



# **Te Rere Hau Windfarm Annual Noise Monitoring Report**

**2019—2020**

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## 1.0 Purpose

This draft annual noise monitoring report for the year through March 2020 has been prepared by TRH Services on behalf of NZ Windfarms to fulfil our resource consent s128 review Condition 20, with contributions by Marshall Day Acoustics as noted.

As required by Condition 19.4, we are providing a copy of this draft report to the Community Liaison Group members prior to submitting the final report to PNCC. Normally the group would be called to meet in person during to discuss, however due to the disruption caused by COVID-19 we request that you submit any feedback on this draft report by e-mail to [engineer@trhservices.co.nz](mailto:engineer@trhservices.co.nz) no later than 22 May.

## 2.0 Compliance with Conditions 4, 5, and 5A—5C

To demonstrate compliance with these conditions, refer to report “Rp 009 R01 2011095W” prepared by Marshall Day Acoustics with TRH Services, and submitted to Council on 1 Feb 2019. Taken with the remainder of this report, which indicates no adverse alterations to wind turbines with respect to noise emissions during the preceding year, we submit that we remain in compliance with the conditions.

The Condition 5C noise curtailment regime active on turbines 88, 103, and 104 prevented approximately 489 turbine-hours of running. The curtailment parameters are unchanged from last year. A further 2,637 turbine-hours of low-wind start-ups and generation were voluntarily curtailed by noise curtailment across the fleet.

## 3.0 Wind turbine alterations

The year included the following significant repairs and machinery replacements

- Blade leading edge tape repairs to 52 of 65 PNCC turbines including all turbines nearest to residents to the southwest.
- Generator replacements (like-for-like, turbines 27, 46)
- Gearbox replacement (like-for-like, turbines 4, 14, 32, 51, 59, 88)

Marshall Day Acoustics provided the following Acoustic Impact statement:

*Where the generator and gearbox replacement parts are the same as those removed there will not be a significant effect on noise emissions.*

*Blade leading edge tape repairs are an ongoing maintenance item which will generally reduce the high-frequency whistle of blade rotation, which would normally accumulate slowly as the leading edge tape wears or becomes damaged. We understand that priority of these repairs is given to turbines which contribute more significantly to residence noise emission. This work is expected to reduce noise levels.*

*None of the repair or maintenance items carried out on the TRH wind farm over the 2019 – 2020 operating year will cause an increase in noise emissions. Leading edge tape repairs will have reduced noise emissions.*

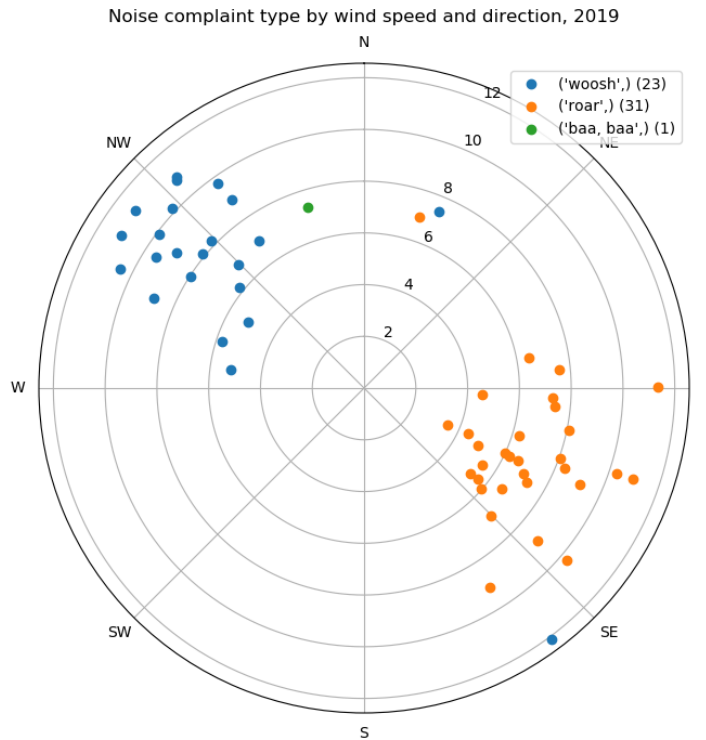
## 4.0 Complaints register

The following 55 complaints were received during 2019.

| Name      | Address         | Date       | Time  | Complaint Description  | Wind Speed [m/s] | Wind Direction [deg] |
|-----------|-----------------|------------|-------|--|------------------|----------------------|
| Ellingham | 47 Ridgeview Rd | 9/01/2019  | 22:12 | Blade noise slicing through air  | 6                | 288                  |
| Ellingham | 47 Ridgeview Rd | 10/01/2019 | 21:40 | Blade noise slicing through air, whoosh whoosh noise   | 9                | 293                  |
| Ellingham | 47 Ridgeview Rd | 29/01/2019 | 07:15 | Roaring noise  | 10               | 130                  |
| Ellingham | 47 Ridgeview Rd | 8/02/2019  | 08:40 | Roaring noise  | 6                | 79                   |
| Ellingham | 47 Ridgeview Rd | 14/02/2019 | 21:50 | Whoosh whoosh noise  | 10               | 306                  |
| Ellingham | 47 Ridgeview Rd | 17/02/2019 | 21:45 | Slicing through air noise  | 7                | 305                  |
| Ellingham | 47 Ridgeview Rd | 26/03/2019 | 09:00 | Blade noise slicing through air  | 8                | 314                  |
| Ellingham | 47 Ridgeview Rd | 27/03/2019 | 07:30 | Blade noise slicing through air  | 11               | 318                  |
| Ellingham | 47 Ridgeview Rd | 29/03/2019 | 23:50 | Roaring noise  | 11               | 90                   |
| Ellingham | 47 Ridgeview Rd | 18/04/2019 | 17:20 | Roaring noise  | 7                | 118                  |
| Ellingham | 47 Ridgeview Rd | 22/04/2019 | 19:00 | Roaring noise  | 5                | 123                  |
| Ellingham | 47 Ridgeview Rd | 23/04/2019 | 08:00 | Roaring noise  | 5                | 117                  |
| Ellingham | 47 Ridgeview Rd | 23/04/2019 | 17:00 | Roaring noise  | 6                | 115                  |
| Ellingham | 47 Ridgeview Rd | 5/05/2019  | 08:15 | Whoosh whoosh noise  | 8                | 310                  |
| Ellingham | 47 Ridgeview Rd | 6/05/2019  | 22:00 | Monday evening 6 May 19 – roaring noise most of evening but louder 10pm onwards  | 8                | 110                  |
| Ellingham | 47 Ridgeview Rd | 22/05/2019 | 22:00 | Whoosh whoosh noise  | 9                | 325                  |
| Ellingham | 47 Ridgeview Rd | 25/05/2019 | 22:00 | Slicing through air noise  | 11               | 308                  |
| Ellingham | 47 Ridgeview Rd | 30/05/2019 | 22:00 | Combination whoosh and whine noise   | 10               | 325                  |
| Ellingham | 47 Ridgeview Rd | 31/05/2019 | 14:00 | Blade noise slicing through air  | 7                | 314                  |
| Ellingham | 47 Ridgeview Rd | 13/06/2019 | 20:30 | Loud roaring noise   | 5                | 129                  |
| Ellingham | 47 Ridgeview Rd | 14/06/2019 | 04:45 | Loud roaring noise   | 10               | 109                  |
| Ellingham | 47 Ridgeview Rd | 17/06/2019 | 17:45 | Whoosh whoosh noise of blades slicing through air  | 5                | 278                  |
| Ellingham | 47 Ridgeview Rd | 21/06/2019 | 08:30 | Whoosh whoosh noise  | 10               | 307                  |
| Ellingham | 47 Ridgeview Rd | 1/07/2019  | 20:17 | Combination roar and whoosh  | 7                | 325                  |
| Ellingham | 47 Ridgeview Rd | 2/07/2019  | 22:30 | Combination roar and whoosh  | 7                | 23                   |
| Ellingham | 47 Ridgeview Rd | 11/07/2019 | 03:00 | Whoosh whoosh noise loud, seems to be more activity from wind farm during early hours.   | 10               | 313                  |
| Ellingham | 47 Ridgeview Rd | 13/07/2019 | 04:00 | combination roar and whoosh (loud)   | 11               | 318                  |
| Ellingham | 47 Ridgeview Rd | 22/07/2019 | 22:30 | Loud roar from Windfarm  | 7                | 120                  |
| Ellingham | 47 Ridgeview Rd | 23/07/2019 | 22:30 | Loud roar from Windfarm  | 9                | 131                  |
| Ellingham | 47 Ridgeview Rd | 18/08/2019 | 09:00 | Roaring noise  | 9                | 148                  |
| Ellingham | 47 Ridgeview Rd | 20/08/2019 | 22:00 | Roaring noise  | 7                | 18                   |
| Ellingham | 47 Ridgeview Rd | 28/08/2019 | 02:15 | Weird sounding noise. Firstly thought it was a sheep baaing far away, but on closer listening in was a continual every few seconds, baa, baa, baa, baa noise light something needed oiling. Had to shut window as it woke us up. | 7                | 343                  |
| Ellingham | 47 Ridgeview Rd | 2/09/2019  | 20:50 | Extremely loud constant roaring noise. Scale of 1 to 10, 10+. Sort of noise to lower property values around here.  | 6                | 107                  |
| Ellingham | 47 Ridgeview Rd | 3/09/2019  | 17:30 | Roar noise   | 11               | 109                  |
| Ellingham | 47 Ridgeview Rd | 5/09/2019  | 08:00 | Roar noise   | 7                | 93                   |
| Ellingham | 47 Ridgeview Rd | 8/09/2019  | 13:15 | Roar noise   | 8                | 102                  |

|           |                 |            |       |   |    |     |
|-----------|-----------------|------------|-------|---|----|-----|
| Ellingham | 47 Ridgeview Rd | 9/09/2019  | 17:30 | roar from wind farm   | 6  | 131 |
| Ellingham | 47 Ridgeview Rd | 9/09/2019  | 19:30 | Extremely loud  | 6  | 129 |
| Ellingham | 47 Ridgeview Rd | 10/09/2019 | 08:00 | horrendous roar noise, 2 options – shut all windows and doors and be a prisoner in ones own home or pack up and leave for the day | 9  | 114 |
| Ellingham | 47 Ridgeview Rd | 10/09/2019 | 23:00 | noise was so loud had to shut the ensuite window to drown noise out   | 8  | 85  |
| Ellingham | 47 Ridgeview Rd | 18/09/2019 | 06:45 | To be honest, this was not as loud and annoying as in the past. Just a slight roar noise.   | 4  | 114 |
| Ellingham | 47 Ridgeview Rd | 29/09/2019 | 21:20 | Whoosh whoosh noise   | 10 | 296 |
| Ellingham | 47 Ridgeview Rd | 6/10/2019  | 17:30 | Roar from windfarm  | 7  | 115 |
| Ellingham | 47 Ridgeview Rd | 14/10/2019 | 17:30 | Roar  | 7  | 96  |
| Ellingham | 47 Ridgeview Rd | 14/10/2019 | 20:45 | roar louder   | 6  | 122 |
| Ellingham | 47 Ridgeview Rd | 15/10/2019 | 09:00 | roar noise  | 7  | 126 |
| Ellingham | 47 Ridgeview Rd | 19/10/2019 | 23:00 | Whoosh whoosh noise   | 8  | 303 |
| Ellingham | 47 Ridgeview Rd | 26/11/2019 | 23:00 | Blades slicing through air  | 11 | 304 |
| Ellingham | 47 Ridgeview Rd | 29/11/2019 | 21:00 | Blades slicing through air  | 7  | 321 |
| Ellingham | 47 Ridgeview Rd | 5/12/2019  | 23:25 | Whoosh whoosh noise   | 11 | 302 |
| Ellingham | 47 Ridgeview Rd | 10/12/2019 | 07:30 | Roar noise  | 7  | 135 |
| Ellingham | 47 Ridgeview Rd | 10/12/2019 | 22:00 | Roar noise  | 5  | 93  |
| Ellingham | 47 Ridgeview Rd | 11/12/2019 | 07:00 | Extremely loud roar noise. (Just as well real estate agent not coming out).   | 8  | 112 |
| Ellingham | 47 Ridgeview Rd | 11/12/2019 | 22:00 | Loaud roar noise  | 4  | 114 |
| Ellingham | 47 Ridgeview Rd | 27/12/2019 | 08:00 | Whoosh whoosh noise   | 10 | 302 |

The figure below shows all complaints categorized based on the text of the complaint and plotted according to the wind speed and direction at the time of the of the complaint.



Generally, for the affected residents, “roar” noise is heard in easterly winds and “woosh” noise in westerly winds.

From the NMT audio recordings, the “baa, baa” sound heard early 28 August 2019 corresponded to the once-per-revolution frequency of 50 per minute and was a piece of damaged fibreglass flapping on the surface of one blade. This is the type of noise our proactive annual blade repairs normally prevent.

In addition, throughout the year our technicians carried out monthly visits to turbines 84 through 104 (the ones nearest residents to the SW) to listen from the ground while generating. These inspections led to blade repairs to three turbines.

## **5.0 Community Liaison Group meeting minutes**

### **5.1 Meeting held 13 May 2019**

#### **Opening**

The meeting of the NZ Windfarms Ltd Community Liaison Group was opened at 7.00pm, on 13 May 2019 at the Aokautere School hall by Adam Radich and Adam Fuller. Also present from NWF Peter Darke and Alison Angove.

#### **Present**

Joe Poff, Lee Huffman & Graham Denvey, Ashley Kells & Lorraine Tremaine, Craig Auckram (PNCC).

#### **Apologies**

Nil

#### **Discussion**

- S128 decision requires NWF to submit draft Annual report to community for feedback prior to submitting final to PNCC
- Overview of voluntary vs mandated curtailment
- Discussion of wind roses to show wind conditions represent previous years wind conditions
- Time line of events which outlined actions taken and to be taken in the future
- Spoke about reduction in complaints from 499 in 2012 to 54 in 2018-19
- Discussed noise monitoring terminal and its effectiveness in evaluating noise issues
- Discussed noise measurements taken and how they demonstrated compliance with our current consent, as well as provide a baseline for comparison with next year's, and subsequent years', data.
- Lee Huffman asked for an addition to report that explained the M7 gear modification impact at T103, 104
- Voluntary Curtailment regime – Feedback/ complaints are extremely important to enable us to specifically identify areas of concern and further refine and develop our curtailment regime.
- Presented recent months' daily hours noise curtailed, with year-on-year comparison.
- Discussed that NMT data allows more quantitative and objective corroboration of complaints and refined location of time and wind conditions which may help understand noisy conditions and improve curtailment.
- Contact details and process was specifically outlined in detail

#### **Closed**

Meeting was closed at 7.45pm

## **6.0 Community Group meeting feedback**

Due to the Government's COVID-19 restrictions, a meeting of the TRH Community Liaison Group was not called. Hardcopies of the draft report were delivered to residents on 15 May with feedback requested via e-mail. No feedback was received.



## 7.0 Noise Monitoring Terminal

Noise monitoring at a permanent noise monitoring terminal (NMT) at the Irvin Property (Site 4, 38 Ridgeview Road) is required in Condition 13. This was completed in May 2018, with calibration completed by 10 June. The NMT gathers A-weighted noise statistics including  $L_{A90}$  as required by NZS6808:2010, and stores audio data to a hard disk, which is regularly exchanged and archived by NZWL.

The NMT is a Norsonic NOR140 sound level meter connected to a class 1 measurement microphone with an outdoor windscreen and protection kit, located at approximately the same location as used during the 2011 – 2013 monitoring exercise. This location complies with the requirements of clause 7.1.6 in New Zealand Standard NZS 6808:2010 “Acoustics – Wind farm noise”.

The measurement system is calibrated periodically by NZWL staff using a class 1 compliant field calibrator. Both the meter/microphone system and the field calibrator are subject to periodic laboratory calibration, which is undertaken at the prescribed intervals by NZWL. Calibration checks have been completed since the draft report was published and the updated certificates are included at the end of this report.  $L_{A90}$  statistics are collected continuously in 10-minute intervals as required by NZS6808:2010 and stored on a web server.

The logger was installed and went live on 7 Jun 2018 at 13:30. In the year through 31 Mar 2020 8632 hours of data were collected, with missing data distributed over the months as tabulated below.

|         | Hours of missing noise data |
|---------|-----------------------------|
| 2019-04 | 78.5                        |
| 2019-05 | 1.3                         |
| 2019-06 | 0.7                         |
| 2019-07 | 0.7                         |
| 2019-08 | 4.3                         |
| 2019-09 | 20.2                        |
| 2019-10 | 1.3                         |
| 2019-11 | 4.0                         |
| 2019-12 | 5.3                         |
| 2020-01 | 4.8                         |
| 2020-02 | 4.2                         |
| 2020-03 | 2.3                         |

Outages can be caused by power failures, or power spikes which may cause a reset of the remote on site PC. Some are also caused by outages in the cellular system, which disrupt the data upload to the web site.

## 8.0 Analysis of operational data

This section has been provided by Marshall Day Acoustics.

We have compared the collected LA90(10-min) sound level measurements with the wind speed measurements taken at the reference met mast, and applied the operational filters described in Condition 7 (ensuring most turbines are operating, including nearest turbines and T103-T104, excluding curtailed periods, assessing only night-time data, and restricting assessments to the operating wind speeds).

These data are presented as scatter plots and regression lines relating to the four critical wind sectors (WNW, NNW, SSE, ESE). These plots can be compared with the plots presented in the Compliance Assessment Report Rp 009 R01 relating to Site 4. Tables are provided to summarise the compliance status of these measurements, and additional graphs are provided to visually summarise the regression lines of background, limit, 2011-2013 measurements, the results from previous annual reports, and current year measurements.

Where possible, the data collected during the 2011-2013 period excluded high background noise periods to reflect the most noticeable periods of turbine noise – during both “shutdown” and “operational” measurements. By contrast the current year measurements (and those of 2018-2019) have not been so selected (aside from removing rainfall periods) and so include increased traffic periods and seasonal effects.

Therefore when evaluating trends of operational noise, it is most useful to compare the values between annual reporting periods.

### 8.1 WNW

#### Site 4, WNW

| Wind Speed (m/s):                  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|------------------------------------|----|----|----|----|----|----|----|----|----|----|
| Background Noise Level (dB LA90):  | 24 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 |
| Operational Noise Level (dB LA90): | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 |
| Noise Limit (dB LA90):             | 35 | 40 | 40 | 40 | 40 | 40 | 41 | 43 | 45 | 47 |
| Turbine Noise Level (dB LA90):     | 22 | 24 | 26 | 27 | 29 | 31 | 34 | 36 | 38 | 40 |
| Exceedance (dB):                   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |

### 8.2 NNW

#### Site 4, NNW

| Wind Speed (m/s):                  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|------------------------------------|----|----|----|----|----|----|----|----|----|----|
| Background Noise Level (dB LA90):  | 25 | 26 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 |
| Operational Noise Level (dB LA90): | 27 | 29 | 31 | 33 | 35 | 37 | 39 | 41 | 44 | 46 |
| Noise Limit (dB LA90):             | 35 | 40 | 40 | 40 | 40 | 40 | 41 | 43 | 45 | 47 |
| Turbine Noise Level (dB LA90):     | 23 | 25 | 28 | 30 | 32 | 35 | 37 | 39 | 41 | 43 |
| Exceedance (dB):                   | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |

### 8.3 SSE

#### Site 4, SSE

| Wind Speed (m/s):                               | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|---|----|----|----|----|----|----|----|----|----|----|
| Background Noise Level (dB L <sub>A90</sub> ):  | 24 | 27 | 29 | 32 | 35 | 38 | 41 | 44 | 47 | 50 |
| Operational Noise Level (dB L <sub>A90</sub> ): | 31 | 34 | 36 | 39 | 41 | 43 | 45 | 47 | 48 | 49 |
| Noise Limit (dB L <sub>A90</sub> ):             | 35 | 40 | 40 | 40 | 40 | 43 | 46 | 49 | 52 | 55 |
| Turbine Noise Level (dB L <sub>A90</sub> ):     | 30 | 33 | 36 | 38 | 40 | 42 | 43 | 43 | 41 | -- |
| Exceedance (dB):                                | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | -- |

### 8.4 ESE

#### Site 4, ESE

| Wind Speed (m/s):                               | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
|---|----|----|----|----|----|----|----|----|----|----|
| Background Noise Level (dB L <sub>A90</sub> ):  | 25 | 31 | 35 | 38 | 41 | 43 | 44 | 45 | 46 | 48 |
| Operational Noise Level (dB L <sub>A90</sub> ): | 35 | 38 | 40 | 42 | 44 | 46 | 47 | 49 | 50 | 51 |
| Noise Limit (dB L <sub>A90</sub> ):             | 35 | 40 | 40 | 43 | 46 | 48 | 49 | 50 | 51 | 53 |
| Turbine Noise Level (dB L <sub>A90</sub> ):     | 34 | 37 | 38 | 40 | 41 | 43 | 44 | 46 | 47 | 48 |
| Exceedance (dB):                                | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  |

### 9.0 Comments

This section has been provided by Marshall Day Acoustics.

The regression lines plotted through the 2019-2020 data all show compliance with the high-amenity noise limit under all conditions. Where there are differences from previous measurements, it is generally because of the high background sound levels which make the determination of “turbine noise level” very sensitive to small changes in average measured operational level.

No curtailments are reflected in this data – periods where turbines have been shut down or have not started due to curtailment requirements have been excluded from this data. If these data were included this would further reduce the average sound levels during the relevant wind conditions.

No significant trend is evident by the comparison of the two “annual report” data sets.

## 10.0 Complaints Assessment

This section has been provided by Marshall Day Acoustics.

NZWL has provided a register of complaints which included the current assessment period 1 Apr 2019 – 31 Mar 2020.

The register shows 61 complaints over this period, all of which were received from the property at 47 Ridgeview Road which is directly across Ridgeview Road from the permanent monitoring location. The noise levels recorded by this device provide a relevant point of reference for these complaints.

The complaints have been divided between general NW and SE wind directions, and in each case sorted by increasing wind speed. The time and text of the complaint are included, and the noise level and wind farm state are described. We note that the time of the complaint may not correspond directly to the time that the problem noise occurred.

The “Full Operation” column describes whether enough turbines were enabled to comply with the requirements of Condition 7.4 for valid sound level reporting. The “Curtailed” column describes whether any turbines were shut down in response to either mandatory or voluntary curtailment programming.

## 10.1 South-easterly Complaints

| Date       | Time  | Complaint Description   | Wind Dir (deg) | Wind Speed (m/s) | Noise Level (dB LA90) | Full Operation ? | Curtailed ? |
|------------|-------|---|----------------|------------------|-----------------------|------------------|-------------|
| 20/01/2020 | 7:30  | Roar noise  | 119            | 3.0              | 34                    | yes              | no          |
| 16/01/2020 | 22:15 | Roar noise  | 144            | 4.0              | 28                    | yes              | no          |
| 18/09/2019 | 6:45  | To be honest, this was not as loud and annoying as in the past. Just a slight roar noise.   | 114            | 4.0              | 37                    | yes              | no          |
| 11/12/2019 | 22:00 | Loud roar noise   | 114            | 4.0              | 33                    | yes              | no          |
| 13/06/2019 | 20:30 | Loud roaring noise  | 129            | 5.0              | 37                    | no               | no          |
| 13/03/2020 | 8:45  | Loud roar   | 129            | 5.0              | 36                    | yes              | no          |
| 5/03/2020  | 11:45 | Loud roar noise   | 125            | 5.0              | 48                    | no               | no          |
| 22/04/2019 | 19:00 | Roaring noise   | 123            | 5.0              | 33                    | yes              | no          |
| 23/04/2019 | 8:00  | Roaring noise   | 117            | 5.0              | 31                    | yes              | no          |
| 10/12/2019 | 22:00 | Roar noise  | 93             | 5.0              | 30                    | yes              | no          |
| 17/01/2020 | 7:30  | Roar noise  | 146            | 6.0              | 34                    | yes              | no          |
| 9/09/2019  | 17:30 | roar from wind farm   | 131            | 6.0              | 42                    | yes              | no          |
| 9/09/2019  | 19:30 | Extremely loud  | 129            | 6.0              | 38                    | yes              | no          |
| 17/01/2020 | 22:00 | Roar noise  | 127            | 6.0              | 33                    | yes              | no          |
| 14/10/2019 | 20:45 | roar louder   | 122            | 6.0              | 40                    | no               | no          |
| 23/04/2019 | 17:00 | Roaring noise   | 115            | 6.0              | 35                    | yes              | no          |
| 15/03/2020 | 7:00  | loud roar continual all Sunday morning  | 108            | 6.0              | 35                    | no               | no          |
| 2/09/2019  | 20:50 | Extremely loud constant roaring noise. Scale of 1 to 10, 10+. Sort of noise to lower property values around here.                 | 107            | 6.0              | 32                    | yes              | no          |
| 10/12/2019 | 7:30  | Roar noise  | 135            | 7.0              | 38                    | no               | no          |
| 15/10/2019 | 9:00  | roar noise  | 126            | 7.0              | 42                    | yes              | no          |
| 22/07/2019 | 22:30 | Loud roar from Windfarm   | 120            | 7.0              | 33                    | yes              | no          |
| 18/04/2019 | 17:20 | Roaring noise   | 118            | 7.0              | 39                    | no               | no          |
| 6/10/2019  | 17:30 | Roar from windfarm  | 115            | 7.0              | 38                    | yes              | no          |
| 6/03/2020  | 20:30 | Loud roar noise   | 106            | 7.0              | 34                    | yes              | no          |
| 14/10/2019 | 17:30 | Roar  | 96             | 7.0              | 37                    | yes              | no          |
| 5/09/2019  | 8:00  | Roar noise  | 93             | 7.0              | 41                    | no               | yes         |
| 26/02/2020 | 9:30  | Loud roar   | 90             | 7.0              | 51                    | no               | yes         |
| 11/12/2019 | 7:00  | Extremely loud roar noise. (Just as well real estate agent not coming out).   | 112            | 8.0              | 39                    | yes              | no          |
| 6/05/2019  | 22:00 | Monday evening 6 May 19 – roaring noise most of evening but louder 10pm onwards   | 110            | 8.0              | 32                    | yes              | no          |
| 8/09/2019  | 13:15 | Roar noise  | 102            | 8.0              | 37                    | no               | no          |
| 10/09/2019 | 23:00 | noise was so loud had to shut the ensuite window to drown noise out   | 85             | 8.0              | 38                    | no               | no          |
| 15/03/2020 | 21:30 | Loud roar   | 78             | 8.0              | 32                    | no               | yes         |
| 18/08/2019 | 9:00  | Roaring noise   | 148            | 9.0              | 38                    | yes              | no          |
| 23/07/2019 | 22:30 | Loud roar from Windfarm   | 131            | 9.0              | 33                    | no               | no          |
| 10/09/2019 | 8:00  | horrendous roar noise, 2 options – shut all windows and doors and be a prisoner in ones own home or pack up and leave for the day | 114            | 9.0              | 42                    | no               | yes         |
| 14/06/2019 | 4:45  | Loud roaring noise  | 109            | 10.0             | 36                    | no               | no          |
| 3/09/2019  | 17:30 | Roar noise  | 109            | 11.0             | 39                    | yes              | no          |
| 20/01/2020 | 22:00 | Roar noise  | 109            | 11.0             | 37                    | yes              | no          |
| 24/02/2020 | 21:00 | Roar noise  | 105            | 11.0             | 44                    | yes              | no          |

## 10.2 North-westerly Complaints

|            |       |   |     |     |    |     |    |
|------------|-------|---|-----|-----|----|-----|----|
| 17/06/2019 | 17:45 | Whoosh whoosh noise of blades slicing through air | 278 | 5.0 | 34 | yes | no |
|------------|-------|---|-----|-----|----|-----|----|

|            |       |  |     |      |    |     |     |
|------------|-------|--|-----|------|----|-----|-----|
| 28/08/2019 | 2:15  | Weird sounding noise. Firstly thought it was a sheep baaing far away, but on closer listening in was a continual every few seconds, baa, baa, baa, baa noise light something needed oiling. Had to shut window as it woke us up. | 343 | 7.0  | 29 | yes | no  |
| 1/07/2019  | 20:17 | Combination roar and whoosh  | 325 | 7.0  | 32 | yes | no  |
| 29/11/2019 | 21:00 | Blades slicing through air   | 321 | 7.0  | 43 | yes | no  |
| 31/05/2019 | 14:00 | Blade noise slicing through air  | 314 | 7.0  | 35 | yes | no  |
| 1/01/2020  | 22:15 | Whoosh whoosh noise  | 290 | 7.0  | 26 | no  | yes |
| 2/07/2019  | 22:30 | Combination roar and whoosh  | 23  | 7.0  | 29 | yes | no  |
| 20/08/2019 | 22:00 | Roaring noise  | 18  | 7.0  | 29 | yes | no  |
| 5/01/2020  | 8:45  | Whoosh whoosh noise  | 321 | 8.0  | 38 | no  | no  |
| 5/05/2019  | 8:15  | Whoosh whoosh noise  | 310 | 8.0  | 34 | no  | no  |
| 19/10/2019 | 23:00 | Whoosh whoosh noise  | 303 | 8.0  | 33 | yes | no  |
| 22/05/2019 | 22:00 | Whoosh whoosh noise  | 325 | 9.0  | 34 | no  | no  |
| 2/01/2020  | 8:15  | Whoosh whoosh noise  | 320 | 9.0  | 37 | no  | no  |
| 30/05/2019 | 22:00 | Combination whoosh and whine noise   | 325 | 10.0 | 32 | yes | no  |
| 11/07/2019 | 3:00  | Whoosh whoosh noise loud, seems to be more activity from wind farm during early hours.   | 313 | 10.0 | 34 | no  | no  |
| 21/06/2019 | 8:30  | Whoosh whoosh noise  | 307 | 10.0 | 39 | yes | no  |
| 27/12/2019 | 8:00  | Whoosh whoosh noise  | 302 | 10.0 | 38 | yes | no  |
| 29/09/2019 | 21:20 | Whoosh whoosh noise  | 296 | 10.0 | 31 | no  | no  |
| 13/07/2019 | 4:00  | combination roar and whoosh (loud)   | 318 | 11.0 | 36 | no  | yes |
| 25/05/2019 | 22:00 | Slicing through air noise  | 308 | 11.0 | 32 | yes | no  |
| 26/11/2019 | 23:00 | Blades slicing through air   | 304 | 11.0 | 26 | yes | no  |
| 5/12/2019  | 23:25 | Whoosh whoosh noise  | 302 | 11.0 | 31 | yes | no  |

### 10.3 Comments

Many of the complaints arise at times of relatively low wind farm noise levels - ones which are below the compliance noise limit individually. There are several instances where markedly higher sound levels are present, such as on 26 February and 5 March. It is likely that much of this noise is ambient wind noise, as the description of the complaints are similar to those where total noise levels are 10 – 20 decibels lower.

However in some cases, indicated by shading, the individual 10-minute periods are higher than the noise limit for the relevant wind conditions.

A number of complaints coincide with periods where some of the nearby turbines are starting or stopping in response to local wind conditions, and this is likely responsible for particularly audible sound.

In one instance -- 28 August -- the complaint indicates a notably different noise character which may have been associated with maintenance issues.

As a general comment, neither the objective nor the complaints records indicate a significant difference in the level or the character of the turbine noise output, aside from occasional spurious issues which appear to be addressed in regular maintenance.

## Calibration certificates

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Calibration, Sales & Service of Audiological and Acoustical Equipment

**TEST REPORT FOR A SOUND LEVEL METER - PERIODIC TESTS: SO012835-1407102**

TRH SERVICES LTD  
C/O 138 Benmore Ave  
Cloverlea  
Palmerston North

**Job Number:** SO012835-1407102      **Date of report:** 19 May, 2020

**Measurement Procedure:** The above instrument was tested using ECS procedure ECSP10 and to the requirements of IEC 61672-3:2006 Electroacoustics - Sound Level Meters - Part 3: Periodic Tests. The laboratory is accredited for compliance to ISO/IEC 17025. All tests and measurements reported here are traceable to New Zealand and Australian National Standards. Measurement results reported are traceable to SI units via recognised National Standards.

**Item tested:**

|                           |  |        |                           |
|---------------------------|--|--------|---------------------------|
| <b>Sound Level Meter:</b> | Norsonic   | Nor140 | <b>Serial No:</b> 1407102 |
| Designation:              | Class: 1   |        |                           |
| Firmware version:         | 4.0.1120   |        |                           |
| Microphone:               | Norsonic   | 1227   | Serial No: 151749         |
| Applied data:             | Body - Norsonic, Nor140. Windscreen - Default, Flat  |        |                           |
| Notes:                    | Fitted a new set of batteries as none were supplied. |        |                           |
| Date of test:             | 19 May, 2020   |        |                           |
| Tested by:                | RJ   |        |                           |


**Ambient conditions at the time of tests:**


Temperature: 23.0 °C      Humidity: 48 %RH      Atmospheric pressure: 1016.5hPa

| Tests Performed:                | Clause | Result |
|---------------------------------|--------|--------|
| Absolute Calibration            | 9      | Pass   |
| Acoustical Frequency Weighting  | 11     | Pass   |
| Self Generated Noise            | 10.1   | Pass   |
| Electrical Noise                | 10.2   | Pass   |
| Electrical Frequency Weightings | 12     | Pass   |
| Frequency and Time Weightings   | 13     | Pass   |
| Reference Level Linearity       | 14     | Pass   |
| Toneburst                       | 16     | Pass   |
| Peak C Sound Level              | 17     | Pass   |
| Overload Indicator              | 18     | Pass   |

**Result:** Passed all tests.

**Statement of Compliance:** The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent organisation responsible for approving the results of pattern evaluation tests performed in accordance with IES 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC61672-1:2002.

()  
Robert Jaques  
Authorised IANZ signatory

()  
Alex Dalay  
Report checked

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Calibration, Sales & Service of Audiological and Acoustical Equipment

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**MICROPHONE CALIBRATION CERTIFICATE**

19 May 2020

**Job No:** SO012835-151749

TRH Services Ltd  
C/O 138 Benmore Ave  
Cloverlea  
Palmerston North

**IANZ Accredited Laboratory 537**

Measurement results reported are traceable to SI units via recognised National Standards.  
Tested using ECS procedure; Proc\_Microphone\_Calibration.

**Test Date:** 19 May 2020      **Type:** Norsonic 1227      **Serial No:** 151749

**Ambient Temperature:** 23°C ± 1°C      **Ambient Pressure:** 1021.5 hPa

**Visual Check:**      OK

Comments:      -

**Open Circuit Sensitivity by Insert Voltage Method:** OK

Value: -27.24 dB re 1 volt/Pa (43.44 mV/Pa) at **1000.0 Hz**

**Reference Calibrator:** Bruel and Kjaer Type 4226 **Serial No:** 2623634

Uncertainty in this result is estimated to be ±0.06 dB with a confidence level of 95% using a coverage factor of 2.02.

**Relative Frequency Response (Electrostatic Actuator):** OK

See attached plot of the pressure response of the microphone.

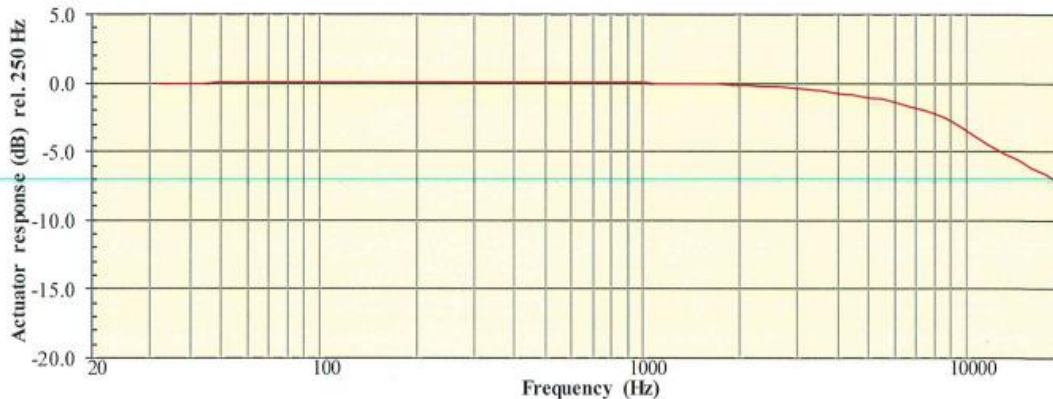
Test performed by:

*R Jaques*  
R Jaques (IANZ Signatory)

Checked and approved:

*A Dalay*  
A Dalay

— Norsonic 1227 / 151749



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Calibration, Sales & Service of Audiological and Acoustical Equipment

**ACOUSTIC CALIBRATOR CALIBRATION CERTIFICATE**

19 May 2020

TRH Services Ltd  
C/O 138 Benmore Ave  
Cloverlea  
Palmerston North

**IANZ Accredited Laboratory 537**

|                          |               |                            |
|--------------------------|---------------|----------------------------|
| Make: Norsonic           | Type: Nor1256 | Serial No: 125626090       |
| Date Tested: 19 May 2020 | By: RJ        | Job No: SO012835-125626090 |

A measurement of the output sound pressure level of the calibrator was made by the insert voltage method, using a microphone of known sensitivity. Testing has been conducted in accordance with IEC60942 (2017) Annex B - Periodic Verification Tests. Tested using ECS procedure; Proc\_Sound\_Calibrators.

**Results**

Measurement results reported are traceable to SI units via recognised National Standards.

**Reference Microphone:** Bruel & Kjaer 4134      **Serial No:** 1094890 fitted with protection grid.

**Ambient Temperature:** 23.0°C ± 1°C      **Ambient Pressure:** 1021.5 hPa

Calibrator frequency was **251.2**Hz on the 250Hz setting  
Calibrator frequency was **1000.0**Hz on the 1kHz setting  
Distortion was **0.26** % THD+N on the 250Hz setting @114dB  
Distortion was **0.21** % THD+N on the 1kHz setting @114dB

The sound pressure level measured **94.04** dBSPL re 20 µPa on the 250 Hz @ 94dB setting.  
The sound pressure level measured **114.03** dBSPL re 20 µPa on the 250 Hz @ 114dB setting.  
The sound pressure level measured **94.12** dBSPL re 20 µPa on the 1 kHz @ 94dB setting.  
The sound pressure level measured **114.09** dBSPL re 20 µPa on the 1 kHz @ 114dB setting.

The expanded uncertainty was calculated using a coverage factor of 2.04 and is estimated to be ±0.06 dB with a confidence level of 95%. The sound calibrator was tested with the ½ inch aperture.

The sound calibrator was tested against Class 1 tolerance limits of the standard and has been shown to meet periodic verification criteria described in IEC60942:2017 for the sound pressure level(s), distortion and frequency(ies) stated, for the environmental conditions under which tests were performed.

**Note 1:** The manufacturer of this model of calibrator does not claim type approval conformance to IEC60942 (2017 edition) as it was manufactured before this standard was written.

  
(Robert Jaques)  
Authorised IANZ signatory

  
(Alex Dalay)  
Report Checked

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