

**BEFORE THE INDEPENDENT COMMISSIONER
OF CENTRAL OTAGO DISTRICT COUNCIL**

IN THE MATTER of the Resource Management Act 1991 ("**RMA**")

AND

IN THE MATTER of an application for resource consent by Helios OTA
OP LP ("**Helios**") to construct, operate and maintain a
photovoltaic solar farm and associated infrastructure
including a substation and transmission line
infrastructure for renewable electricity generation at
48 Ranfurly-Naseby Road, Naseby ("**Project**")

**STATEMENT OF EVIDENCE OF PETER ALEXANDER IBBOTSON
ON BEHALF OF HELIOS**

21 JULY 2025

1. EXECUTIVE SUMMARY

- 1.1 My evidence provides an overview of the noise generating aspects of the Project, including an assessment of the noise following removal of the Battery Energy Storage System ("**BESS**") component of the Project.
- 1.2 The result of my Assessment of Noise Effects dated 17 October 2023 ("**Assessment**") shows that noise levels from the solar farm will be very low at all surrounding dwellings. The loudest rating¹ noise levels at the compliance receivers over the daytime would be 11 to 26 dB L_{A10} during peak operation. This would comply with the Central Otago District Plan ("**District Plan**") daytime noise rule of 55 dB L_{A10} by a significant margin (of at least 29 decibels). The daytime rating noise levels from the solar farm would be much lower than the existing ambient (L_{A10}) noise levels that I measured around the solar farm during my noise survey. The loudest possible level of solar farm noise emission may be similar to the existing background (L_{A90}) noise levels in the area during still daytime conditions. Operational solar farm noise levels within the Naseby and Ranfurly townships will be entirely negligible.
- 1.3 Construction will occur over a period of 24 months. The loudest construction activity will be piling to support solar panel arrays. The closest dwellings are approximately 500 metres from the closest part of the solar farm array. Construction noise levels at these dwellings will be in the order of 50 dB L_{Aeq} during piling. Compliance with the NZS6803:1999 guideline of 75 dB L_{Aeq} will be achieved by a margin of approximately 25 decibels, and thus the District Plan noise limit will be readily complied with. Noise from the closest piling areas to the nearest dwellings will be audible at these dwellings, but noise will be at reasonable levels. When piling is occurring at areas of the site more distant from these dwellings, the noise level will be lower. Construction noise levels within the townships of Naseby and Ranfurly will be negligible.
- 1.4 Several submissions reference noise. Many submissions have been received from those living in Ranfurly (and other locations at greater distances) who have raised concerns about transformer noise. I have calculated noise from the transformers using appropriate engineering principles.² I consider that the submitters can have certainty that they will not be affected by transformer noise due to the significant distances between the proposed substation and

¹ Rating level established using method outlined in NZS6802:2008 based on L_{A10} parameters.

² For example International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation and AS/NZS 60076.10:2009 Power Transformers Determination of Sound Levels.

dwellings, and the low overall transformer noise levels. I have responded to other submission points in this evidence.

- 1.5 The conclusions of the Council's Section 42A Hearing Report ("**Section 42A Report**") that the proposed activity should be granted consent subject to appropriate conditions aligns with my view. I have addressed matters raised in the Section 42A Report such as transformer noise levels and the need for acoustic barriers (which are not required). Mr Vincent and I differ in our views as to the appropriate construction noise limit to apply (Long-Term vs Typical), however as the Project will comply with either of these by a significant margin, I do not consider that this is a determinative point.
- 1.6 I have reviewed Council's proposed consent conditions. Given the margin by which construction noise is predicted to comply I do not consider there is utility to a construction noise and vibration management plan being prepared at this time. Similarly, ongoing noise monitoring for construction noise does not seem warranted to me. Should the Panel consider monitoring during construction is warranted, in my view this should be restricted to an initial period to demonstrate that compliance is and can be achieved as expected, rather than ongoing monitoring to no point. I consider the version of the proposed conditions of consent appended to Ms Banhidi's evidence are appropriate for controlling potential acoustic effects from the construction and operation of the Project to reasonable levels.
- 1.7 Overall, the Project would result in low operational daytime noise emissions and will operate at a level of noise that is considerably below any recognised national or international environmental noise guideline for the protection of human health or amenity. Under standard operating conditions the Project will not make noise at night. Construction noise due to piling will be audible at surrounding dwellings at times, but noise will be considerably below recognised construction noise guidelines. I expect construction vibration to be imperceptible at dwellings.

2. INTRODUCTION

- 2.1 My full name is Peter Alexander Ibbotson. I am an acoustic consultant at Marshall Day Acoustics ("**MDA**"). I hold a Bachelor of Mechanical Engineering with Honours from the University of Auckland.
- 2.2 I have been engaged in the field of acoustics for 23 years. I have been employed with MDA for the past 20 years. I am a shareholder of the company with responsibility for our Northland operations. MDA is a leading international

acoustical consultancy with offices in New Zealand, Australia, China, and France.

- 2.3 I have been involved in many environmental sound assessment projects in New Zealand, Australia and the South Pacific. I have appeared as an expert and presented expert evidence in New Zealand at council resource consent hearings and Environment Court hearings, and in Supreme Court hearings overseas.
- 2.4 I have been involved in around 30 solar farm or grid scale BESS projects within New Zealand over the past six years. My work on these projects has involved the detailed assessment of noise emissions, reporting and the management of other MDA staff involved on these projects. I also have experience in noise emissions from other energy power generation projects (mainly geothermal and gas), electricity distribution projects (mainly substations and transmission lines), as well as a very broad range of experience in assessing environmental noise from other industrial, transportation and construction projects within New Zealand.

Involvement in the Project

- 2.5 I have been engaged by the Applicant since June 2023 to provide advice on this project (including the Assessment) and provide evidence for this hearing. I visited the site and surrounds and have carried out noise measurements between 18 and 20 July 2023. I reviewed all information relevant to noise submitted with the application for resource consent to Central Otago District Council ("**Council**").

Code of conduct

- 2.6 I confirm that I have read the Expert Witness Code of Conduct set out in the Environment Court's Practice Note 2023. I have complied with the Code of Conduct in preparing this evidence and will continue to comply with it while giving oral evidence before the Hearing Commissioners. Except where I state that I am relying on the evidence of another person, this written evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in this evidence.

3. SCOPE

- 3.1 This evidence is given in respect of the resource consent application by Helios for the proposed new solar farm at 48 Ranfurly-Naseby Road, Naseby ("**Site**").

3.2 In my evidence I will:

- (a) describe the existing noise environment including potentially noise sensitive receivers;
- (b) summarise the relevant acoustic performance standards contained in the operative District Plan;
- (c) provide an overview of the application from an acoustic perspective;
- (d) summarise my Assessment of construction noise and vibration effects;
- (e) summarise my Assessment of operational noise effects;
- (f) respond to acoustic matters raised in submissions;
- (g) respond to matters in the Section 42A Report relating to acoustics; and
- (h) comment on the proposed conditions of consent, including any changes to those conditions that I recommend.

4. OVERVIEW OF THE PROJECT

- 4.1 Helios proposes to construct and operate a 300 MWac solar farm on a 665-hectare property located between Naseby and Ranfurly.
- 4.2 The original application involved solar panels, inverters and a BESS system near the proposed on-site substation.
- 4.3 Subsequent to the lodgement of the application, Helios has formally removed the BESS aspect of the application. The removal of the BESS takes away a significant potential noise source from the proposed Project and in particular, the only significant source of typical night-time noise.³
- 4.4 The revised application⁴ acknowledged that the expert assessments (including mine) were not revised, as the impact of removing the BESS from the application would only be positive from an acoustic perspective. My Assessment was included in the application with a note that any consequential

³ Sources of night-time noise on a solar farm would include power generation if the sunrises before 7am (during the longest days of summer) and any inverter fan cooling required if VAR control occurs at night (typically low loads).

⁴ Dated 16 June 2025.

changes to my Assessment would be addressed in my evidence. I provide this additional information in this evidence.

4.5 The key parts of the solar farm operation in relation to noise are now:

- (a) **73 inverters**⁵ – the inverters are broadly laid out in seven rows east-west across the Site.⁶ Inverters can be directional (emitting more noise in certain directions, typically from the ventilation discharge louvre). Noise from inverters comprises fan noise (a broadband or "white" source of noise) as well as some tonal noise from the inverter switching. The inverters are not a "loud" plant item, but they do generate some noise during periods of peak solar load.
- (b) **The single axis tracking solar panel arrays** – these are shown distributed broadly across the Site. The solar panels themselves do not emit noise⁷ however they are mounted on tracking systems that include small DC motors. These DC motors operate intermittently for short periods to change the orientation of the panels incrementally as the sun moves across the sky. Each DC motor emits very little noise.
- (c) **The transformers at the substation** – transformers do emit some noise when under load, however they are generally low sources of noise. I allowed for two large high voltage transformers (with cooling fans) in my assessment.⁸ The substation for this Project is located within the central west position of the Site, well away from dwellings.

4.6 The Project would only generate electricity during daylight hours and thus predominantly during the District Plan prescribed daytime period (7:00am to 10:00pm).⁹ In summer, electricity generation (and therefore some noise) could occur prior to 7:00am.¹⁰ However, there is very little solar gain in the early morning and ambient temperatures are lower, meaning that only low fan rates

⁵ An inverter turns Direct Current (DC) created by the photovoltaic cells into Alternating Current (AC), used in the electricity grid (and vice versa).

⁶ Refer to Appendix 2 of the Helios Application (Site Layout Plan), subsequently amended in the document "240065 Amended Appendix 2A Solar Farm Layout Received 20250616.pdf".

⁷ There is no active noise from electricity flow from the panel, nor is there any passive noise from wind (no aeolian tones), creaking (due to thermal expansion) or any other sources of noise from the panels.

⁸ The sound power level used in my assessment (90 dB L_{WA} per transformer) is a suitable engineering assumption for a modern well-constructed transformer at up to 200 MVA (which is appreciably larger than what will be required for this site).

⁹ Section 4, Rule 4.7.6E(a) of the District Plan provides permitted activity noise standards for the *Rural Resources* zone. The statutory daytime is 7:00am to 10:00pm and the statutory night-time is 10:00pm to 7:00am.

¹⁰ This is because sunrise occurs prior to 7:00am in the summer months. Note that inverters may sometimes operate at low loads at night for grid VAR control purposes.

would be expected to be required for inverter cooling (if fans are required at all). In my experience the inverters will generate lower levels of noise during the early morning than they do later in the day when the solar farm is generating electricity.¹¹

5. EXISTING NOISE ENVIRONMENT

- 5.1 I carried out a comprehensive noise survey at the site in July 2023. This involved noise logging over three days on the western boundary of the Site. I also carried out attended noise measurements at a range of locations around the Site over a period of three days and nights. These noise measurements are summarised in Section 4.0 of my Assessment.
- 5.2 My logger data shows that average daytime noise levels are fairly typical of a rural area that receives some traffic (between 44 to 48 dB LA10). Average background noise levels are low (29 to 33 dB LA90), indicating that there are periods of quiet during the daytime where there is little noise (e.g. during gaps between vehicle pass bys, low insect activity, and calm wind conditions). Background noise levels during the daytime are relatively low compared to my general experience in some other rural areas in New Zealand. Lower daytime noise levels typically occur where there are few birds, insects, vegetation or road/air traffic.
- 5.3 My logger measurements did not show a significant diurnal variation in noise. This is likely due to the wind conditions that occurred at night. During calmer conditions, night-time ambient noise levels fell to an average of 38 dB LA10, and background noise levels fell to 31 dB LA90, which is still a low level of environmental noise. I expect that during very still conditions at night noise levels could fall to below 30 dB LA10 and 25 dB LA90.
- 5.4 Overall, my measurements show that the Site and surrounding area is one that is relatively quiet, as would be expected for a rural area far from busy highways and industry. Ambient noise levels will vary from day-to-day and season to season, based on both weather patterns and localised seasonal activities.

¹¹ Inverter fans are only required to keep the inverters cool. Heat is only generated in the inverters when there is load (such as when there is sunshine and the solar farm is generating power). The inverter fans typically have fan speed settings, and fans will turn on and increase in speed as there is increasing load on the inverters (and when ambient temperatures increase requiring more airflow). As well as fan noise, there is also noise from the inverter switching noise – in my experience this is not generated until the sun is well above the horizon in summer.

6. NOISE PERFORMANCE STANDARDS AND LEGISLATION

- 6.1 The Site is subject to the operative District Plan, which identifies zoning and noise assessment standards for the Site. The Site is situated on land zoned *Rural Resources*. Adjacent land parcels are also zoned *Rural Resources*.

Operational Noise

- 6.2 Section 4, Rule 4.7.6E(a) of the District Plan provides permitted activity noise standards for the *Rural Resources* zone. The noise rules are set out in my Assessment at section 5.2. The relevant noise rules are:

E. Noise

- (a) *All activities shall be conducted so as to ensure the following noise limits are not exceeded at any point within the notional boundary of any dwelling, rest home or hospital, or at any point within any Residential Resource Area or any Rural Settlements Resource Area:*

<i>On any day 7:00am to 10:00pm</i>		<i>55 dBA L₁₀</i>	
<i>10:00pm to 7:00am the following day</i>	<i>40</i>	<i>dBA</i>	<i>L₁₀</i>
		<i>70 dBA L_{AFmax}</i>	

Provided that the above noise limits shall not apply to:

- any temporary activity (as defined)*
- devices used to protect crops from birds or frost (see (b)-(c) below)*
- sirens associated with emergency service activities. 4.7.6E(a)*
(cont'd)

"Notional boundary" is defined as a line 20 metres from part of any living accommodation or the legal boundary where this is closer to the living accommodation.

- 6.3 The District Plan sets out the assessment measures for noise in 12.7.4. In my Assessment, I discussed that these provisions relate to older versions (1991) of the New Zealand acoustic assessment standards which have since been superseded by the 2008 versions. I recommend that the 2008 versions be used for the assessment of noise for the Project. The application of the more recent versions of the assessment standards results in a more logical assessment protocol that is also consistent with National Planning Standards.¹² The use of these more modern standards would not result in a more permissive outcome for the residents, or the environment.

Construction Noise

- 6.4 Section 12.7.4 (ii) of the District Plan states that any construction work activity must be measured and assessed in accordance with the requirements of New Zealand Standard *NZS 6803P:1984 The Measurement and Assessment of Noise from Construction, Maintenance, and Demolition Work*. This is also a superseded noise standard that has been replaced with New Zealand Standard *NZS 6803: 1999 Acoustics - Construction Noise*. I recommend any consent conditions should refer to the modern version of the standard. Both standards provide similar noise limits. Based on section c7.2.1 of NZS 6803:1999, the appropriate NZS 6803 construction noise limit is 75 dB L_{Aeq}.¹³

7. ASSESSMENT OF OPERATIONAL NOISE LEVELS

Solar Generation Noise Levels

- 7.1 I prepared a detailed noise model to calculate noise from the proposed Project (including the BESS that was previously included in the design). The noise model was based on the data set out in Section 6.1 of my Assessment.
- 7.2 Even with the BESS installed (which is no longer proposed) my calculations as outlined in my Report showed that the Project readily complied with the night-time noise limit, with a significant margin of compliance.¹⁴
- 7.3 I have revised the noise model to remove the BESS operation. This has resulted in further reductions to noise levels overall. The results are shown in the following table.

¹³ I understand the processing planner is of the view that the "long term duration" construction noise rules are appropriate for this solar farm construction. This is not a view I share. Section 7.2.1 and C7.2.1 of NZS6803:1999 makes it clear that the "typical duration" limits are suitable for a mobile construction activity such as this, and this approach has been accepted on other solar farm project consents. For this application it is somewhat immaterial which construction noise limits are applied as the construction activity will readily apply with either, nonetheless I consider that the typical duration noise limits should be used as this is the correct way to apply them.

¹⁴ I note that since my assessment was prepared in 2023, BESS technology has continued to improve. Based on my knowledge of how modern systems operate in NZ, my expectation is that the noise level from the solar farm with BESS would have been even lower than indicated in the "typical scenario".

Receiver Location	Noise Limits [daytime / night] (dB L _{A10})	Calculated Rating Noise Level (dB L _{A10} / L _R) ¹⁵	
		Solar Farm Operation	
		Day	Night (before 7am during longest days of year or for VAR)
512 Ranfurly-Naseby Road, Naseby	55 / 40	26	22
581 Ranfurly-Naseby Road, Naseby	55 / 40	20	16
885 Ranfurly Back Road, Naseby	55 / 40	20	16
873 Ranfurly Back Road Naseby	55 / 40	22	18
788 Ranfurly Back Road, Naseby	55 / 40	27	22
366 Ranfurly Back Road, Ranfurly	55 / 40	23	17
5 Bypass Road, Ranfurly	55 / 40	18	12
305 Bypass Road Ranfurly	55 / 40	11	5
Other areas			
48 Ranfurly-Naseby Road, Ranfurly (Landowner leasing to Helios)	55 / 40	29	23
Mānīatoto Golf Club	-	22	18
Naseby Township	55 / 40	9	5
Ranfurly Township	55 / 40	<0	<0

7.4 The results show:

- (a) Loudest rating noise levels at the compliance receivers over the daytime would be 11 to 27 dB L_{A10} during peak Project operation. This is a very low level of noise which would comply with the District Plan daytime noise rule (55 dB L_{A10}) by a margin of at least 28 decibels. This is a significant margin of compliance.
- (b) The daytime rating noise levels from the Project would be much lower than the existing ambient noise levels I measured near the proposed Site during my noise survey. The loudest possible level of solar farm emission at the closest dwellings may be similar to the existing background noise levels during still, daytime conditions.

¹⁵

The "rating" noise level in this context is the L_{A10} noise level (as per the District Plan noise limits), but with Special Audible Character and Duration Correction corrections applied to the L_{A10} level as per the NZS6802:2008 standard. Refer to Section 5 of the Assessment of Noise Effects report for a discussion of the version standards in the District Plan and how they have been applied to this Project.

- (c) The Project would not operate overnight, although it may be possible that some minimal solar gain could be received before 7am during the longest days of summer, and inverter fans may consequentially operate (likely at the lowest speed, if required at all). A low level of fan speed may also be required at times for grid VAR control. During these times, noise levels will be between 5 to 22 dB L_{A10} at the compliance receivers – this will readily comply with the District Plan night-time noise limits by a margin of at least 18 decibels.

Operational Traffic

- 7.5 Operational solar farms generate very few traffic movements per day. I understand the main Site accesses will be via Ranfurly-Naseby Road at the mid-point of the Site.¹⁶ Noise from traffic movements within the Site will generate negligible noise. All roads surrounding the application site are public roads. District Plan noise rules do not apply to traffic on public roads.

8. ASSESSMENT OF CONSTRUCTION NOISE AND VIBRATION LEVELS

- 8.1 The appropriate NZS 6803 construction noise limit is 75 dB L_{Aeq} .
- 8.2 The primary noise source of a solar farm construction is the use of a pile driver¹⁷ to install the piles to support the solar array tracking system. I have been to a solar farm construction site to observe this piling activity and have measured noise emissions from it. Solar farm pile driving activity uses a rig similar in size to a small excavator. Piling involves a short period of set up (perhaps five minutes), followed by a brief period of piling noise as the pile is "pushed" into the ground by the piling head. Piling activity progresses quickly over the Site and the piling rig is not in any one area for long. Piling works will be audible in the vicinity of the Site area when the rig is actively driving the pile.
- 8.3 The closest dwelling is around 500 metres from the closest part of the solar farm array.¹⁸ I am confident that the relevant noise limit of 75 dB L_{Aeq} can be met for this dwelling, likely by a margin of at least 25 decibels.

¹⁶ There are two access points central on Ranfurly-Naseby Road and there is a secondary access for maintenance on Ranfurly Back Road which would be expected to have some traffic but not be the main access point. Regardless of what access point is used, noise from traffic within the site will generate negligible noise.

¹⁷ For the purposes of the Assessment of Noise Effects a Vermeer PD10 (type) Pile Driver has been assumed as it is common across solar construction projects in New Zealand and is indicative of standard piling equipment.

¹⁸ The closest dwellings are 512 Ranfurly-Naseby Road (to the north) and 366 Ranfurly Back Road (to the south-east). These appear to be around 500 metres from the closest array piling positions.

- 8.4 Furthermore, I expect that even when a piling rig is at the closest extent of the piling works to a neighbouring dwelling (relevant to the northern corner and the south-eastern corner of the Site), that noise levels will typically be lower than the District Plan zone standard (55 dB LA10). This noise limit does not apply to construction works, however, I have nonetheless provided this as a comparison to put the noise from the construction in context with what is permitted in the District Plan.
- 8.5 I expect vibration from piling to be imperceptible at the distances between the piling works and the few neighbouring dwellings. Vibration will readily comply with suitable construction vibration standards.¹⁹

9. OVERALL NOISE AND VIBRATION EFFECTS

- 9.1 The Project would result in low operational daytime noise emissions and will operate at a level of noise that is considerably below any recognised national or international environmental noise guideline for the protection of human health or amenity.
- 9.2 Construction noise may be audible at times, but noise will be considerably below recognised construction noise guidelines. Construction vibration effects will be insignificant.

10. RESPONSE TO SUBMISSIONS

- 10.1 I have read the submissions lodged on the Project that relate to acoustic matters. There are shared concerns in several of the submissions, and I address these concerns thematically in the following paragraphs.²⁰

Construction noise, quantity of piles, duration of construction noise²¹

- 10.2 These submissions question the number of piles required. The number of piles required per solar table will vary with the design ground conditions and solar table design, though often there may be seven piles per solar table (totalling around 70,000 piles). Solar farm construction teams will often average 120 piles per day (per pile driver) although in ideal, flat conditions it could be up to

¹⁹ German Standard DIN 4150:2016 *Vibrations in buildings Part 3: Effects on structures*.

²⁰ Where a submitter simply states that "noise" is of concern, I have not made a specific response.

²¹ Refer: 05 Submission – Ngaire Barton [Ranfurly], 024 Submission - Jenny Grimmett [Ida Valley Back Road], 038 Submission - Wendy Kearney [Ranfurly], 057 Submission - Inez Baxter [Ranfurly], 058 Submission – Gavin James Crossan [366 Ranfurly Back Road], 060 Submission - Karen Munro [Ranfurly], 074 Submission - Kristina Wills [Stafford Street, Ranfurly], 081 Submission - Eric Swinbourn [Naseby], 128 Submission – Healey [Dunedin], 135/136 Submission - The Real Dog Equipment Company Ltd / Rose and Nigel Voice [Bypass Road].

200 piles per day. While subject to specific ground conditions, each pile driver may work for approximately 30 seconds or so to actively drive a pile with the remaining time (perhaps two to five minutes) being (quiet) set up to preparing to drive the next pile. Pile driving noise on a solar farm is not constant or derived from the same location with the Site (but it is regular while this activity is being carried out as part of the construction programme).

- 10.3 Many submissions concerned about piling noise are from Ranfurly and Naseby townships, or from further afield such as Ida Valley and Dunedin. These locations are a significant distance from the Site. I expect noise levels will be negligible at the township locations (perhaps around 10 dBA in enhanced propagation conditions), significantly below the existing ambient noise levels in these areas (and likely below the threshold of hearing for most adults). Residents of Ranfurly, Naseby and those further afield do not need to be concerned about construction noise.
- 10.4 Two submissions were received from those living somewhat closer to the Site,²² although these dwellings are still 500m to 1,000m away from the closest point of solar farm construction. I expect piling noise will be audible at the submitters' dwellings during periods of construction. Noise levels may be in the order of 50 dB L_{Aeq} at the closest dwelling when piling is occurring at the nearest points in the Site. Piling activities will occur in stages and piling will not occur at the closest distances for the duration of the construction works. Noise will comfortably comply with the District Plan construction noise limits at all submitter dwellings. In my view, while construction noise will be audible at times over a 24-month period, the noise levels are reasonable and in keeping with the requirements of NZS6803:1999.
- 10.5 These submissions also raise concerns about the duration of the works being up to 24-months in total. A key aspect of Section 16 of the RMA is to adopt the best practicable method to reduce noise. In this situation, the best practicable method to construct the solar farm is to construct it as quickly as possible. The best practicable option likely to be the use of the short throw hydraulic piling rig. Other methods (such as excavation and concreting) are likely to be extremely slow in comparison. In any event, the applicant will be incentivised to choose the most appropriate and efficient construction method once ground conditions are confirmed.

Fan Noise, Heat Loads, Cooling Methods²³

- 10.6 General concerns have been raised about fan noise. Concerns have also been raised about the high ambient temperatures that can occur in Mānīatoto.
- 10.7 The collective level of fan noise on a solar farm is primarily from the inverters but is not a particularly high sound power level. Submitters do not need to have any concern about this source of noise in the Ranfurly and Naseby townships, or at further distances. Operational fan noise will be below the threshold of human hearing (even in enhanced sound propagation conditions) at these locations. Operational noise levels at dwellings closer to the solar farm will also be low overall, as set out in my assessment.
- 10.8 I do not expect that noise levels emitted from inverters will be higher than expected due to Mānīatoto's temperatures. Inverter and other solar equipment is typically designed to operate in a wide range of environments (e.g. hot Eurasian deserts). I have measured noise from solar inverters during hot summer days in Northland and found that the emitted noise levels were consistent with the sound power level data used in my assessment.

Transformer Noise²⁴

- 10.9 Several submitters raise general transformer noise concerns. Transformers can be constructed by different manufacturers but all work on largely the same principle and generate noise in proportion to their MVA rating (with some variation).
- 10.10 Medium voltage transformers produce little noise. Large transformers do generate some noise, however people often live very close to substations without unreasonable noise effects arising. In the case of the subject solar farm, the transformer will be at a very significant distance from any dwelling (around 1.9 km), and transformer noise levels will consequentially be low.
- 10.11 Some submitters²⁵ have expressed concerns about low frequency noise and tones from transformers. Transformers generate a low frequency "hum" at 100 Hz, which is due to the vibration of the transformer core as it is excited by

²³ 05 Submission – Ngaire Barton [Ranfurly], 024 Submission - Jenny Grimmett [Ida Valley Back Road], 038 Submission - Wendy Kearney [Ranfurly], 135/136 Submission - The Real Dog Equipment Company Ltd / Rose and Nigel Voice [Bypass Road, Ranfurly].

²⁴ 035 Submission - Shona Harrison [Wet Gully Road, Naseby], 050 Submission - Sandra Stuart, 058 Submission – Gavin James Crossan [366 Ranfurly Back Road, Ranfurly], 074 Submission - Kristina Wills [Stafford Street, Ranfurly], 077 Submission - Annabel and David Dodd [Allison Lane, Ranfurly], 128 Submission – Healey [Dunedin], 135/136 Submission - The Real Dog Equipment Company Ltd / Rose and Nigel Voice [Bypass Road, Ranfurly]

²⁵ 074, 077, and 128.

power at 50 Hz. This will be at a very low level of noise due to the significant distance between the solar farm and receivers. My assessment allows for the tonality generated by plant items such as transformers and inverters. I have added a tonality correction to my calculations, as required by NZS6802.

- 10.12 Some submissions question the data used in my assessment. I have addressed transformer noise by using suitable input data to inform a detailed noise model that is based on established engineering principles. I have assessed the noise using the appropriate New Zealand standards. The sound power levels I have used accord with data in standards such as IEC 60076-10 and also compare well with similarly sized modern transformers (e.g. Pauwels 150 MW) that we have measured in detail in operation at South Island substations. The input data is appropriately chosen to represent a modern transformer. Even if transformer noise levels were somehow higher than I have allowed for, this would not be of any concern given the large distances between the proposed substation and the nearest receivers, and the low noise levels that will result.

Health Effects²⁶

- 10.13 Noise levels from the Project will be significantly below all relevant guidelines for the protection of human health.

Construction Noise Management²⁷

- 10.14 Some submitters are concerned about the lack of a proposed construction noise and vibration management plan.
- 10.15 A construction noise and vibration management plan is most useful where compliance is marginal and the effects of piling at certain locations needs to be mitigated. A noise management plan can also show "zones" where piling cannot occur, in the event that a consent requires this.
- 10.16 In the case of the Project, compliance is not marginal and there are no proposed restrictions on where piling can occur within the Site.

Sound Propagation and Meteorological Conditions²⁸

- 10.17 A submission raises concern about sound propagation in the Mānīatoto area. My noise assessment calculates noise in conditions that are favourable to

²⁶ 093 Submission - Phyllipa LaBonte [Thomas Street, Ranfurly].

²⁷ 128 Submission – Healey [Dunedin], 081 Submission - Eric Swinbourn [Naseby].

²⁸ 057 Submission - Inez Baxter [Ranfurly].

sound propagation, such as temperature inversions or downwind situations. This is in keeping with the *International Standard ISO 9613-2:1996 Acoustics - Attenuation of sound during propagation outdoors – Part 2: General method of calculation method*. My assessment is likely very conservative at large distances, as solar farms operate during periods of solar gain when temperature inversions and stable atmospheric conditions are less likely. I expect that noise levels will typically be lower than what I have calculated for this reason. Submitters can be confident that the sound propagation conditions encountered around the Māniatoto have been adequately taken into account.

11. RESPONSE TO SECTION 42A REPORT

11.1 I have reviewed the Section 42A Report prepared by Mr Vincent. I agree with Mr Vincent's conclusion that consent should be granted, subject to appropriate consent conditions.

11.2 Mr Vincent poses a number of questions or makes comments that I wish to address.

Operational noise effects

11.3 At paragraph 54, Mr Vincent invites commentary around what the difference in noise effects might be if the transformers were to produce 93 dB L_{WA} rather than 90 dB L_{WA} as I have assumed.

11.4 This question stems from the submission of Mr Healey, who expresses the view that the transformers are more likely to be "93-95dBA"²⁹. Firstly, it is not clear from Mr Healey's submission whether he is using a sound pressure level, or a sound power level. The distinction is important as the different starting points require the use of different calculations to derive the sound pressure level for comparison against the District Plan noise limits.

11.5 Based on Mr Healey's assertion that the night-time noise limit would be exceeded at 1,000m, it seems to me that he has used a sound pressure level. To confirm, I have used a sound power level.

11.6 In the absence of the BESS I predict a noise level of approximately 21 dB from the operation of the Project (including transformer contribution) at 512 Ranfurly Road, the nearest dwelling to the transformers (1,900 metres away), during

the District Plan night-time. This noise level is from the DC tracking motors and inverters, which may be operating prior to 07:00am.

- 11.7 While a change in noise level of 3 dB would generally be considered on the margin of perceptibility, the transformer contribution to the overall noise level from the proposed Project is such that an increase in transformer noise of 3 dB would change the overall noise level by less than 1 dB.
- 11.8 This is an imperceptible difference.
- 11.9 Mr Healey notes, correctly, that transformers can be tonal. I confirm that as part of my assessment I have assumed that tonality is present at receivers and that the predicted noise levels have been penalised +5 dB in accordance with the relevant assessment Standard.
- 11.10 Given the very low level of noise contribution by the transformers to the overall noise level from the Project, I do not see any utility in including any additional noise control fencing as suggested at paragraph 55 by Mr Vincent.

Construction effects

- 11.11 At paragraphs 91 and 92 Mr Vincent makes a case for applying the 'typical' construction noise limits in NZS 6803 rather than the 'long term' noise limits which are 5 dB lower. Mr Vincent asks whether compliance can be achieved with the lower long-term noise limits.
- 11.12 I confirm that the construction noise, dominated by piling, would be less than 60 dB LAeq at the closest dwellings approximately 500m away. This comfortably complies with the 70 dB LAeq noise limit Mr Vincent prefers.
- 11.13 At paragraph 94 of his report Mr Vincent discusses his preference for monitoring of construction noise (piling). In my view the large margin by which compliance is predicted means that there is little utility in noise monitoring. Noise monitoring would only be required if compliance with conditions and time restrictions on the activity are not being met.

12. COMMENTS ON PROPOSED CONDITIONS

- 12.1 I have reviewed Council's proposed consent conditions relevant to noise and vibration.

Conditions 5 e) and f)

- 12.2 The proposed construction methodology I assessed in the noise assessment report demonstrates compliance with the long-term noise standards of NZS 6803:1999, and so no specific action would be required against proposed condition 5(e). As I have stated above, I do not consider that onsite monitoring would be required to confirm compliance with this condition.

Condition 8

- 12.3 Proposed condition 8 contains a typographic error carried over from my report. "DIN 41503:2016" should read "DIN 4150-3:2016".

Condition 31

- 12.4 I suggest amendment as follows:

The noise level from all solar farm operations must meet the following noise limits at the notional boundary of all existing or consented dwellings on any other site at the time of issue of consent:

- a) 55 dB ~~LA10~~ LAeq from 7:00 am to 10:00 pm
- b) 40 dB ~~LA10~~ LAeq and 70 dB L_{AFmax} from 10:00 pm to 7:00 am the following day

Note: Noise levels shall be measured and assessed following NZS 6801:2008 Acoustics – Measurement of Environmental Sound and NZS 6802:2008 Acoustics – Environmental Noise (or any subsequent replacement standard).

- 12.5 Proposed condition 31 requires compliance against the district noise limits expressed as L_{A10} noise levels, along with adopting the latest versions (2008) of NZS 6801 and 6802. The National Planning Standards ("**NPS**") require eventual adoption of these new versions of the standards along with the use of the L_{Aeq} parameter to replace the L_{A10} . On reflection, I consider that it would be more appropriate for the noise limits in the consent to be changed to the L_{Aeq} parameter.
- 12.6 This will have no perceptible effect on neighbours because the noise level of the activity is controlled by equipment that has a very small difference between the L_{A10} and L_{Aeq} noise level and compliance with either can be met by the proposed Project. However, in addition to conforming to the NPS, the 2008 version of NZS 6802 is entirely based around the L_{Aeq} parameter. The use of L_{A10} noise levels with the calculation methodology of NZS 6802:2008

introduces some ambiguity that may lead to different practitioners predicting and assessing noise in different ways.

13. CONCLUSION

- 13.1 The proposed Project would result in low operational daytime noise emissions and will operate at a level of noise that complies with the District Plan and is considerably below any recognised national or international environmental noise guideline for the protection of human health or amenity.
- 13.2 Construction noise will be audible at times, but noise will comply with the District Plan and be considerably below recognised construction noise guidelines. Construction vibration effects will be insignificant.

Peter Ibbotson
21 July 2025