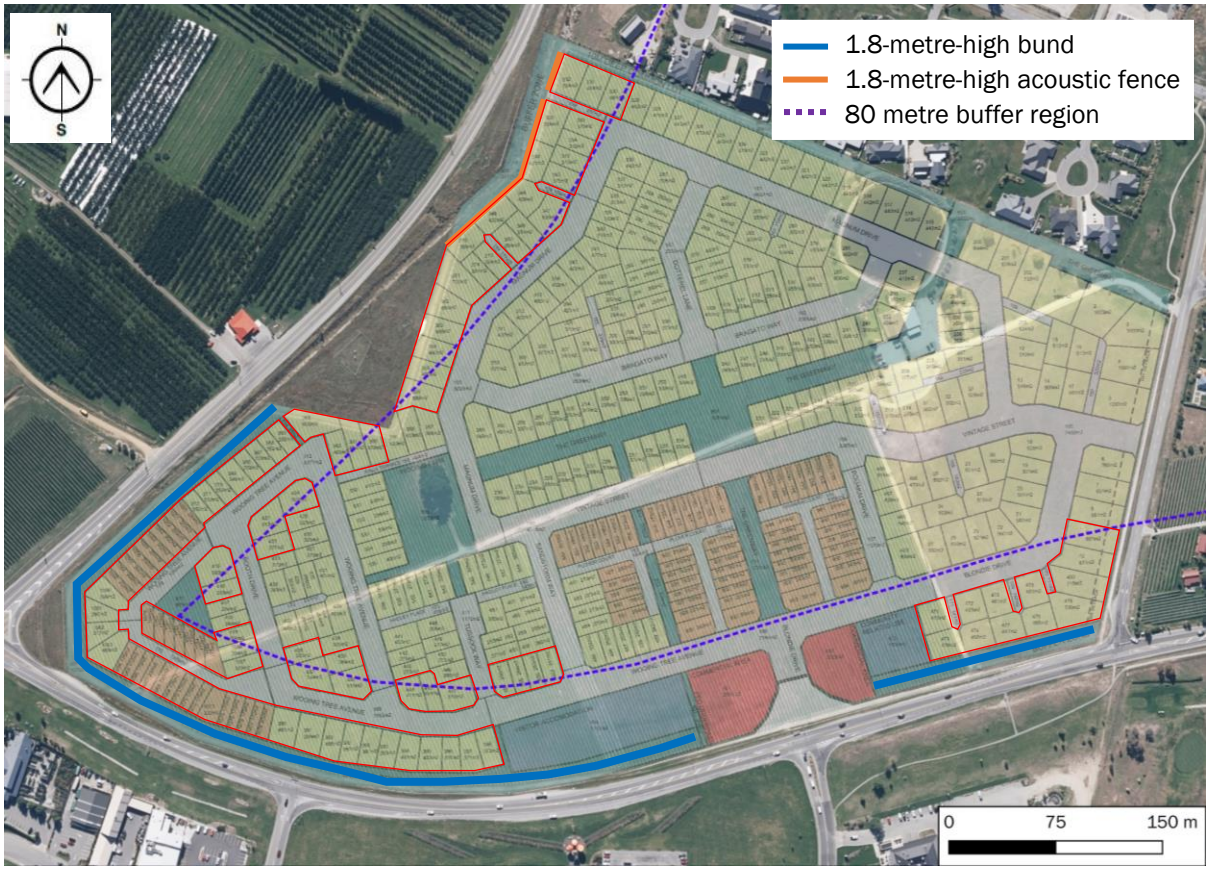

Figure 1.1 – Location of the Wooing Tree Development

Lots that are subject to the relevant conditions include: Lots 9 to 10, 273 to 275, 330 to 335, 343 to 356, 360 to 372, 388 to 398, 415, 416, 419, 421, 422, 424, 436, 437, 439, 440, 444, 445, 447, 454 to 457, 471 to 480, and 1050 to 1087, as shown in red in figure 1.1.

2.0 ACOUSTIC CRITERIA

As outlined above, Condition 84 of the approved Resource Consent requires the consideration of traffic noise insulation, as reproduced below:

A consent notice shall be placed on the titles of all lots covered by Land Use Condition 111 requiring noise attenuation for new residential buildings located on lots within the Residential Resource Area, the Residential Resource Area (3) and the Residential Resource Area (11) in the Wooing Tree Overlay Area within 80 m of the carriageway edge of SH6 or SH8B to meet noise performance standards for noise from traffic on SH6 or SH8B.

The applicable noise performance standards are based on Central Otago District Plan Rule 7.3.6.xii.b, as reproduced below:

New residential buildings located in the Residential Resource Area, The Residential Resource Area (3) and the Residential Resource Area (11) in the Wooing Tree Overlay Area within 80 m of the sealed edge of State Highway 6 or 8B shall be designed and constructed to meet noise performance standards for noise from traffic on State Highway 6 or 8B that will not exceed 35 dBA $L_{eq\ (24hr)}$ in bedrooms and 40 dBA $L_{eq\ (24hr)}$ for other habitable rooms in accordance with the satisfactory sound levels recommended by Australian and New Zealand Standard AS/NZ2107:2008 Acoustics – Recommended design sound levels and reverberation times for building interiors.

While not explicitly referenced in the District Plan Rule or Consent Condition, traffic noise insulation rules are generally based on compliance with the internal noise levels being achieved while also meeting the requirements of NZBC Clause G4. This typically requires a mechanical ventilation system to be provided for buildings exposed to higher external noise levels.

3.0 EXPECTED NOISE LEVELS

The expected noise levels due to vehicles travelling past the site on SH6 and SH8B have been calculated using the Calculation of Road Traffic Noise (CoRTN) algorithm applied with the SoundPLAN (v8.2) 3D noise modelling software.

The modelling was based on data inputs for Average Annual Daily Traffic (AADT) traffic flow volume, local terrain, local ground conditions, designated speed limit, percentage of heavy vehicles using the road and the road surface type.

Average Annual Daily Traffic (AADT) data was sourced from the NZTA State Highways traffic data website[1], and data was adjusted allowing for a 3% increase in traffic volume per year up to 2023. Future traffic noise was projected with a further increase of 3% in traffic volume per year up to 2043.

Traffic for SH6 was predicted at 13669 AADT and traffic for SH8B was predicted at 11675 AADT for 2043, with 8.0% of the flow composition being heavy vehicles for SH6, and 8.3% of the flow composition being heavy vehicles for SH8B. The road surface was assumed to be Grade 3/5 Chip Seal, and the noise model was adjusted accordingly.

The predicted traffic noise contours are shown in figures 3.1 and 3.2 below at heights of 1.5 and 4.5 metres above ground level respectively. Traffic noise modelling accounts for a 1.8 metre high bund in the buffer zones to the west and south of the site and a 1.8 metre high fence in the northwest buffer zone. We note that the noise levels appear to differ from the contours presented in the Marshall Day Acoustics report (titled *EPA RFI Response – Acoustics* and dated the 5th of July 2021), however, the Marshall Day Acoustics modelling did not include screening from the bunds, and in areas without screening the predicted noise levels are comparable.

[1] https://maphub.nzta.govt.nz/public/?appid=31305d4c1c794c1188a87da0d3e85d04 retrieved 19 May, 2023

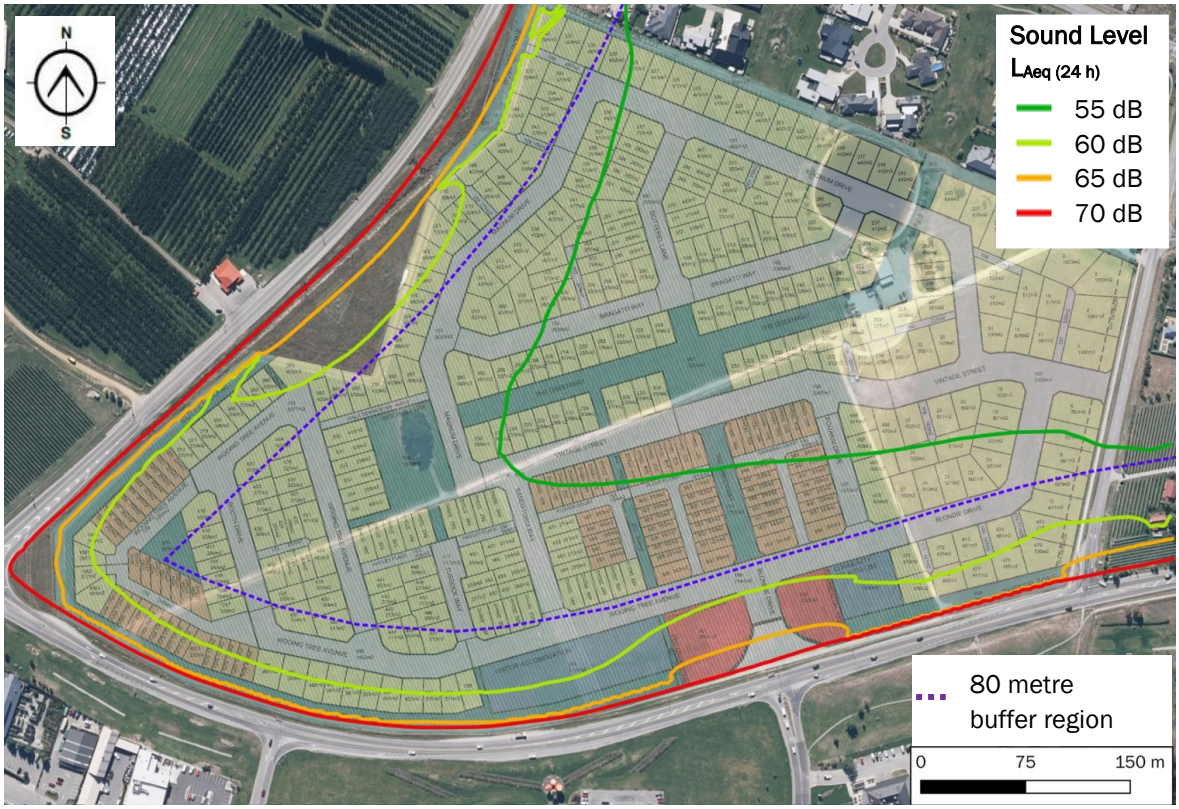

Figure 3.1 – Predicted future traffic noise contours at 1.5 metres above ground level

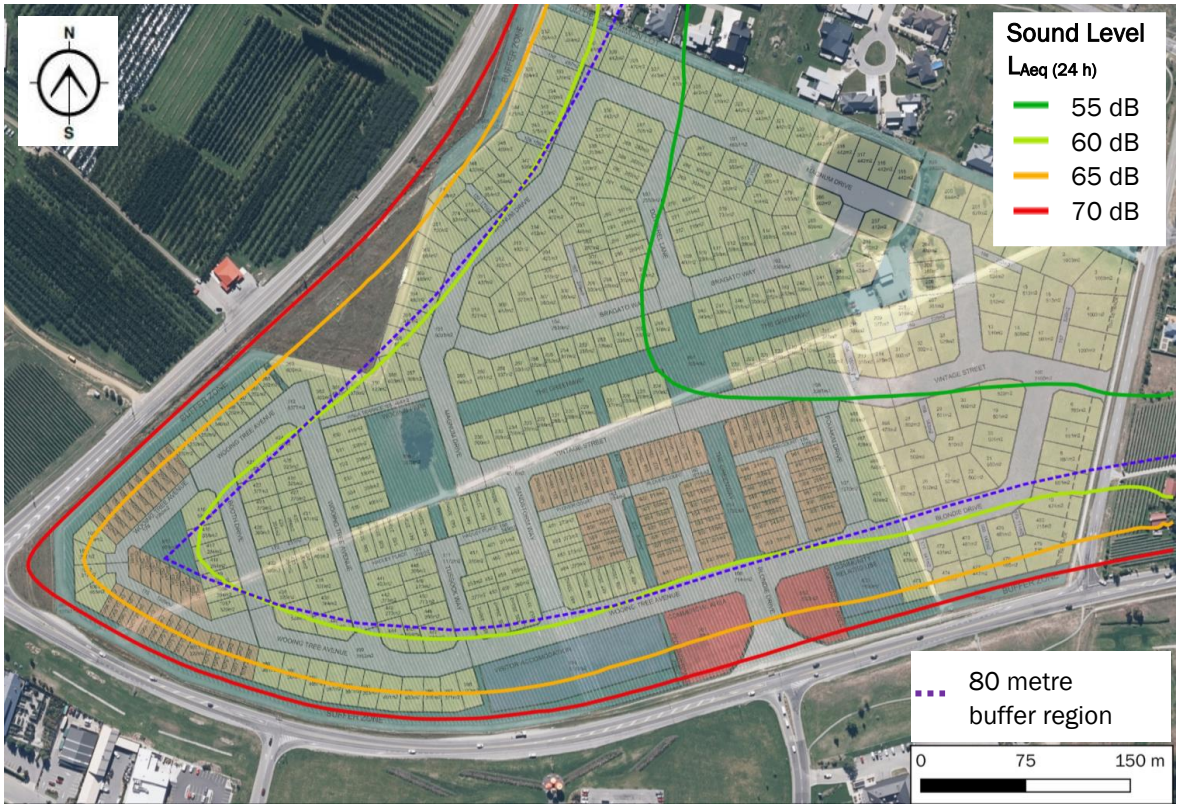

Figure 3.2 – Predicted future traffic noise contours at 4.5 metres above ground level

4.0 TYPICAL DWELLING CONSTRUCTIONS AND UPGRADES

4.1 Classification of lots

We have categorised lots within the 80 metre buffer region into three types based on received noise levels for both the case of single storey dwellings and multi storey dwellings. Table 4.1 below shows the expected external noise levels for each classification type, as well as the external to internal noise reduction requirements for bedrooms and other habitable spaces within each classification type.

Table 4.1 – Classification for lots within the 80 metre buffer zone

Type	Noise levels experienced dB L_{Aeq}	Noise insulation for bedrooms dB $D_{nT,w} + C_{tr}$	Noise insulation for other habitable spaces dB $D_{nT,w} + C_{tr}$
Type 1	65 – 70	35	30
Type 2	60 – 65	30	25
Type 3	55 – 60	25	20

All of the houses in the above categories will require mechanical ventilation and temperature control to habitable spaces, to ensure that Resource Consent Condition 112 and the requirements of NZBC Clause G4 can be achieved at all times with windows closed for acoustic insulation.

If a house is built in a lot that is within the 80 metre buffer region, but the house itself is outside of the 80 metre buffer region then noise insulation would not be required. Where a habitable space falls partially within the 80 metre buffer region the upgrades outlined in section 4.2 should be applied. Where a habitable space is further than 80 metres from the carriageway edge, upgrades are not required.

Single storey buildings

For lots containing single storey buildings only, the following lots are classified as Type 2:

- Lots 273 – 275, 332, 335, 351 – 355, 361, 363, 365 – 367, 388 – 398, 473, 474, 476 – 480, 1055 – 1078

Other lots with single storey buildings only will be classified as Type 3. There are no lots classified as Type 1 where there are single storey buildings only.

Classifications for lots containing single storey buildings are shown in figure 4.1 below.

Multi storey buildings

For lots containing multi storey buildings the following lots are classified as Type 1:

- Lots 275, 332, 335, 351, 363 – 372, 388 – 398, 473, 474, 477 – 479, and 1050 – 1078

For lots containing multi storey buildings the following lots are classified as Type 2:

- Lots 9 – 10, 273, 274, 330, 331, 333, 334, 343 – 347, 349, 350, 352 – 356, 360 – 362, 415, 416, 419, 421, 424, 436, 437, 440, 444, 445, 447, 454, 471, 472, 475, 476, 480, and 1079 – 1087

Lots with multi storey buildings and not classified as Type 1 or 2 above are classified as Type 3.

Classifications for lots containing multi storey buildings are shown in figure 4.2 below.

Figure 4.1 – Locations of categorised sites for single storey dwellings

Figure 4.2 – Locations of categorised sites for multi storey dwellings

4.2 Example façade constructions

Examples of typical façade constructions to achieve the various levels of required external sound insulation are outlined below. The rating indicates the level of noise reduction relative to the external noise levels.

We note that the requirements for façade element upgrades and mechanical ventilation of individual dwellings may be lower if they are specifically reviewed once other nearby dwellings have been constructed. This should be reviewed by an acoustic engineer on a case-by-case basis with detailed review based on the layout of the relevant spaces and proposed façade design.

Mechanical ventilation with temperature control to habitable spaces is also required to ensure that the NZBC Clause G4 requirements and Resource Consent Condition 112 can be met at the same time as the internal noise level condition.

Land owners must annotate their Building Consent plans to show how compliance with noise insulation and ventilation requirements will be met.

35 dB $D_{2m,nT,w} + C_{tr}$

A 35 dB external to internal noise reduction will be required for bedrooms in houses built on Type 1 lots. Examples of constructions that would achieve this are given below:

External walls

- Lightweight façade with a total surface mass of not less than 35 kg/m^2. Examples include:
  - 20 mm timber weatherboard or 9 mm fibre cement cladding / 6 mm fibre cement RAB board / 140 mm timber frame with fibrous insulation to the cavity / 10 mm Standard GIB plasterboard
  - 20 mm timber weatherboard or 9 mm fibre cement cladding / 140 mm timber frame with fibrous insulation to the cavity / 2 x 10 mm Standard GIB plasterboard or 1 x 13 mm GIB Noiseline plasterboard
- High mass constructions (including 70 mm brick, 50 mm AAC concrete panels, or minimum 50 mm thick concrete) strapped with 50 mm timber with fibrous insulation to the cavity, and 10 mm Standard GIB plasterboard.

External glazing (total coverage up to 35% of the floor area of the room)

- Standard double glazing (4 mm float glass / 12 mm air gap / 4 mm float glass) with secondary pane of 6 mm float glass at least 75 mm from the outer glazing. Fixed panes or opening sashes with full compression seals.
- 13 mm PMMA laminate / 12 mm air gap / 13 mm PMMA laminate
- 10 mm float glass / 16 mm air gap / 10.5 mm HUSH laminate

We note that some of these options may not fit inside a standard window frame, and specialist window framing to accommodate thicker windows may be required.

Roof (pitched)

- Profiled long run steel with a minimum thickness of 0.4 mm on timber trusses at minimum 800 mm centres, fibrous insulation to the cavity, and minimum 12 kg/m^2 ceiling linings (e.g., 1 x 13 mm GIB Noiseline plasterboard or 2 x 13 mm Standard GIB plasterboard).

Roof (skillion)

- Profiled long run steel with a minimum thickness of 0.4 mm on timber framing at minimum 600 mm centres, minimum 200 mm cavity with fibrous insulation, and two layers of minimum 12 kg/m^2 ceiling linings (e.g., 2 x 13 mm GIB Noiseline plasterboard).

In addition, mechanical ventilation and temperature control are required for all habitable spaces.

30 dB $D_{2m,nT,w} + C_{tr}$

A 30 dB external to internal noise reduction will be required for bedrooms in houses built on Type 2 lots and habitable spaces for Type 1 lots. Examples of constructions that would achieve this are described below:

External walls

- Lightweight construction with a total surface mass of not less than 23 kg/m^2. Examples include:
    - 20 mm timber weatherboard or 9 mm fibre cement cladding / 140 mm timber frame with fibrous insulation to the cavity / 10 mm Standard GIB plasterboard

External glazing (total coverage up to 35% of the floor area of the room)

- 10 mm float glass / 12 mm air gap / 6 mm float glass
- 11 mm PMMA laminate / 12 mm air gap / 6 mm float glass
- 6 mm float glass / 16 mm air gap / 8.5 mm HUSH laminate

Roof (pitched)

- Profiled long run steel with a minimum thickness of 0.55 mm on timber trusses at minimum 800 mm centres, fibrous insulation to the cavity, and 13 mm Standard GIB plasterboard lining.

Roof (skillion)

- Profiled long run steel with a minimum thickness of 0.4 mm on timber framing at minimum 600 centres, minimum 200 mm cavity with fibrous insulation, and 13 mm Standard GIB plasterboard lining.

In addition, mechanical ventilation and temperature control are required for all habitable spaces.

25 dB $D_{2m,nT,w} + C_{tr}$

A 25 dB external to internal noise reduction will be required for habitable spaces that are not bedrooms in Type 2 lots, and for bedrooms in Type 3 lots. To achieve this reduction façade elements could be built according to the specifications presented below.

External walls

- Lightweight timber wall construction. Examples include:
    - Timber weatherboards over RAB board / 100 mm minimum wall cavity with fibrous insulation / 10 mm Standard GIB plasterboard

External glazing

- Standard double glazing (4 mm float glass / 12 mm air gap / 4 mm float glass)

Roof (pitched)

- Profiled long run steel with a minimum thickness of 0.4 mm on timber trusses at minimum 800 mm centres, fibrous insulation to the cavity, and 13 mm Standard GIB plasterboard lining.

In addition, mechanical ventilation and temperature control are required for all habitable spaces.

20 dB $D_{2m,nT,w} + C_{tr}$

For spaces that require a 20 dB reduction or less, most common building constructions would be appropriate, however mechanical ventilation and temperature control are required for habitable spaces that fall within the 80 metre buffer region.

5.0 CONCLUSIONS

Dwellings on all relevant lots can be constructed to comply with Resource Consent Condition 84, provided façade elements are designed to meet the requirements for the corresponding external to internal noise insulation outlined in table 4.1 based on the type classification outlined in section 4.0 above.

Mechanical ventilation and temperature control are required in all of the applicable dwellings to ensure compliance with NZBC Clause G4 and Resource Consent Condition 112 can be met at the same time as the internal noise level condition.

A suitably qualified acoustic engineer should review any proposed changes or substitutions to the constructions described above.

Please do not hesitate to contact us to discuss further if required.

Kind Regards,

Jonathan Prins
BE Hons, ME
Acoustic Engineer
Acoustic Engineering Services

6.0 APPENDIX A – COMBINED FIGURES

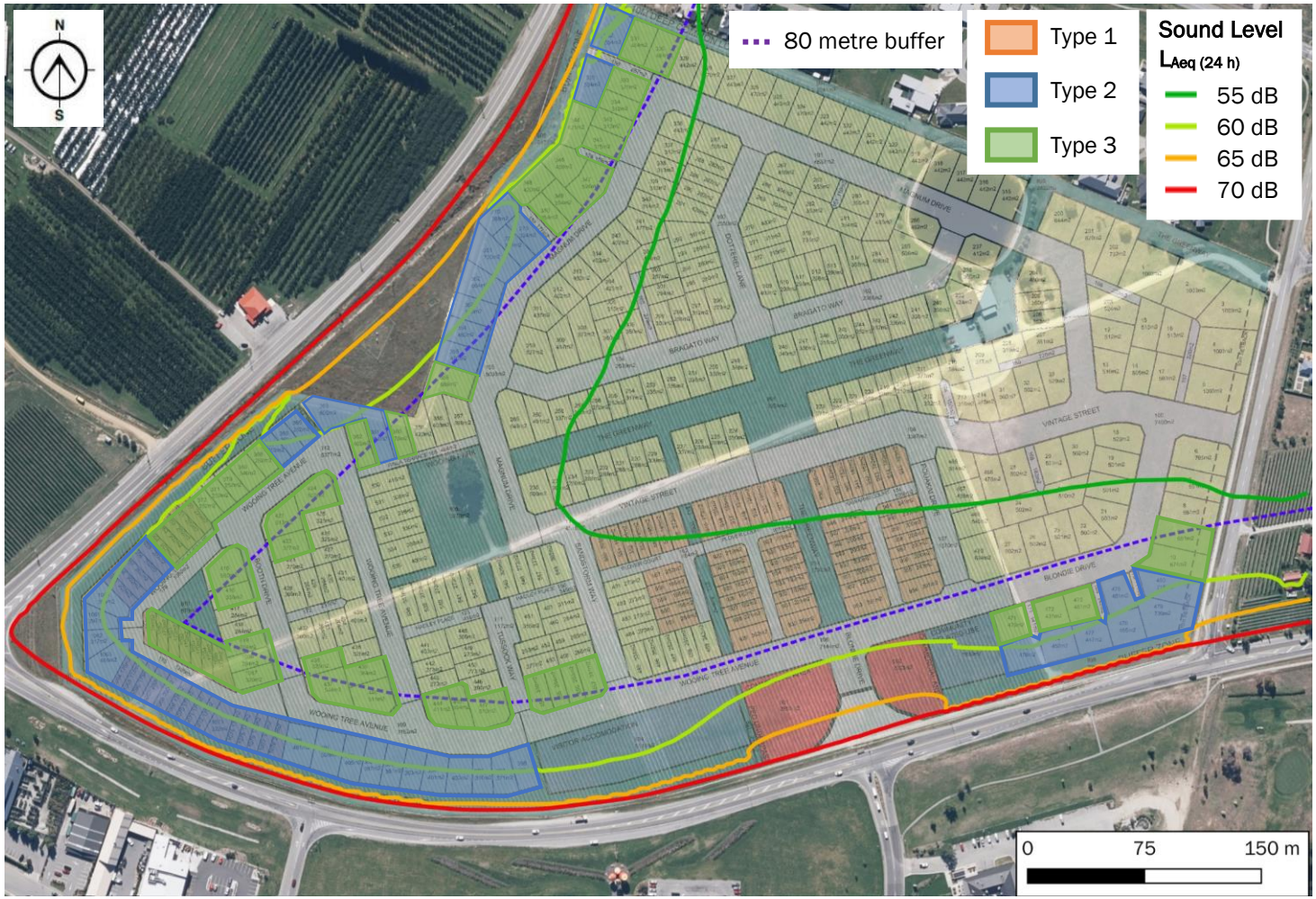

Figure 6.1 – Noise contours and house categories – Ground Level

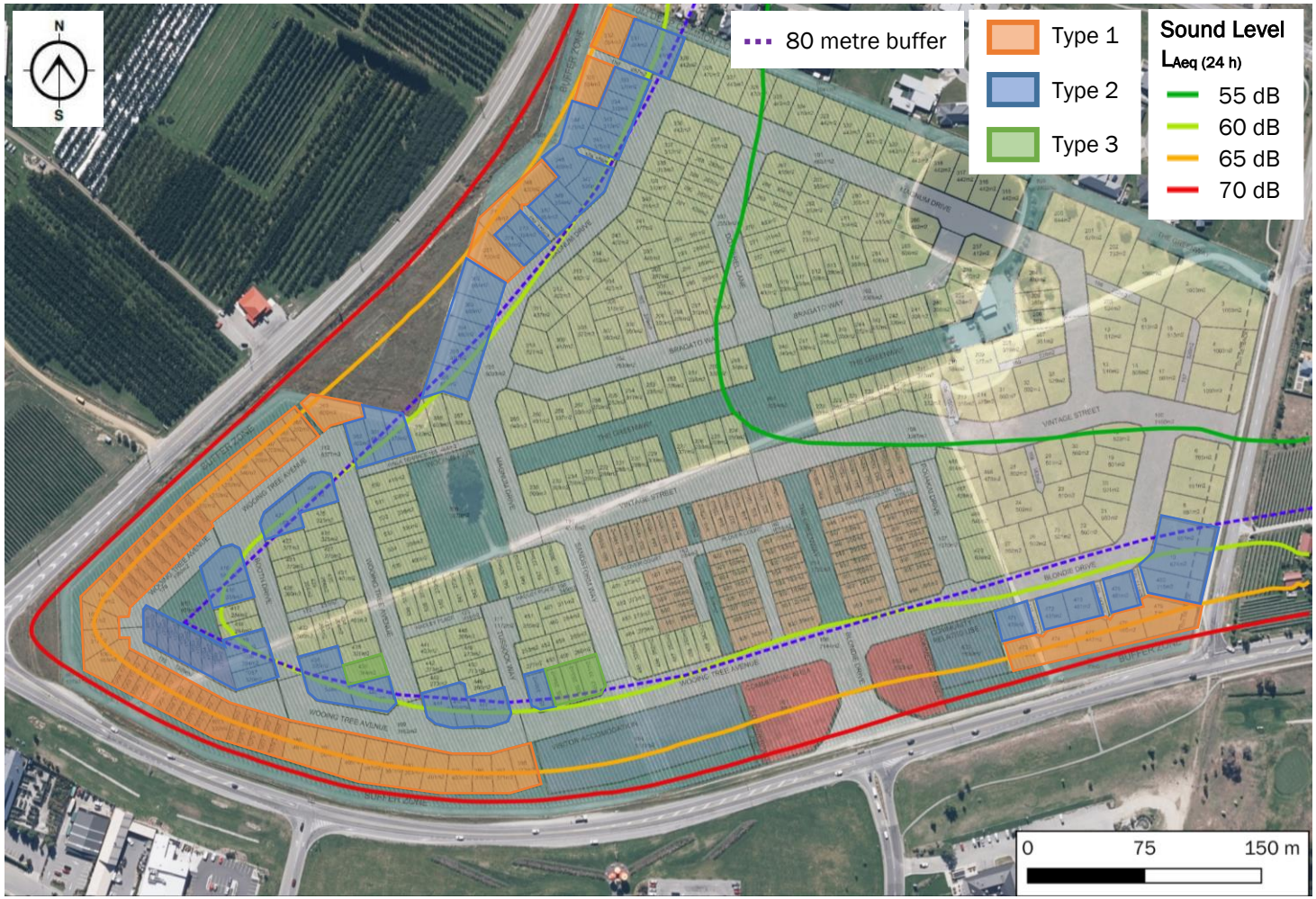

Figure 6.2 – Noise contours and house categories – Level 1 and above