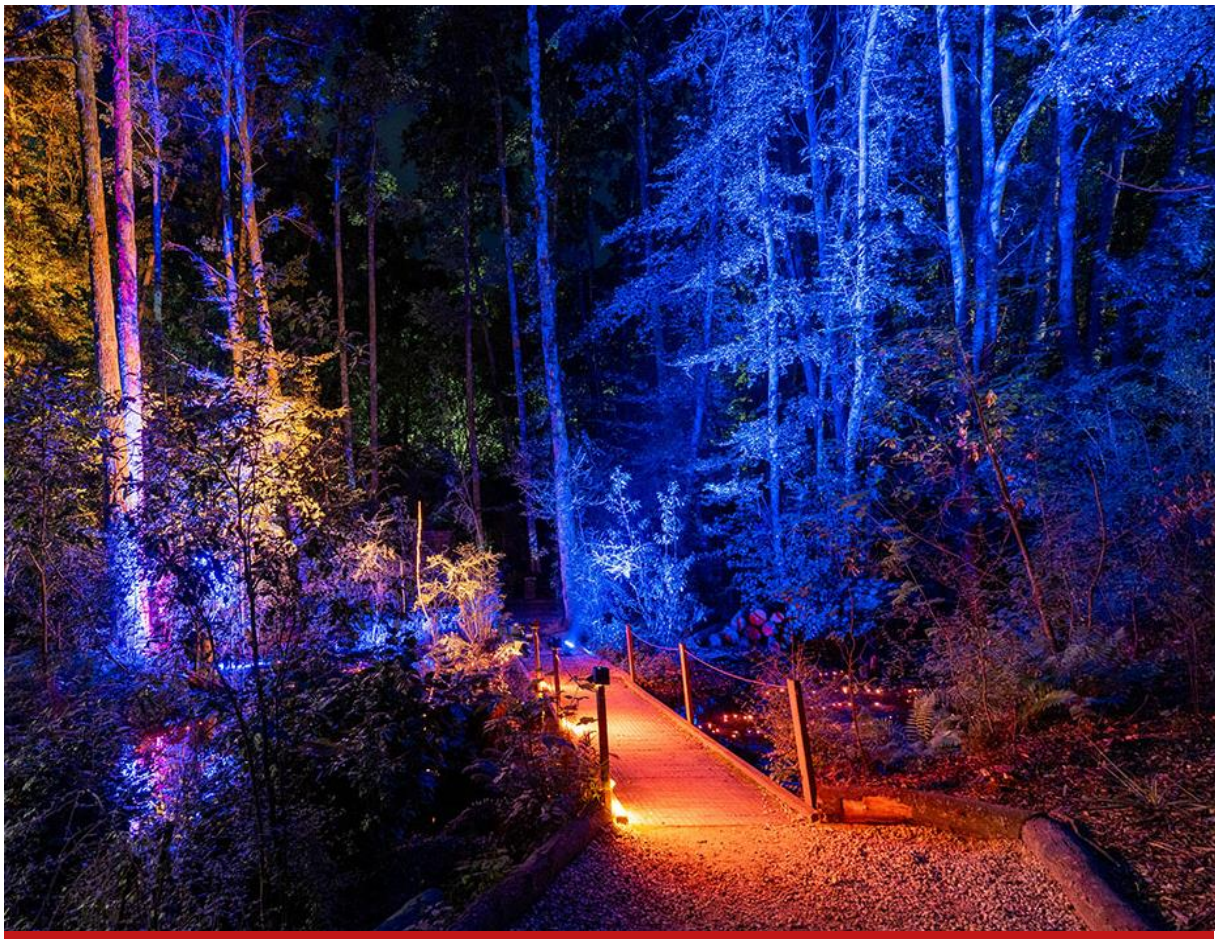
www.aeservices.co.nz
office@aeservices.co.nz
Auckland +64 9 917 0369
Wellington +64 4 890 0122
Christchurch +64 3 377 8952



Report Number: AC25138 – 02 – R2

LUMA Enchanted
Enchanted Forest, Queenstown

Assessment of Environmental Noise Effects

Prepared for:
Philly de Lacey
Screentime New Zealand

Issued:
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Document Acceptance

Author	Signature
Mr Robin Chen *BE Hons (Mech)* Intermediate Acoustic Engineer	
Reviewer	**Signature**
Mr William Reeve *BE Hons (Mech) MASNZ* Senior Associate	
Approver	**Signature**
Dr Jeremy Trevathan *Ph.D. B.E.(Hons.) Assoc. NZPI® MASNZ* Managing Director	

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1.0 BACKGROUND

Acoustic Engineering Services Ltd (AES) have been engaged to provide acoustic engineering advice relating to the Resource Consent application for the LUMA Enchanted – 'Enchanted Forest' temporary night walk light show, to operate at the Kiwi Birdlife Park at 51 Brecon Street, Queenstown, from 30 May to 16 November each year.

The Applicant requires an Assessment of Environmental Noise Effects (AENE) for the activity with regard to section 104 (1) of the Resource Management Act (RMA), which requires the actual and potential effects of the activity to be considered.

We have based our analysis on our correspondence to date, along with the following documentation:

- Assessment of Environmental Effects prepared for *Kiwi Birdlife Park Limited & LUMA Enchanted Limited,* as prepared by Vivian + Espie Ltd and dated the 27th of March 2025.
- Site layout titled Kiwi-Park-Map – LUMA Enchanted Map Sound Layout V2, received via email on the 30th of April 2025, revised layout received 3rd May 2025.
- Overall site layout titled Kiwi-Park-Map – LUMA Enchanted Map Sound Layout wide, received via email on the 30th of April 2025.
- Approved Resource Consent RM020457, as prepared by Queenstown Lakes District Council and dated the 25th of July 2002.

1.1 Site and activity

The event will take place at Kiwi Park Queenstown, 51 Brecon Street, Queenstown, legal description Lot 2 DP 345184, Part Section 131 Block XX Shotover SD, Part Section Block XX Shotover SD held in Record of Title 795902, and Section 1 SO 24407.

The site is split zoned Open Space – Informal Recreation and Queenstown Town Centre under the Proposed Queenstown Lakes District Plan (QLDC PDP). Sites to the east, south, and west are zoned High Density Residential, Queenstown Town Centre, and Open Space – Informal Recreation under the PDP respectively. Sites immediately to the north are un-zoned under the PDP but are zoned High Density Residential under the Operative Queenstown Lakes District Plan (ODP).

The closest residentially-zoned sites are the ones to the north on Hamilton Road, and 20 Robins Road to the east (Queenstown Primary School). A public carpark is located to the south of the site. Skyline Queenstown is located at 53 Brecon Street to the south-west.

The site is shown in figure 1.1 below, with the ODP zoning included for reference.

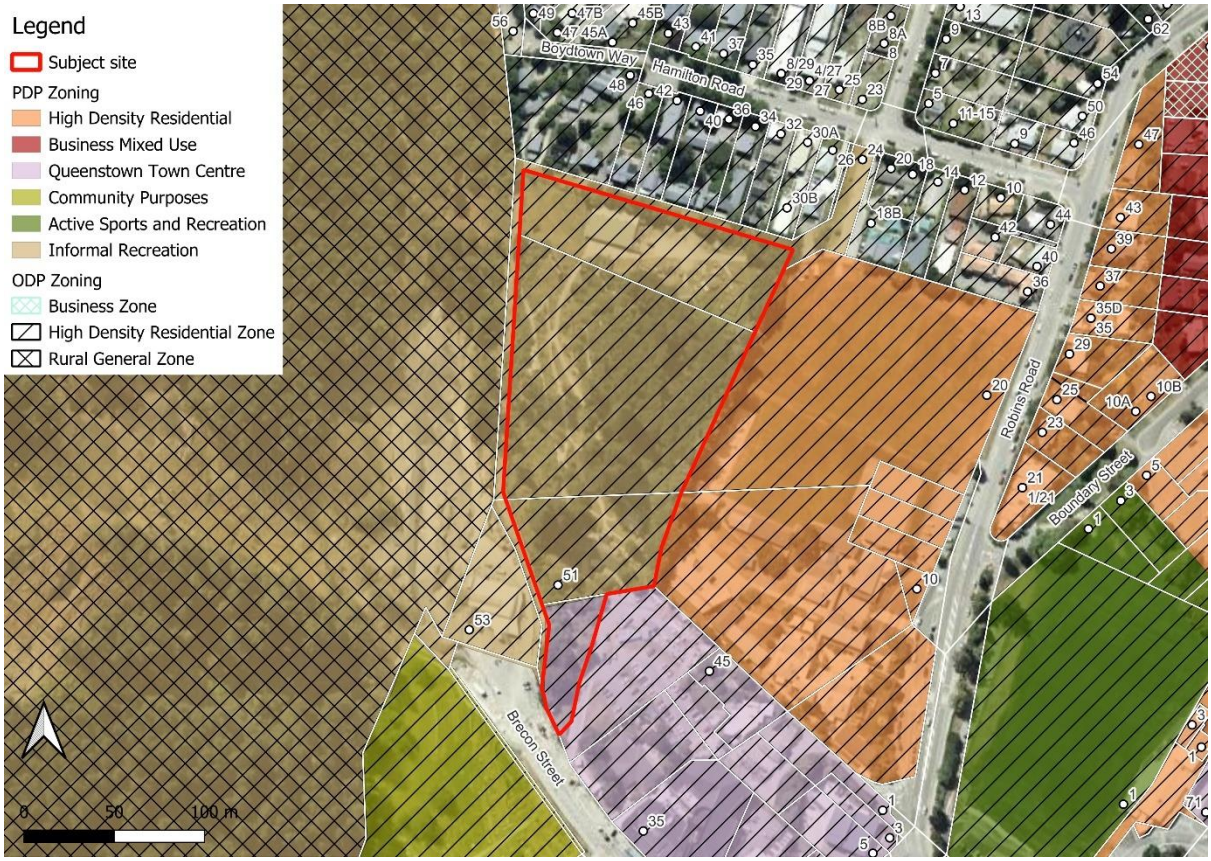

Figure 1.1 – Site and surroundings

The event is a night walk light show which aims to tell the story of New Zealand's native and introduced animals in an abstract and 'whimsical' manner. This will involve temporary artistic structures, lights and soundscapes, setup at regular intervals of a trail on the south-eastern side of the site. Examples of exhibitions include 'Dawn Chorus', 'Dragonfly', and 'Moa'. The location of the trail relative to the site boundaries is shown in figure 1.2 below.

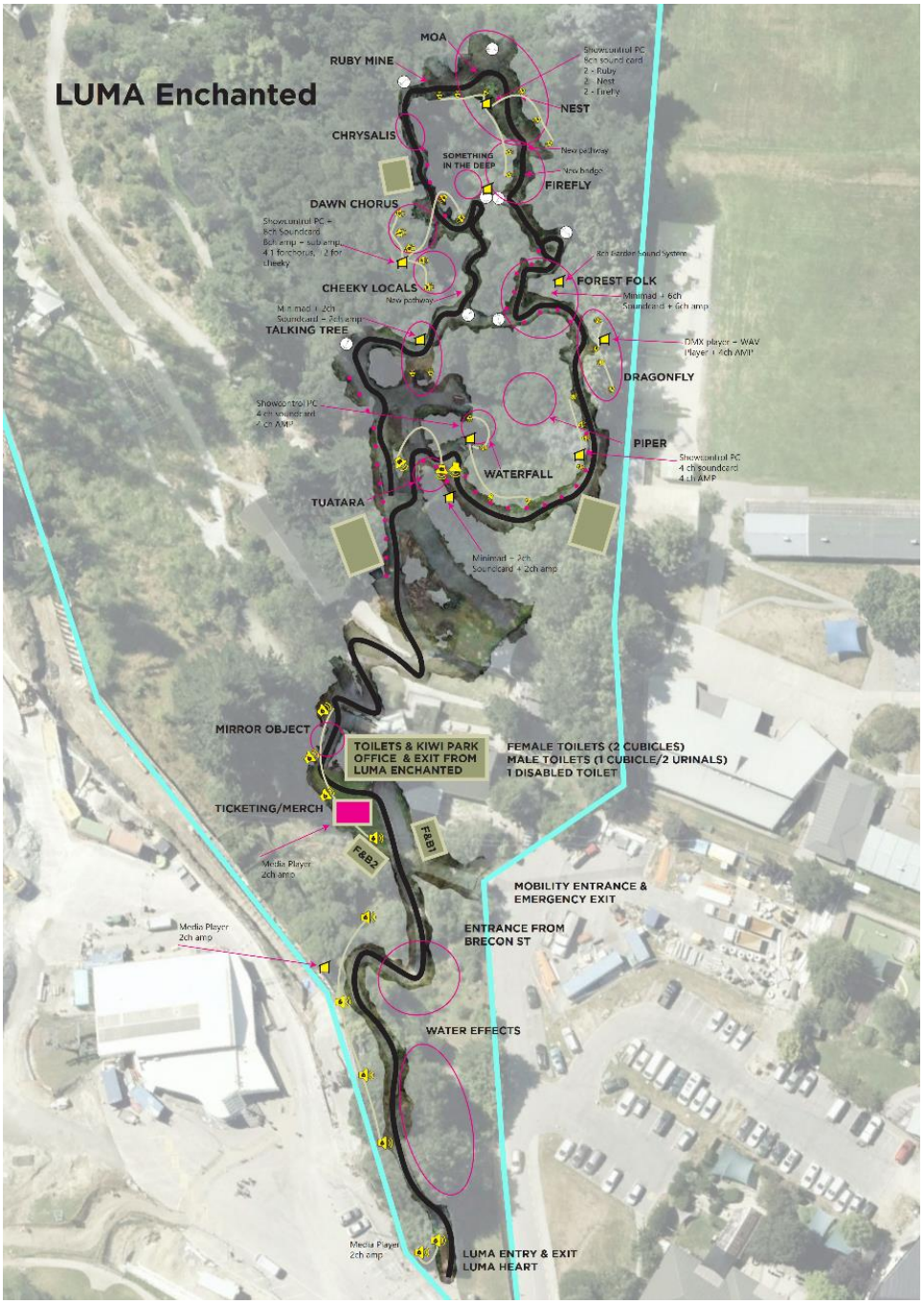

Figure 1.2 – Proposed site layout

The event will occur between 1700 – 2300 hours each night and will be a ticketed event to limit guest numbers to 300. However, once inside the venue guests are free to explore the various exhibitions at their own pace.

2.0 ACOUSTIC CRITERIA

Guidance as to the significance of any adverse noise effects may be obtained from several sources.

2.1 Applicable Consent Conditions

RM020457 contains the following noise condition for activities conducted upon the subject site 51 Brecon Street:

> *The Consent Holder shall ensure that activities conducted on the premises shall not exceed the following noise limits (adjusted for special audible characteristics in accordance NZS 6802:1991) when measured at any point beyond the boundaries of this site within the High Density Residential Zone:*
>
> *Daytime (0800 – 2000 hours) 50 dBA L10*
>
> *Night-time (2000 – 0800 hours) 40 dBA L10*
>
> *70 dBA Lmax*
>
> *Noise levels shall be measured and assessed in accordance with NZS 6801:1991 and NZS 6802:1991 and shall take into account special audible characteristics.*

2.2 Proposed QLDC District Plan

The relevant PDP noise standards applicable for nearby zoning can be found in Chapter 36 of the PDP and are reproduced below. Activities that breach these standards and do not have an exemption are deemed non-complying with regard to noise.

There are no PDP noise limits for receiving sites zoned Informal Recreation or Community Purposes.

Table 2.1 – QLDC PDP Noise limits

Zone sound is received in	Assessment location	Time	Noise Limits
All residential zones (Low Density Suburban, Medium Density, High Density) Open Space and Recreation Zone – Community Purposes	Any point within any site	0800 – 2000	50 dB $L_{Aeq(15min)}$
		2200 – 0800	40 dB $L_{Aeq(15min)}$
Queenstown Town Centre	Any point within any site	0800 – 2200	60 dB $L_{Aaq(15min)}$
		2200 – 0800	50 dB $L_{Aeq(15min)}$ 75 dB L_{AFmax}

The PDP also states that noise shall be measured and assessed in accordance with NZS 6801:*2008 Acoustics – Measurement of Environmental Sound* and NZS 6802:2008 *Acoustics – Environmental Noise.*

As mentioned above the parcels of land immediately north of the subject are un-zoned under the PDP, and zoned High Density Residential under the ODP.

While not directly relevant, we note that Rule 12.5.10.5 of the PDP also contains the following requirements for any speakers on sites zoned Queenstown Town Centre Zone:

> *12.5.10.5*
>
> *within the Town Centre Zone, excluding the Town Centre Transition Sub-Zone sound* from any loudspeaker outside a building shall not exceed 75 dB LAeq(5 min) measured at 0.6 metres from the loudspeaker.*
>
> ** measured in accordance with NZS 6801:2008 and assessed in accordance with NZS 6802:2008, excluding any special audible characteristics and duration adjustments.*

2.3 New Zealand Standard NZS 6802:2008

For long term activities, NZS 6802:2008 *Acoustics – Environmental noise* outlines an upper guideline daytime limit of 55 dB $L_{Aeq\,(15\,min)}$ and a night-time noise limit of 45 dB $L_{Aeq\,(15\,min)}$ for "the reasonable protection of health and amenity associated with the use of land for residential purposes".

For town centres and mixed-use areas NZS 6802:2008 offers a guideline daytime and night-time limit of 60 dB L_{Aeq} for non-residential receivers.

The Standard describes how a -3 dB adjustment may be applied to sound received for less than 50% of the daytime period, and a -5 dB adjustment may be applied to sound received for less than 30% of the daytime period. Where the level of sound reduces significantly for large periods of time but does not stop completely, an energy average can be calculated across the whole daytime period, with a reduction of up to 5 dB permitted. No such adjustment is permitted for the night-time period.

The Standard also describes how a +5 dB adjustment is to be applied to any sound with special audible characteristics such as tonality or impulsiveness.

2.4 World Health Organisation

Guidelines for Community Noise[1], a document produced by the World Health Organisation (WHO) based on extensive international research recommends a guideline limit of 55 dB L_{Aeq} to ensure few people are seriously annoyed in residential situations. A guideline limit of 50 dB L_{Aeq} is recommended to prevent moderate annoyance.

A guideline night-time limit of 45 dB L_{Aeq} is recommended to allow occupants to sleep with windows open. The document also offers a guideline limit of 30 dB L_{Aeq} within bedrooms to avoid sleep disturbance.

These guideline noise levels are measured at the façade of dwellings and other noise sensitive locations and apply for 16 hours in the daytime, and 8 hours for the night-time.

2.5 Discussion regarding appropriate noise levels

We observe that the PDP noise limits applicable at the residential boundary are 5 dB lower than the upper guideline limits outlined in national and international guidance. The limits for the business mixed use zones are consistent with NZS 6802:2008 guidelines.

We note that the consented noise limits in RM020457 only apply to receiving sites zoned High Density Residential. The RM020457 limits refer to the outdated 1991 editions of NZS 6801 and NZS 6801, which use the dB L_{A10} noise descriptor. The latest versions of NZS 6801 and NZS 6802 recommend the $L_{Aeq(15min)}$ descriptor as best practice for the assessment of environmental noise. The dB L_{A10} noise level is the noise level that is exceeded for 10 % of the monitoring period. Whereas a dB L_{A10} noise level cannot be directly

[1] Edited by Berglund, B et al. *Guidelines for community noise.* World Health Organization 1999.

equated to an $L_{Aeq(15min)}$ noise level, an approximate conversion of $L_{Aeq(15min)}$ = dB L_{A10} – 3 dB has been used, making the outdated RM020457 limits slightly more stringent than the PDP limits.

Based on this we have the following comments:

- We expect compliance with the RM020457 noise limits to result in minimal adverse effects, when received at residential sites (with the exception of 20 Robins Road discussed further below). We also expect a small exceedance of the RM020457 noise limit (up to 3 dB), but compliance with the PDP 40 dB $L_{Aeq(15min)}$ noise limit to also result in minimal adverse noise effects.

- We expect technical exceedances of the RM020457 and PDP noise limits at the boundary of 20 Robins Road (Queenstown Primary School) to result in minimal effects, as this site is not expected to be noise sensitive during the proposed operating hours (1700 – 2300 hours). Similarly, we also expect technical exceedances of the Town Centre Zone noise limits in the carpark and Open Space – Informal Recreation Zone noise limits at 53 Brecon Street (Skyline Queenstown) to the south-west to result in minimal adverse noise effects.

3.0 PREDICTED NOISE LEVELS

The main noise sources expected to be associated with the activity are as follows:

- Noise from speakers
- Noise from guests

We understand that public parking is available in the carpark south of the site (offsite). Immediate receivers in the vicinity of the carpark – 20 Robins Road (Queenstown Primary School), and 45 Brecon Street (Queenstown Preschool & Nursery) are not expected to be noise sensitive during the proposed operation hours (1700 – 2300 hours), and we therefore expect any adverse noise effects associated with vehicle noise in the carpark to be minimal.

We understand that the nature of the activity will be consistent across the PDP daytime (1700 – 2000 hours) and night-time (2000 – 2300 hours) periods and have therefore assessed a single worse-case operating scenario.

Noise from speakers

As described above, speakers will be installed at various locations in the trail to create an immersive experience. We understand that the Martin Audio CDD series speakers will be used, and there will be a total of 40 speakers spread out throughout the park, compromised of two CDD10, eight CDD8, and twenty-eight CDD6 speakers. There will be two SX112 subwoofers, one each at the 'Dawn Chorus' and 'Nest' exhibitions.

A demo sound clip was provided to demonstrate what noises might be played by the speakers. These included waterfall sounds, insects, birds, and 'ethereal-sounding' music – slow, hazy, and immersive. Given that the nature of the sounds will vary, we have conservatively applied a pink noise spectrum to the speaker noise sources and have assumed in a worse-case scenario these will operate continuously for a 15 minute period.

Directional data for the speakers was provided in the Common Loudspeaker File format (CLF), and where applicable the narrower dispersion pattern in the horizontal plane was adopted (i.e., 110x60 instead of 60x110) which can be achieved by physically rotating the speaker. We understand that the height and angle of the speaker relate to the ground will depend on site conditions. At this stage we have assumed an average speaker height of 3 metres and have not allowed for any downward tilt.

We understand that although this is ticketed event, once inside the venue guests are free to explore the various exhibitions at their own pace. This means that in a worse-case scenario, all speakers in the park will be operational at the same time.

The sound power of the various speakers will be limited to the levels as shown in figure 3.1 below. The noise limit refers to individual speakers in each exhibition area, and not to the overall exhibition. We note that the five speakers located in the southern-extent of the site (zoned Queenstown Town Centre) have been calibrated to comply with Rule 12.5.10.5 of the PDP as discussed above. Speaker calibration will be performed prior to any events with a continuous pink noise spectrum, with the microphone directly in front of the metre at the distance shown in figure 3.1. Each speaker will be calibrated individually and in the absence of other intrusive ambient noise sources to ensure accurate calibration.

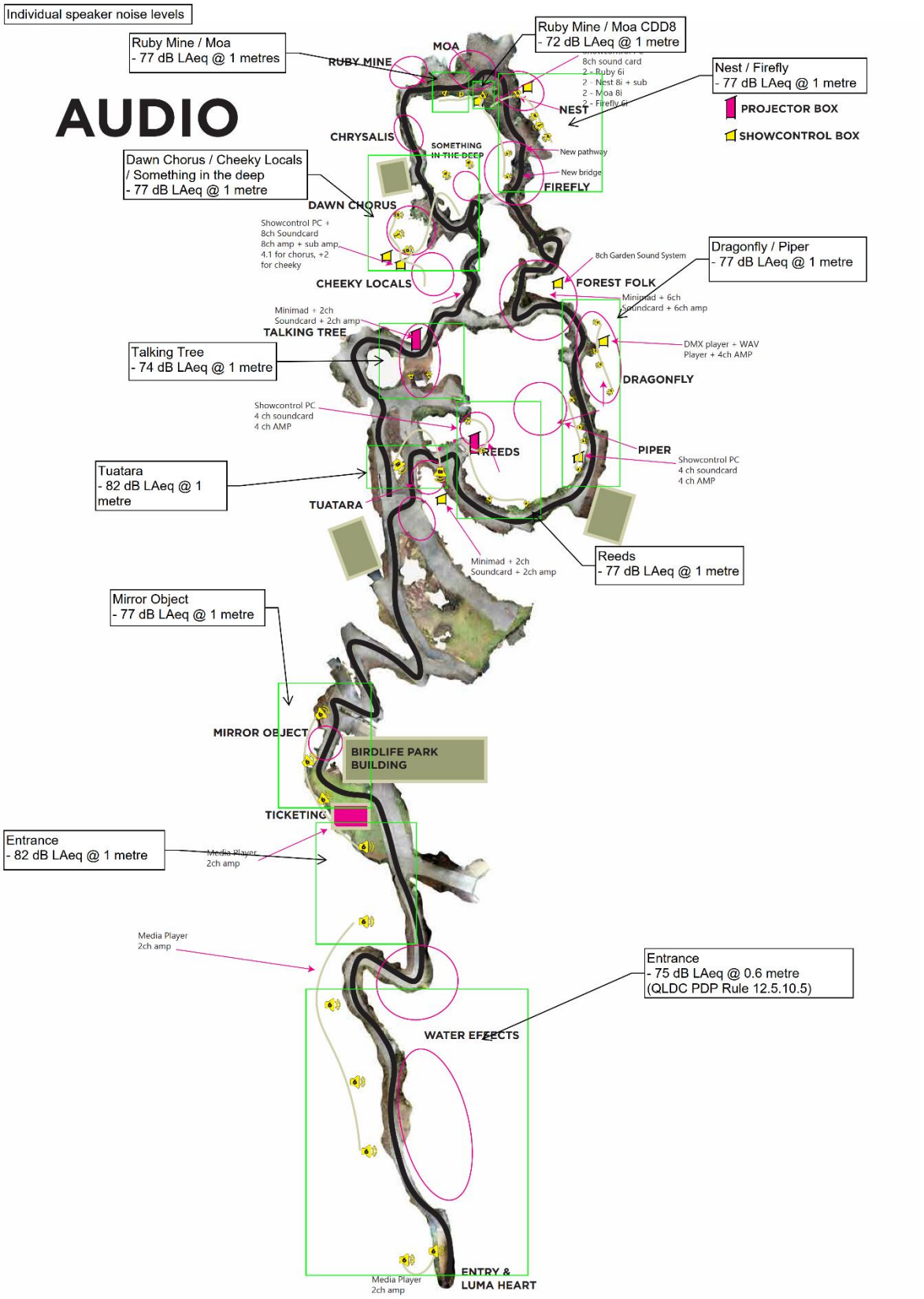

Figure 3.1 – Speaker noise limits

Noise from guests

We understand that guests will be encouraged to enjoy the experience in a 'quiet' manner. Nonetheless, in the absence of any controls we have modelled groups of 30 people at regular intervals along the trail at locations like 'Ruby Mine / Moa' and 'Dawn Chorus / Cheeky Locals', with half of these people continuously talking in a normal voice effort of 68 dB $L_{wA,}$ based on the American National Standards Institute Standard ANSI S3.5 – 1997 *Methods for calculation of the Speech Intelligibility Index*. We expect this to be conservative.

3.1 Typical operation

As the activity is expected to occur during the PDP night-time period (past 2000 hours), a duration adjustment is not applicable in accordance with NZS 6802:2008. As described above, the speakers will predominantly replicate natural sounds, like birds, insects and waterfalls. Any music played will be 'ethereal-sounding' as described above, in contrast to more conventional pop / rock styles. For these reasons we do not expect a +5 dB Special Characteristics Adjustment (SAC) penalty in accordance with NZS 6802:2008 to be applicable.

Based on the above operational scenario the following noise levels are expected.

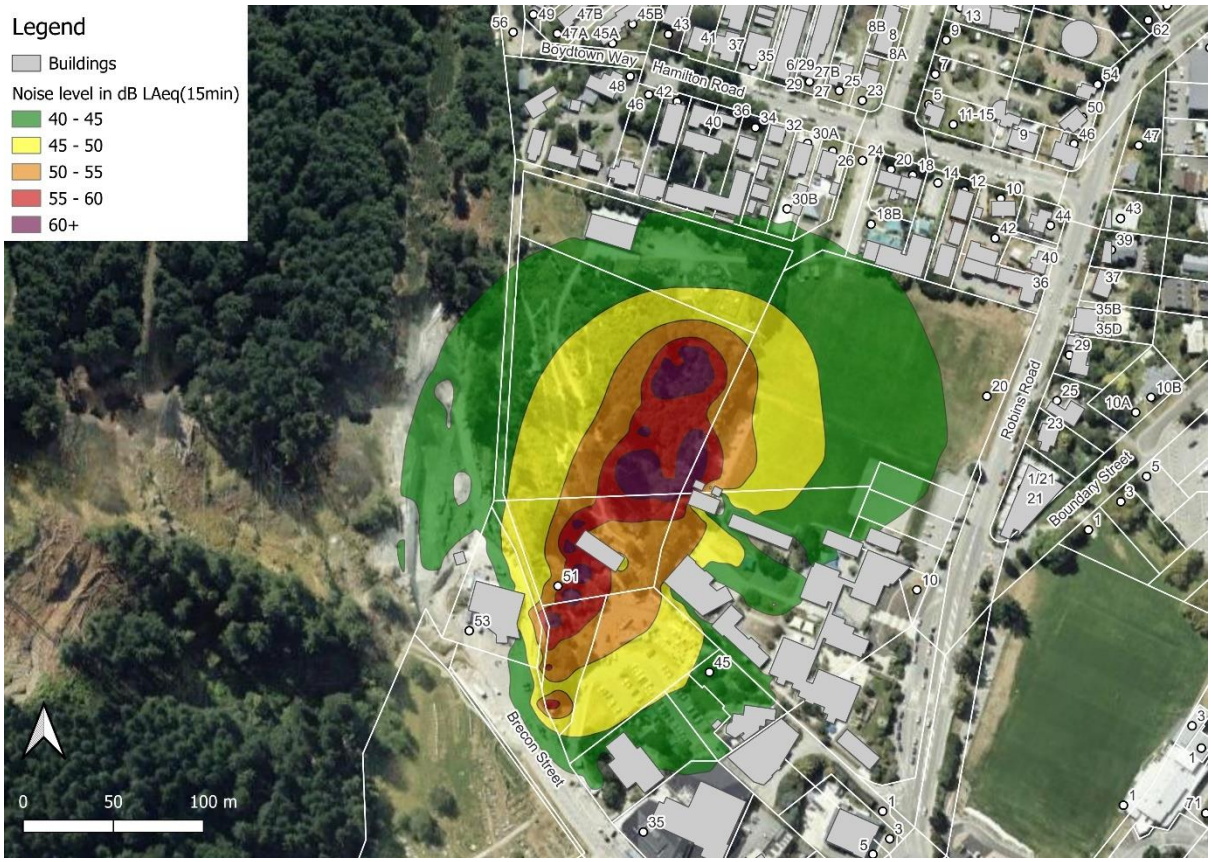

Figure 3.2 – Expected noise levels

Based on this analysis, we have the following comments:

- Compliance with both the RM020457 and PDP daytime and night-time noise limits is expected at residential sites across Robins Road (with 21 Robins Road receiving 40 dB L_{A10} / 37 dB $L_{Aeq(15min)}$), and we expect adverse noise effects to be minimal.

- Compliance with the PDP 40 dB $L_{Aeq(15min)}$ noise limits (daytime and night-time) are expected at the residential sites to the north (with 18, 26, 30B, 32, 34, and 36 Hamilton Road receiving up to 40 dB $L_{Aeq(15min)}$). There is a technical exceedance of the RM020457 40 dB L_{A10} noise limit of up to 3 dB which we expect to result in minimal adverse noise effects.

- Technical exceedances of the RM020457 (by 27 dB) and PDP (by 24 dB) night-time noise limits are expected at the boundary to 20 Robins Road (Queenstown Primary School). As discussed above this site is not expected to be noise sensitive during the proposed operating hours of 1700 – 2300 hours, and we expect adverse noise effects to be minimal.

- We expect the 5 dB technical exceedance of the PDP Town Centre 50 dB $L_{Aeq(15min)}$ night-time noise limit in the public carpark to the south of the site to result in minimal adverse effects given that this is not a noise sensitive site. Similarly, we expect the 15 dB technical exceedance of the PDP Open Space – Informal Recreation 40 dB $L_{Aeq(15min)}$ night-time noise limit at the boundary of 53 Brecon Street (Queenstown Skyline) to also result in minimal adverse noise effects.

Overall, we expect adverse noise effects associated with the proposed activity to be minimal.

4.0 CONCLUSION

Noise from all sources expected to be associated with the proposed night walk light show 'Enchanted Forest' at 51 Brecon Street, Queenstown, has been considered. The Applicant proposes to operate and temporarily install various light structures and soundscapes to tell the story of New Zealand's animals in a fun and surreal manner.

We have considered what noise levels may be appropriate for this activity, based on the historic RM020457 noise limits for the site, our review of the QLDC PDP noise provisions, WHO guidelines, and NZS 6802:2008. For residential sites, we expect that compliance with the slightly more stringent RM020457 noise limits will ensure adverse noise effects are minimal. However, we also expect a slight exceedance of the RM020457 noise limits (up to 3 dB) but compliance with the PDP noise limits to also result in minimal adverse noise effects. We expect technical exceedances at 20 Robins Road (Queenstown Primary School), the public carpark to the south, and 53 Brecon Street (Skyline Queenstown) to result in minimal adverse noise effects as these sites are not expected to be noise sensitive.

We have assessed noise associated with the activity including noise from the 40 Martin Audio CDD series speakers, including two SX-112 subwoofers. Our analysis indicates that the acoustic criteria is achieved, and we expect the activity to result in minimal noise effects on all receivers.

The following Conditions of Consent are proposed to ensure this is achieved:

- Noise levels of individual speakers will be calibrated to be no higher than the values shown in figure 3.1 prior to the event. Calibration will be done with a continuous pink noise spectrum, with the microphone directly in front of the metre at the distance shown in figure 3.1. Each speaker will be calibrated individually and in the absence of other intrusive ambient noise sources to ensure accurate calibration. Where applicable the narrower dispersion pattern in the horizontal plane will be used for the speakers.