BEFORE THE HEARING COMMISSIONERS
AT PALMERSTON NORTH

IN THE MATTER	of the Resource Management Act 1991 (**the Act**)
AND	
IN THE MATTER	of a review by **PALMERSTON NORTH CITY COUNCIL** of the conditions of consent for Te Rere Hau Windfarm under section 128 of the Act

JOINT STATEMENT OF ACOUSTIC EXPERTS FOR NEW ZEALAND WINDFARMS LIMITED AND PALMERSTON NORTH CITY COUNCIL 8 SEPTEMBER 2017

INTRODUCTION

1. This joint statement has been prepared by Miklin Halstead of Marshall Day Acoustics and Dr Stephen Chiles of Chiles Ltd, as acoustic experts engaged by New Zealand Windfarms Limited ("**NZWL**"); and Nigel Lloyd of Acousafe Limited and Tom Evans of Resonate Consultants Pty Limited, as acoustic experts engaged by Palmerston North City Council ("**PNCC**") respectively.

2. Expert conferencing occurred on 5 September 2017.

3. Miklin Halstead is an Associate with Marshall Day Acoustics Limited. He holds a Bachelors degree in Industrial Engineering from The University of Washington, USA; He has 26 years experience assessing and advising on the environmental sound effects of various projects, including wind farms, gas production plants, electricity substations and roading projects for industrial and public sector clients; his experience with wind farms includes consenting and/or compliance measurements for Te Apiti, Tararua 3, Te Rere Hau, West Wind, Waitahora wind farms, and research on propagation of wind turbine noise; and he served as Chair of the NZS6801-6802 (noise measurement and assessment standards) revision committee, and was a member of the NZS6808:2010 (wind farm noise) standard revision committee.

4. Stephen Chiles holds Doctor of Philosophy and Bachelor of Engineering degrees in acoustics and has been employed in acoustics since 1996. He has made assessments and measurements of sound from many wind farms, including both large utility scale wind farms and smaller wind farms. He was chair for the 2010 revision of the New Zealand wind farm noise standard (NZS 6808) and is Convener of the New Zealand Industry Reference Group for the committee responsible for approximately 200 published 'ISO' standards relating to acoustics. He is a Chartered Professional Engineer and Fellow of the UK Institute of Acoustics.

5. Nigel Lloyd has been an acoustic consultant with Acousafe Consulting & Engineering Ltd since 1985. He holds a degree in Mechanical Engineering from the University of Wales received in 1976. His previous work experience includes five years as the noise control engineer with the New Zealand Department of Labour and three years with the Industrial Acoustics Company in the United Kingdom. He assisted various Councils with noise reviews of information for different wind farms including Westwind, Mill Creek, Tararua 3, Turitea, Motorimu, Mahinerangi, Waitahora as well as others. He advised the Council Reporting Officer on noise matters during the consent hearing for the original Te Rere Hau wind farm and Tararua District Council for the eastern extension of Te Rere Hau wind farm.

6. Tom Evans is an Associate Director with Resonate Consultants Pty Ltd. He holds a bachelor degree in Mechatronic Engineering from the University of Adelaide, graduating with first class honours. He has 11 years of experience in the field of environmental noise, including assessments of wind farm noise, transport noise, industrial noise and

construction and demolition noise. He has provided advice and undertaken assessments of many wind farm projects, including Macarthur Wind Farm, Oaklands Hill Wind Farm and the Hallett Wind Farms in Australia, and Burgos Wind Farm in the Philippines. He has authored and co-authored a number of technical papers in the field of wind farm noise, including papers on noise prediction accuracy, tonality and amplitude modulation.

7. The acoustic experts confirm that they have read the Environment Court's Code of Conduct for Expert Witnesses and agree to comply with their terms. Our qualifications as experts are set out above. We confirm that the issues addressed in this statement are within our areas of expertise. We have not omitted to consider any material facts known to us that might alter or detract from the opinions expressed.

SCOPE

8. This joint statement covers the proposed wording of consent conditions relating to noise for Te Rere Hau Wind Farm **(TRH)** as follows:

   (a) Matters of agreement;
   (b) Matters of disagreement;
   (c) Suggested changes to Conditions.

9. Reference to the Conditions of Consent relate to the version presented in Attachment 1 to the evidence of Mr Low, which includes suggested changes by NZWL in addition to the original wording and subsequent proposed changes by PNCC.

MATTERS OF AGREEMENT

10. It was agreed that the following conditions were acceptable as written in the attachment of Mr Low, without further adjustment except as noted:

    (a) Condition 2;

    (b) condition 3 (but with a comment that in principle the updated version of standards and references to measurement metrics referenced in the current District Plan is normally preferable);

    (c) condition 5;

    (d) condition 6;

    (e) condition 7, including all sub-sections;

    (f) condition 8, 8.1 and 8.3 (but not 8.2, 8.4 or 8.5);

    (g) condition 9;

(h) condition 10 in its entirety, subject to review of rewording of condition 10.7 by Mr Halstead as shown in "suggested changes to conditions";

(i) condition 11;

(j) conditions 12, including 12.1, 12.2, 12.3, 12.5 and 12.6, subject to rewording as discussed in "Suggested Changes to Conditions"; but not 12.4.

11. While accepting the veracity of the conditions as listed above, Dr Chiles considers some of the provisions are unnecessarily prescriptive.

MATTERS OF DISAGREEMENT

12. Several conditions contained matters of disagreement as noted below. The issues causing disagreement include:

(a) The wind speed up to which the High Amenity noise limit described in Condition 4 applies;

(b) the method by which amplitude modulation (AM) is assessed (condition 8.2);

(c) the way that penalties due to special audible characteristics are averaged within the entire data set (condition 8.5);

(d) the inclusion of a sound power level compliance criterion for Stage 4 turbines.

High amenity limit wind speed threshold (condition 4)

13. Condition 4 contains a number of changes proposed by PNCC and NZWL which were accepted by all noise experts.

14. Additionally, all experts agreed that the text "*and where the difference between operational and background noise levels is greater than 8 dB(A) in accordance with Section C5.3.1 of NZS 6808:2010*" should be removed, as it does not correctly apply the test described in that section of the standard.

15. The experts disagreed on whether the wind speed threshold described in the second paragraph should be 6 m/s (preferred by Messrs Halstead and Chiles) or 8 m/s (preferred by Messrs Lloyd and Evans).

16. Additionally, Messrs Halstead and Chiles disagreed that a high amenity noise limit was warranted for this area on technical grounds.

17. The reasons for their separate views are those expressed in their respective statements of evidence.

Assessment of amplitude modulation (condition 8.2)

18. Condition 8.2 proposes to use the UK Institute of Acoustics AM metric, and apply a penalty as described in the UK Department of Environment and Climate Change Wind Turbine AM Review – Phase 2 Report. NZWL proposes to replace this method with the Interim Method as described in NZS6808:2010

19. Messrs Halstead and Chiles consider that the method proposed by PNCC is not sufficiently tested in field situations, particularly in NZ or Australia, and that in the absence of such positive field experience the method described in NZS6808:2010 is more prudent.

20. Mr Evans acknowledges uncertainty about what result the application of the UK methodology may bring, but does not consider this a reason not to apply it. He states that NZS 6808:2010 is clear that it only provides an interim methodology for the assessment of AM, that should be replaced by more robust methodologies, and that the level of review and research that has gone into the development of the UK methodology is significant and he considers it to fulfil this requirement.

21. Mr Lloyd has not applied the UK methodology and relies on Mr Evans' experience with respect to its application and appropriateness.

Averaging of special audible characteristic penalties (condition 8.5)

22. Condition 8.5 seeks to apply a penalty to a wind speed / wind direction bin of measurement points, equivalent to the arithmetic average of the penalised data points when this comprises more than 10% of the points in the bin.

23. Messrs Halstead and Chiles oppose this application of a blanket penalty, preferring instead that the data points in the bin each receive a penalty based on their individual special audible character. They consider that this allows the bin to be penalised in proportion to the frequency of occurrence of the penalisable sound.

24. Mr Evans supports the condition as written, for the reasons described in his statement of evidence. In particular, he considers it to provide a more accurate representation of the potential annoyance arising from intermittently occurring characteristics.

25. Mr Lloyd is of the opinion that the Windflow 500 turbines generate significant tones when assessed close to the turbines and, knowing this, it is important to provide appropriate protection against the wind farm noise using the precautionary principle. There is considerably difficulty in determining the times and conditions that these tones become manifest at the receiver locations (dwellings). The condition recognizes the adverse impacts likely to be caused by the presence of tonality and applies an appropriate penalty.

Inclusion of sound power level compliance criterion (condition 12.4)

26. Condition 12.4 seeks to impose a requirement that Stage 4 turbines, once installed, are shown to produce sound power levels not exceeding that described in the prediction stage of the pre-construction acoustic assessment.

27. Messrs Halstead and Chiles consider that the sound power level of the turbines are contractual matters between the developer and the turbine supplier, and is not relevant to the assessment of compliance. Rather, the assessment of compliance is appropriately made by measurement of noise levels at noise sensitive locations as provided for in Condition 12.5. They agree however that sound power level should be submitted prior to installation to demonstrate that compliance should be achieved.

28. Mr Evans supports the inclusion of the condition, saying,

> "In this circumstance, and particularly given the history of the site, I consider this condition worthwhile. Given the 12-month timeframe between the commencement of operation and the submission of a compliance assessment, this provides a simpler method of addressing issues should they arise. I also note it addresses the requirement of 9.8.6 of the District Plan that there be safeguards regarding compliance with stated wind turbine noise emission levels.
> I note that there is no specific requirement for evidence to be provided to PNCC that compliance has been achieved with this condition. It may be worthwhile considering inclusion of a requirement for test reports for a certain number of newly installed WTGs, say 2-3, to be provided to PNCC that could be considered to demonstrate compliance with this Condition."

29. Mr Lloyd agrees with Mr Evans because the WTGs generate significantly greater noise levels than were predicted in the original AEE. If this was to be repeated during the Stage 4 installation then this condition would allow the higher noise emissions to be quickly identified allowing mitigation or removal of the offending WTG(s) to occur.

SUGGESTED CHANGES TO CONDITIONS

30. In first column of the following tables, all formatting is presented as in the attachment to Mr Low's evidence, with Mr Low's changes shown in red text and PNCC's changes shown highlighted in blue. Changes suggested as agreed by this group of experts are shown in green text (or deletions by ~~green strikethrough~~) Other columns indicate the final preferred wording of the indicated noise experts, as agreed or disagreed during conferencing.

31. Condition 4 is proposed to read as follows, except we note that the selection of 6 or 8 m/s is still a matter of disagreement.

Condition as in Mr Low Evidence and with agreed changes	**Condition preferred by Halstead/Chiles**	**Condition preferred by Evans/Lloyd**
4. The wind farm shall operate such that when measured within the notional boundary of any residential dwelling ~~For residences~~ in existence at the time this consent was granted on 30 May 2005 that is ~~are~~ within the Rural Residential Overlay mapped in the Palmerston North District Plan as notified in Plan Change 15, ~~the wind farm shall operate such that~~ wind farm noise does not exceed the greater of: 4.1 35 dB(A); OR 4.2 The background noise level plus 5 dB(A). This condition only applies twelve months after the conditions have been amended pursuant to PNCC's review under RMA, s 128(1)(c), from 7pm to 7am ~~during evening and night time~~, up to a hub height wind speed of 6 ~~8~~ m/s ~~and where the difference between operational and background noise levels is greater than 8 dB(A) in accordance with Section C5.3.1 of NZS 6808:2010~~, otherwise condition 5 applies. This condition does not apply to any property owned by the Consent Holder, or which has a covenant in favour of the Consent Holder, or is owned by a home owner who has confirmed in writing that they consent to this condition not applying to their dwelling.	4. The wind farm shall operate such that when measured within the notional boundary of any residential dwelling in existence at the time this consent was granted on 30 May 2005 that is within the Rural Residential Overlay mapped in the Palmerston North District Plan as notified in Plan Change 15, wind farm noise does not exceed the greater of: 4.1 35 dB(A); OR 4.2 The background noise level plus 5 dB(A). This condition only applies twelve months after the conditions have been amended pursuant to PNCC's review under RMA, s 128(1)(c), from 7pm to 7am, up to a hub height wind speed of 6 m/s, otherwise condition 5 applies. This condition does not apply to any property owned by the Consent Holder, or which has a covenant in favour of the Consent Holder, or is owned by a home owner who has confirmed in writing that they consent to this condition not applying to their dwelling.	4. The wind farm shall operate such that when measured within the notional boundary of any residential dwelling in existence at the time this consent was granted on 30 May 2005 that is within the Rural Residential Overlay mapped in the Palmerston North District Plan as notified in Plan Change 15, wind farm noise does not exceed the greater of: 4.1 35 dB(A); OR 4.2 The background noise level plus 5 dB(A). This condition only applies twelve months after the conditions have been amended pursuant to PNCC's review under RMA, s 128(1)(c), from 7pm to 7am, up to a hub height wind speed of 8 m/s, otherwise condition 5 applies. This condition does not apply to any property owned by the Consent Holder, or which has a covenant in favour of the Consent Holder, or is owned by a home owner who has confirmed in writing that they consent to this condition not applying to their dwelling.

32. Agreement on Condition 8.2 is still a matter of disagreement. The preferred conditions are as follows.

Condition as in Mr Low Evidence	Condition preferred by Halstead/Chiles	Condition preferred by Evans/Lloyd
8.2 "If the AM threshold described in NZS6808:2010 B3.2 Interim Test Method are exceeded on a regular basis, an adjustment of +5 dB shall be applied to the wind farm sound level at that location for the wind conditions under which the modulation occurs." ~~If average amplitude modulation exceeding 3 dB is detected for any 10-minute period in accordance with the UK Institute of Acoustics amplitude modulation metric, then a penalty shall be applied to that 10-minute period in accordance with the penalty scheme detailed in the UK Department of Environment and Climate Change Wind Turbine AM Review – Phase 2 Report dated August 2016~~;	8.2 If the AM thresholds described in NZS6808:2010 B3.2 Interim Test Method are exceeded on a regular basis, an adjustment of +5 dB shall be applied to the wind farm sound level at that location for the wind conditions under which the modulation occurs.	8.2 If average amplitude modulation exceeding 3 dB is detected for any 10-minute period in accordance with the UK Institute of Acoustics amplitude modulation metric, then a penalty shall be applied to that 10-minute period in accordance with the penalty scheme detailed in the UK Department of Environment and Climate Change Wind Turbine AM Review – Phase 2 Report dated August 2016;

33. Agreement on Condition 8.5 is still a matter of disagreement, and the need for Condition 8.4 depends on the presence of Condition 8.5. The preferred conditions are as follows.

Condition as in Mr Low Evidence	Condition preferred by Halstead/Chiles	Condition preferred by Evans/Lloyd
8.4 If less than 10% of the data points within a 1 m/s-wind speed bin attract a penalty, then the 10-minute data points, including penalty, shall be included in the data for the assessment of the overall noise level; ~~8.5 If 10% or more of the data points within a 1 m/s-wide wind speed bin attract a penalty, then the arithmetic average penalty for those penalised data points shall be determined and applied to the overall measured wind farm noise level for that wind speed.~~	[Conditions 8.4 and 8.5 deleted]	8.4 If less than 10% of the data points within a 1 m/s-wind speed bin attract a penalty, then the 10-minute data points, including penalty, shall be included in the data for the assessment of the overall noise level; 8.5 If 10% or more of the data points within a 1 m/s-wide wind speed bin attract a penalty, then the arithmetic average penalty for those penalised data points shall be determined and applied to the overall measured wind farm noise level for that wind speed.

34. Condition 10.7 is proposed to be reworded as follows:

Condition as in Mr Low Evidence and with agreed changes
10.7 If any mitigation measures are identified within the compliance noise monitoring report, then evidence shall be provided that these measures have been applied at all times of day, unless justification is provided within the compliance noise monitoring report as to why the mitigation measures should be limited to specific times of day. This is not intended to suggest that mitigations required in order to meet the high amenity noise limit should also be applied during hours when that limit does not apply.

35. Condition 12 is proposed to be reworded as follows:

Condition as in Mr Low Evidence and with agreed changes
12 Prior to the installation of any ~~new~~ WTG at the site beyond the 65 already constructed as at 1 November 2016:

36. Condition 12.3.2 is proposed to be reworded as follows:

Condition as in Mr Low Evidence and with agreed changes
12.3.2 Provide evidence supporting the assumed sound power levels for the ~~new~~ Stage 4 WTGs. This should include sound power test data for the WTGs. Sound power levels are to be measured in accordance with IEC 61400-11:2012;

37. No agreement has been reached on Condition 12.4. Mr Lloyd seeks that the condition be retained with the additional words added as follows, with the additional comment that conditions 12.4 onwards may need to be renumbered starting "Condition 13", to separate post-construction requirements from pre-construction requirements:

Condition as in Mr Low Evidence	**Condition preferred by Halstead/Chiles**	**Condition preferred by Evans/Lloyd**
~~12.4. When installed, the new WTGs must not exceed (allowing for measurement uncertainty) the sound power levels stated in the acoustic assessment at 12.3. Sound power levels are to be measured and measurement uncertainty is to be quantified in accordance with IEC 61400-11 Edition 3.~~	[Condition deleted]	13 A Stage 4 sound power monitoring compliance report shall be provided to PNCC within 3 months of installation of additional WTGs. If the installation is itself staged, then a compliance report shall be provided within 3 months of each stage. The compliance report shall present test results from a minimum of 2 WTGs, unless only 1 additional WTG has been installed in which case only that WTG need be tested. PNCC must approve the WTGs selected for testing prior to the commencement of testing.

38. Condition 12.5 is proposed to be reworded as follows, with the additional comment that conditions 12.4 onwards may need to be renumbered starting "Condition 13", to separate post-construction requirements from pre-construction requirements:

Condition as in Mr Low Evidence and with agreed changes
12.5 Following the installation of the additional WTGs, compliance monitoring should be conducted again to demonstrate compliance of the whole site including TRH Extension with conditions 4 – 8 ~~and the compliance monitoring report referred to in condition 10 should be re-submitted to PNCC~~.
12.5A A Stage 4 compliance monitoring report shall be provided to PNCC within 12 months of installation of the additional WTGs which addresses all the matters required of the post review compliance monitoring report in Condition 10. The Stage 4 compliance monitoring report is to be independently peer reviewed by an acoustic expert acceptable to PNCC

Date: 8 September 2017

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Stephen Chiles
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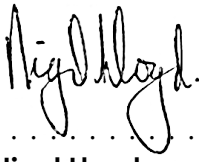

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