MARSHALL DAY Acoustics

Level 4, 24 Garden Place
PO Box 19039
Hamilton 3244
T: +64 7 834 3022
www.marshallday.com

31 July 2025

Lodestone Energy Limited
Email: [redacted]

Attention: Daniel Cunningham

Dear Daniel

HALDON SOLAR FARM ACOUSTIC ADVICE

Piling noise is predicted to comfortably comply with the construction noise limits at the closest receivers. Piling noise received at Haldon Arm Campground will be noticeable, however, we understand that campers generally bring and use powered boats and jet skis out on the lake. These activities will characterise typical ambient noise levels during the daytime (when in use). We anticipate that noise from recreational use of these craft, particularly when operating around Haldon Boat Harbour, would likely be of a similar level to predicted piling noise.

Solar farm operation noise is predicted to readily comply with both the daytime and night-time limits. The solar farm may be audible at times outside a dwelling. Internal noise levels are likely to be very low and bordering on inaudible, particularly where windows are closed. No adverse effects will arise from the operation of the proposed solar farm.

INTRODUCTION

Lodestone Energy has engaged Marshall Day Acoustics to provide a high-level acoustic assessment for their proposed Haldon Solar Farm (the site). We have assessed these activities against the relevant provisions in the Mackenzie District Plan and supporting decision. This letter summarises the results of our modelling and subsequent assessment.

A glossary of technical acoustic terminology is contained in Attachment 1.

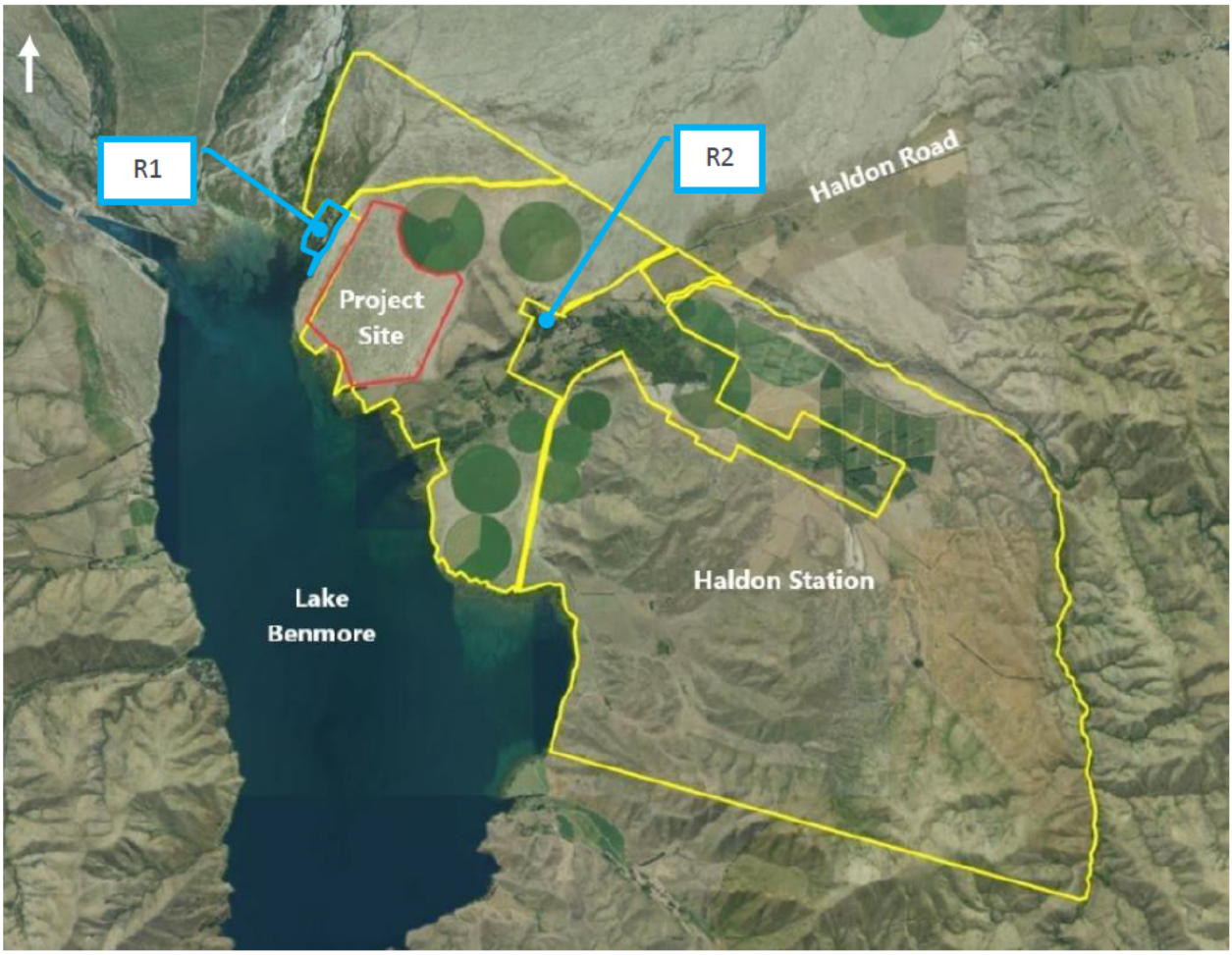
SITE LOCATION

The project site is within the Mackenzie District and wider Canterbury Region, approximately 15 km south-east of Twizel. It is located on a fluvioglacial outwash plain forming part of Haldon Station, which comprises some 22,000 ha of land, extending east from Te Ao Marama / Lake Benmore to the Kirkliston Range.

The project site is bounded to the north by a farm access road and centre pivot irrigation area. To the east lie the low hills known as Mount Maggie, beyond which are the Haldon Station School and a cluster of dwellings. The project site is accessed via Haldon Road. It is set back~ 200m from the southern and western edges of Te Ao Marama / Lake Benmore. An approximate 8 m high ridge blocks line-of-sight to the eastern boundary of Haldon Arm Campground (the closest potentially noise sensitive receiver).

Figure 1 shows the project site and closest receivers (R2 – Haldon Station School and surrounding dwellings) and (R1 – Haldon Arm Campground).

Figure 1: Project site and closest noise-sensitive receiver locations



NOISE PERFORMANCE STANDARDS

Plan Change 29 proposed changes to the noise provisions contained in the operative MDP. A decision on Appendix 1 NOISE was handed down by the hearings panel on 24 July 2025, with the updated noise provisions given legal weight thereafter. Our assessment uses the relevant provisions contained in the decisions report.

Construction noise

NOISE-R6 contained in Appendix 1 NOISE stipulates that construction activity in any zone must be measured and assessed in accordance with NZS 6803:1999 "Acoustics – Construction Noise" and must comply with the limits in that standard. As the project's construction is expected to span approximately 14 to 18 months, the applicable 'long-term' duration noise limits for daytime works are 70 dB L_{Aeq} / 85 dB L_{AFmax}.

These limits apply to construction activities undertaken between 7:30 am and 6:00 pm Monday to Saturday, in accordance with the standard.

Operation noise

NOISE-TABLE 1 sets out the relevant limits for operation noise received in the General Rural Zone (GRUZ) as measured at any point within the notional boundary of any noise sensitive activity in this zone. The relevant noise limits are summarised in Table 1.

Table 1: Operation noise performance standards

Time period (any day)	dB $L_{Aeq(15min)}$	L_{AFmax}
7am to 10pm	55	-
10pm to 7am	45	70

Noise levels arising from activities shall be measured in accordance with NZS 6801:2008 Acoustics - Measurement of Environmental Sound and assessed in accordance with NZS 6802:2008 Acoustics - Environmental Noise.

NOISE ASSESSMENT

Construction noise

Based on detailed measurements of piling undertaken at a comparable solar farm project, we have predicted noise levels at the identified receiver locations.

We have assumed that the worksite would be divided into approximately 300 x 300 metre 'grids' with two piling teams operating within each grid. We understand that up to 10 piling rigs are anticipated to operate concurrently. Of the total anticipated construction period of 14 to 18 months we understand that piling will occur for approximately six months.

A sound power level of 127 dB L_{WA} per piling rig has been used. We have modelled two scenarios based on piling occurring near the western and eastern project site boundaries respectively. The respective scenarios place piling as close as practicably possible to the relevant receiver therefore can be considered worst-case. For the majority of piling, noise levels lower than predicted in Table 2 will occur.

Table 2: Solar farm piling noise levels at closest receivers

Approx. Distance	Receiver[1]	Predicted Noise Levels	
		70 dB L_{Aeq} Limit	85 dB L_{AFmax} Limit
300 m	R1 - Haldon Arm Campground	61	63
1,000 m	R2 - Haldon Station School and surrounding dwellings	41	42

Table notes:

(1) Refer to Figure 1 for receiver locations
(2) Refer to Figures 2 and 3 in Attachment 3 for noise contours

Operation noise

We have predicted solar farm operation noise using ISO 9613-2:1996. The following noise sources have been modelled, based on the layout in Attachment 2.

Table 3: Modelled solar farm noise sources

Item	Quantity	Sound power level (dB L_{WA})	Daytime max power output (%)	Night-time max power output (%)
Inverter[1]	49	97	100	85
BESS	98	80[2]	36	36
DC to DC converter	147	83	100	100

Table notes:

(1) Inverter includes +5dB special audible characteristic adjustment
(2) As advised by Lodestone via email dated 25.07.2025

The results of our noise modelling are given in Table 4.

Table 4: Solar farm operation noise

Rec. no.	Address	Project Noise Limits Day/Night	Predicted Rating Level (dB L_R)[2]		Complies?
		(dB L_{Aeq})	Daytime	Night-time	
R1	Haldon Arm Campground	50/40	33	29	☑
R2	Haldon Station School and surrounding dwellings	50/40	21	<20	☑

Table notes:

(1) Refer to Figure 1 for receiver locations
(2) Refer to Figures 4 and 5 in Attachment 3 for noise contours

CONCLUSIONS AND RECOMMENDATIONS

Construction noise

Our modelling of piling noise indicates comfortable compliance with Rule NOISE-R6 contained in Appendix 1 NOISE of the decisions report.

We understand that campers using Haldon Arm Campground typically bring powered boats and jet skis to use out on the lake. These activities will characterise typical ambient noise levels during the daytime (when in use). We anticipate that noise from recreational use of these craft, particularly when operating around Haldon Boat Harbour, would be of a similar level to piling noise. Solar farm operation noise on the other hand would be appreciably lower, as discussed in the following section.

To practicably reduce construction noise the Project may wish to explore the staging of piling works e.g., splitting the piling crews up across the site could reduce noise levels by ~3-5 dB.

Operation noise

Our modelling of operation noise indicates that the solar farm will readily comply with both the daytime and night-time limits in NOISE-Table 1 of Appendix 1 of the decisions report. The solar farm may be audible at times outside a dwelling. Internal noise levels are likely to be very low and bordering on inaudible, particularly where windows are closed.

We anticipate that no adverse effects will arise from the operation of the proposed solar farm.

We trust this information is satisfactory. Please contact us if you have any further questions.

Yours faithfully

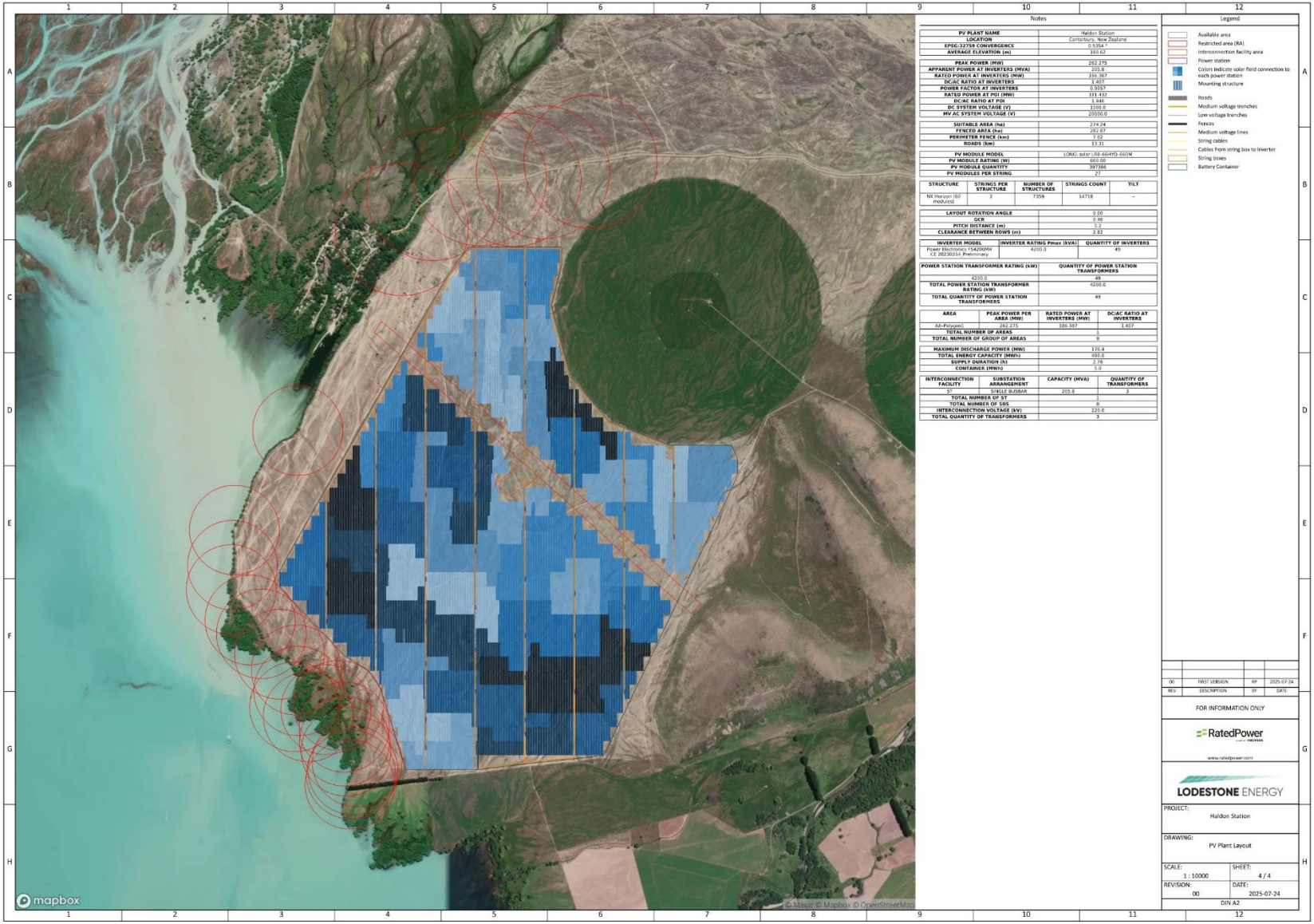
MARSHALL DAY ACOUSTICS LIMITED

Mathew Cottle
Associate

ATTACHMENT 1 GLOSSARY OF TERMINOLOGY

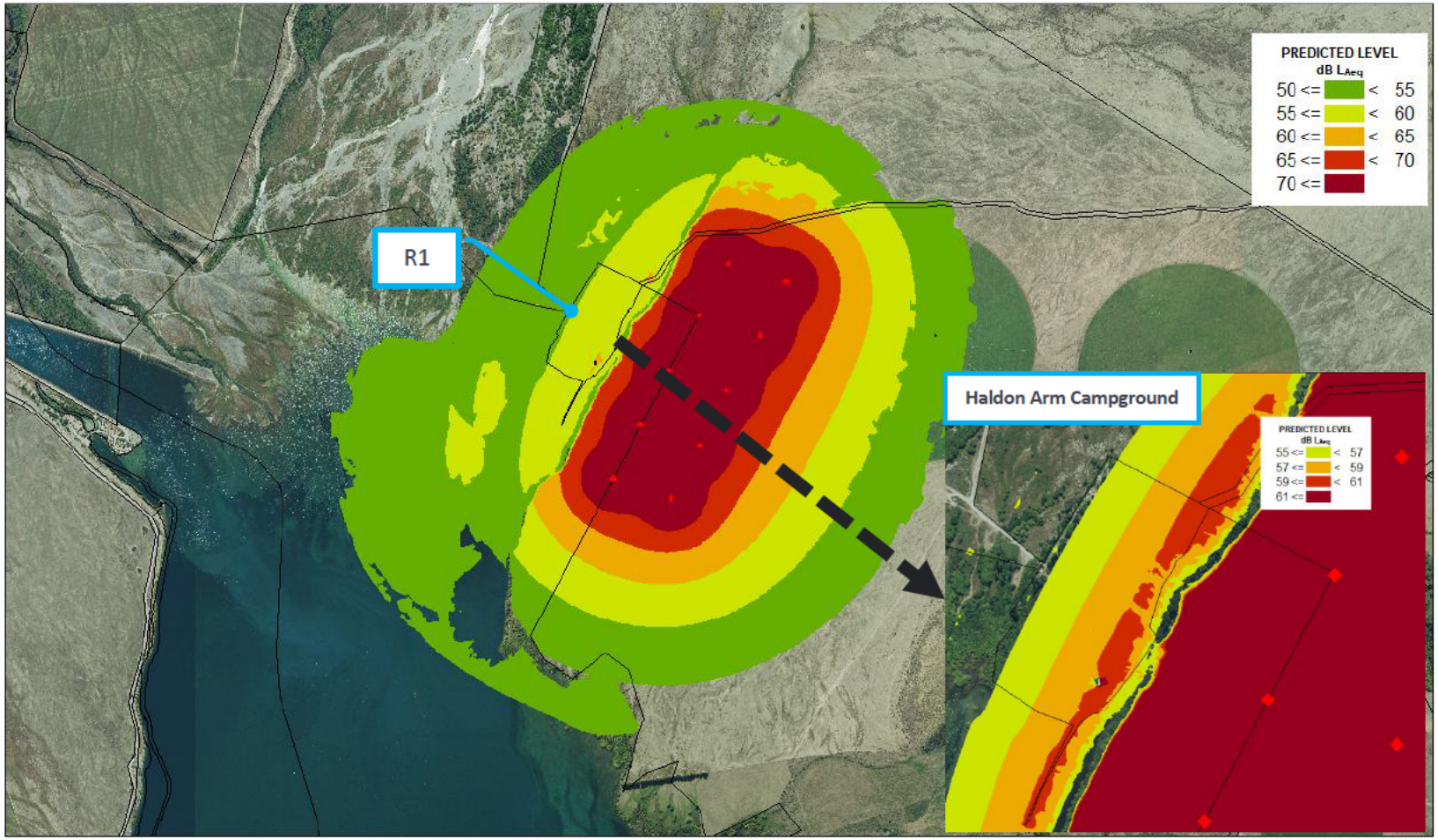
A-weighting	The process by which noise levels are corrected to account for the non-linear frequency response of the human ear.
dB	Decibel The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of Pr=20 μPa i.e. dB = 20 x log(P/Pr)
dBA	The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to closely approximate the frequency bias of the human ear.
$L_{Aeq\ (t)}$	The equivalent continuous (time-averaged) A-weighted sound level. This is commonly referred to as the average noise level. The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) will represent a period of 8 hours, (15 min) will represent a period of 15 minutes and (2200-0700) will represent a measurement time between 10 pm and 7 am.
L_{Amax}	The A-weighted maximum noise level. The highest noise level which occurs during the measurement period.
NZS 6801:2008	New Zealand Standard NZS 6801:2008 *Acoustics – Measurement of environmental sound*
NZS 6802:2008	New Zealand Standard NZS 6802:2008 *Acoustics - Environmental Noise*
NZS 6803:1999	New Zealand Standard NZS 6803: 1999 *Acoustics - Construction Noise*
Special audible characteristics	Distinctive characteristics of a sound that make it more likely to cause annoyance or disturbance. A penalty of up to 5 decibels can be applied when assessing sounds with SAC Examples are tonality – a hum or a whine) and impulsiveness – bangs or thumps.
SWL or L_W	Sound Power Level A logarithmic ratio of the acoustic power output of a source relative to 10^{-12} watts and expressed in decibels. Sound power level is calculated from measured sound pressure levels and represents the level of total sound power radiated by a sound source.

ATTACHMENT 2 PROPOSED SITE LAYOUT



ATTACHMENT 3 PREDICTED NOISE CONTOURS

Figure 2: Predicted noise levels from piling rig operations on western side



LEGEND
- Piling rig
- Line

Version: SoundPLAN 9.1	Project: Haldon Solar Farm Piling Noise Advice
Prediction method: 9613 2:1996	Project number: 20250640
Model number: SP 01	Client name: Lodestone Energy Limited
Run No & Title: 4/GNM S1 Western Piling rig ac	
File: Western piling activity	
Prediction Height: 1.5 m	

SCALE
0 100200 400 600 800 m

N

Piling rigs at western side
Predicted noise contours

MARSHALL DAY Acoustics

Figure 3: Predicted noise levels from piling rig operations on eastern side

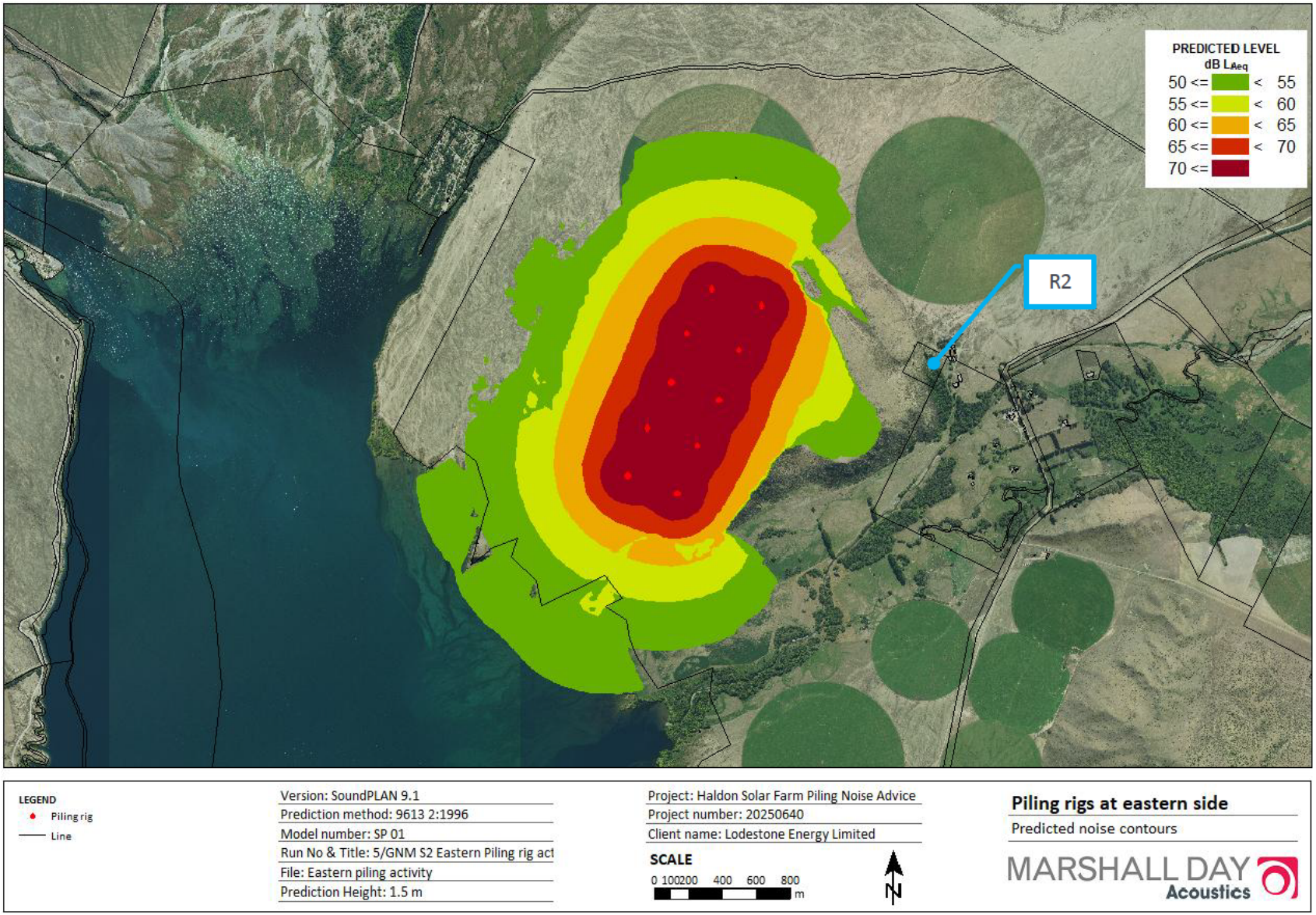


Figure 4: Daytime rating noise level contours

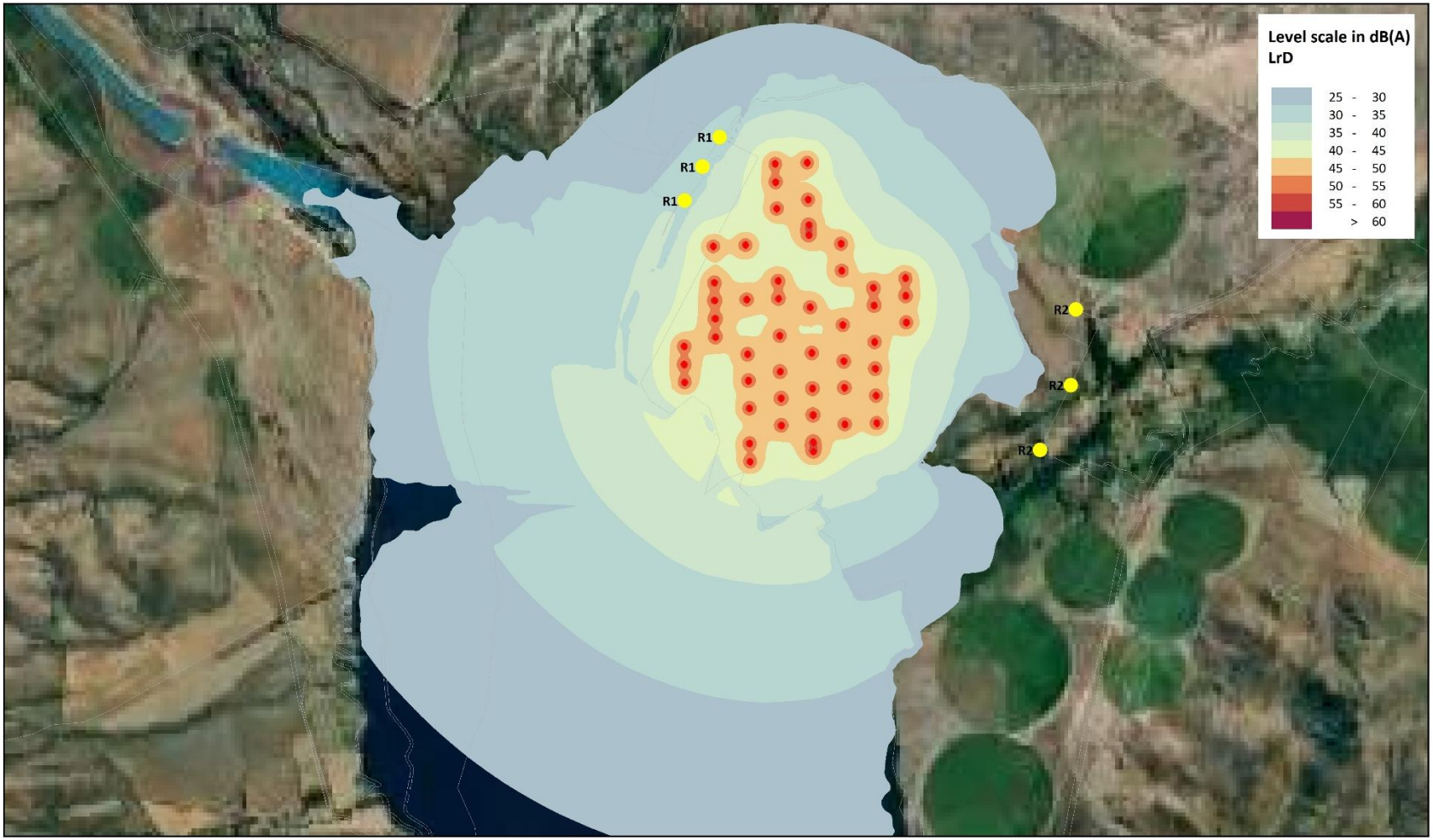


Figure 5: Night-time rating noise level contours