

Salt Creek Wind Farm Pty Ltd  
**Salt Creek Wind Farm**  
Independent Review of Noise  
Compliance Test Plan and Post  
Construction Noise Monitoring  
Results

R02

Issue | 30 August 2019

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 263682-00

Arup Pty Ltd ABN 18 000 966 165

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**Peer Review of Noise Reports ARUP**

**MOYNE PLANNING SCHEME**

THIS PLAN IS ENDORSED PURSUANT TO  
PLANNING PERMIT No. **PL06/304.01**  
SUBJECT TO THE CONDITIONS OF THE PERMIT AND  
PROVISIONS OF THE MOYNE PLANNING SCHEME

Delegate: *Michelle Gage* Page 1 to 18 inclusive  
Date: 29/7/2020

**ARUP**

# Document Verification



<b>Job title</b>		Salt Creek Wind Farm		<b>Job number</b>		263682-00		
<b>Document title</b>		Independent Review of Noise Compliance Test Plan and Post Construction Noise Monitoring Results				<b>File reference</b>		
<b>Document ref</b>		R02						
<b>Revision</b>	<b>Date</b>	<b>Filename</b>	0002ReportKAB_DWS_Issue.docx					
Issue	30 Aug 2019	<b>Description</b>	Issue					
			Prepared by	Checked by	Approved by			
		Name	Kym Burgemeister	David Spink	David Spink			
		Signature						
		<b>Filename</b>						
		<b>Description</b>						
			Prepared by	Checked by	Approved by			
		Name						
		Signature						
		<b>Filename</b>						
		<b>Description</b>						
			Prepared by	Checked by	Approved by			
		Name						
		Signature						
<b>Issue Document Verification with Document</b> <input checked="" type="checkbox"/>								

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## Environmental Auditor's Declaration

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This Environmental Auditor's Declaration (Declaration) provides an opinion on the compliance of the Salt Creek Wind Farm to be operated by Salt Creek Wind Farm Pty Ltd (a subsidiary of Tilt Renewables) (the Proponent) with Conditions 12–14 of the Planning Permit PL06/304.01 (the Planning Permit) issued under the Moyne Planning Scheme on 30/6/2016.

The report attached to this Declaration provides a summary of a peer review of the proposed *Noise Compliance Test Plan* (NCTP) and *Post Construction Noise Monitoring Report* (PCNMR) provided by the Proponent for assessment of compliance with Conditions 12 and 14 of the Planning Permit.

### Objective

The Planning Permit does not specifically require that an Environmental Auditor appointed under the *Environment Protection Act 1970* is to be engaged to undertake a review of the proposed methodology and results contained in the NCTP or the PCNMR.

Nevertheless, the Proponent has engaged David Spink, an Environmental Auditor appointed under the *Environment Protection Act 1970*, to undertake this review.

The Declaration and accompanying report has been prepared as specified in the *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria* (DELWP, January 2016) (Guideline).

### Review Process

The Environmental Auditor's opinion on each of these conditions was based on the information provided by the Proponent as noted below, with technical assistance provided by Dr Kym Burgemeister (Audit Specialist Support Team Member, Arup Pty Ltd).

With respect to the Guideline, the audit has been undertaken in a manner and format consistent with the accepted EPA Auditor requirements<sup>1</sup>. The report accompanying the Declaration is consistent with EPA Auditor requirements, and "thorough but concise" as noted in the Guideline.

### Declaration

I, David Spink, declare that I and Dr Kym Burgemeister (Audit Specialist Support Team Member) have reviewed the following reports:

- *Background Noise and Compliance Limit Assessment for The Salt Creek Wind Farm*, GL Garrad Hassan Report 45539/PR/01 Rev B, 23 February 2012.

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<sup>1</sup> *Environmental auditor guidelines for appointment and conduct*, Environmental Protection Authority Victoria, Publication 865.12. December 2016.

- *Salt Creek Wind Farm, Noise Compliance Test Plan for submission to Council, Sonus Pty Ltd Report S5168C2, July 2018.*
- *Salt Creek Wind Farm, Noise Compliance Test Plan, Sonus Pty Ltd Report S5168C2, July 2018.*
- *Salt Creek Wind Farm, Noise Compliance Test Plan, Sonus Pty Ltd Report S5168C2, January 2019.*
- *Salt Creek Wind Farm, Post Construction Noise Monitoring – Interim Results, Sonus Pty Ltd Report S5168C16, June 2019.*
- *Salt Creek Wind Farm, Post Construction Noise Monitoring, Sonus Pty Ltd Report S5168C17, August 2019.*
- *Salt Creek Wind Farm, Post Construction Noise Monitoring, Sonus Pty Ltd Report S5168C18, August 2019.*

and assessed the content of these reports against Conditions 12 and 14 of the Planning Permit, and relevant standards. In particular, the technical assessment was based on compliance with the *New Zealand Standard 6808:2010 Acoustics – Wind Farm Noise* (NZS 6808:2010).

I hereby declare that I am of the opinion that the methodologies and findings contained in these reports complies with the relevant requirements of Conditions 12 and 14 of the Planning Permit. I found the reports to be complete and appropriately applying industry standards, and that the findings can be reasonably relied on for assessment of the performance of the facility.

This determination comes with the following findings and qualifications on the NCTP and the PCNMR, with further details provided in the accompanying report:

**In regard to the NCTP:**

- **Specialist Assessment**

The NCTP has been prepared by Sonus Pty Ltd, a recognised specialist company for undertaking this technical work.

- **Proposed Tests**

The proposed tests are acceptable (refer to Section 4 of attached report), but it is noted Amplitude Modulation testing could also be undertaken adopting the more recent UK Institute of Acoustics Amplitude Modulation Working Group (AMWG) Hybrid Method (August, 2016)<sup>2</sup>.

- **Residential Logging Locations**

Compliance measurements are proposed at 3 locations, shown in the report. I agree that these locations are suitable non stakeholder residential premises for the purposes of assessment of compliance with the Planning

<sup>2</sup> IOA Noise Working Group (*Wind Turbine Noise*) Amplitude Modulation Working Group, *Final Report, A Method for Rating Amplitude Modulation in Wind Turbine Noise*, Version 1, UK Institute of Acoustics, 9 August 2016.

Permit noise requirements. The measurements will be undertaken for 12 months at each location. The proposed approach is in compliance with the requirements of NZS 6808:2010.

- **Measurement and Data Assessment Methodology**

The proposed methodology is consistent with the requirements of NZS6808:2010.

It is noted that Condition 12 b) of the permit introduces an additional requirement to assess compliance based on whether the night-time (10pm–7am) noise limit is exceeded for 10% or more of the night-time period. Sonus has proposed to limit the selection of assessment data to only the 10% of data points collected when the wind direction is closest to downwind (based on the direction of the closest turbine to the noise logger). We believe that this method is reasonable, and in-keeping with the intent of Condition 12 b). It is likely to result in more reasonable objective measurement of compliance against Condition 12 b).

In terms of testing for Special Audible Characteristics (SACs), tonality testing is proposed only if the Stage 1 (near-field) or Stage 2 (intermediate screening) tests demonstrate tonality. Amplitude Modulation (AM) testing will be undertaken at the residences. The proposed approaches are acceptable.

The proposed timing of the commissioning and associated reporting complies with the requirements of the Planning Permit.

**In regard to the PCNMR:**

- **Specialist Assessment**

The PCNMR has been undertaken by Sonus Pty Ltd (Sonus), a recognised specialist company for undertaking this technical work.

- **Monitoring Program**

The monitoring program has been undertaken in compliance with the NCTP, and NZS 6808:2010. The three monitoring locations (H1, H6, H8) are considered to be appropriate.

The sound monitoring equipment used was appropriate for use, and within calibration.

- **Overall Assessment of Compliance**

Review of the PCNMR indicates that the assessment has been prepared considering the requirements of NZS 6808:2010, particularly the necessary details of *S8.3 Compliance Assessment*.

The primary measurements at the three locations (H1, H6, H8) indicate that the wind farm sound levels comply with the noise criteria, except for during the night-time period at H6 for wind speed of 11-13 m/s.

- **Assessment of Compliance at Location H6**

The following is noted in regard to the compliance issue at location H6:

- A slightly different location was used for the post monitoring compared with the background monitoring, at the request of the residents at H6. The monitoring location was closer to the nearest turbine than for the background monitoring.
- It was suspected by Sonus that the current background noise at H6 may generally be higher than when the background noise assessment was undertaken (circa 2011-12), due to increased growth of local vegetation.
- Measurements in the near-field of the turbines supported the likely influence of current higher background noise levels at H6, rather than due to noise from the turbines.
- This assumption was further tested using an additional “on-off” methodology (allowed under NZS 6808:2010), with measurements at H6, and an intermediary position subject to less background noise. These ‘on-off’ tests confirm that compliance of the wind farm noise at H6 at wind speeds of 8, 9 and 10 m/s, but again compliance was not able to be positively demonstrated at wind speeds of 11–13 m/s due to environmental conditions on the night of testing.
- Three methods overall were used to assess the data (all allowed under NZS 6808:2010), and all indicated that the noise levels at H6 demonstrate compliance below 11 m/s. Two of the three methods indicated that compliance with applicable criteria between 11–13 m/s. The third method indicated that the measured level at H6 is likely to be influenced by background noise levels; however, was not able to positively demonstrate compliance between 11–13 m/s.

In summary, it is agreed that the slight exceedance of the noise criteria at H6 for the night-time period under higher wind velocities (ie 11–13 m/s) is likely due to influence of the background noise, rather than the wind farm.

- **Influence of special audible characteristics**

- The methods used for assessment of tonality and Amplitude Modulation (AM) are consistent with NZS 6808:2010.
- An approach using near-field and intermediate locations was adopted due to the significant influence of background noise at the receiver locations. The assessment indicated that tonality is not considered to be significant. This approach is likely to be conservative, and therefore the results are acceptable (they indicate very little penalty).

- It is noted that the assessment indicates relatively low levels of AM, with no penalties.

DATED: 30 August 2019

Signed:



David Spink  
Environmental Auditor (Appointed pursuant to the *Environment Protection Act 1970*)



## 1 Introduction

Salt Creek Farm Pty Ltd (a subsidiary of Tilt Renewables) (the Proponent) has constructed the Salt Creek Farm project in Victoria. The Salt Creek Wind Farm has been subject to an environmental assessment and approvals process, and was granted a Planning Permit by the Moyne Shire Council (Permit No. PL06/304.1) issued under the Moyne Planning Scheme on 29/02/2016).

In respect of noise, the Planning Permits states:

*12. The operation of the wind energy facility must comply with the New Zealand Standard 6808:2010 Acoustics – Wind Farm Noise (the standard) in relation to any occupied dwellings existing on the land (other than the site) at 8 May 2007, to the satisfaction of the Responsible Authority. In determining compliance with the standard, the following requirements apply:*

*a) The sound level from the wind energy facility, when measured outdoors within 10 metres of a dwelling at any relevant nominated wind speed, must not exceed the background level ([L90] by more than 5dBA or a level of 40dBA L90, whichever is the greater.*

*b) Compliance at night must be separately assessed with regard to night time data. For these purposes the night is defined as 10.00pm to 7.00am. For sleep protection purposes, a breach of the standard set out at Condition 12a), for 10% of the night, amounts to a breach of the condition.*

*c) Where special audible characteristics, including tonality, impulsive sound or enhanced amplitude modulation occur, as assessed in accordance with Appendix B of the standard, the noise limit will be modified by applying a penalty of up to +6dB L90 in accordance with Section 5.4 of the standard.*

*This condition does not apply if the operator of the wind energy facility has entered into an agreement with the landowner under which the landowner acknowledges and accepts that the noise standards in this condition may be exceeded at the landowner's dwelling(s). Evidence of this agreement must be provided to the satisfaction of the responsible authority, and must be in a form which runs with the land for the life of the wind energy facility.*

*13. If Condition 12 is determined to have been breached, the Responsible Authority shall notify the wind energy facility operator with a request that steps be taken to rectify the breach, which may include, ascertaining the relevant meteorological circumstances at the time of the breach and requiring the operator to noise optimise the operation of the relevant wind turbine or turbines if such meteorological circumstances occur again. If a further breach is determined to have occurred in similar meteorological circumstances and at the same receptor location, the Responsible Authority shall notify the wind energy facility operator, with a request to selectively reduce or modify the operation of the relevant wind turbine or turbines in such meteorological circumstances. If a third breach occurs in the same meteorological circumstances and at the same receptor location, notwithstanding the procedures outlined above, the Responsible Authority may take further action, as appropriate.*

*14. An independent post-construction noise monitoring program must be commissioned by the proponent within 2 months from the commissioning of the first turbine and continue for 12 months after the commissioning of the last turbine, to the satisfaction of the Responsible Authority. The independent expert must have experience in acoustic measurement and analysis of wind turbine noise. The program must be carried out in accordance with New Zealand Standard 6808:2010 Acoustics - Wind Farm Noise. The permit holder must pay the reasonable costs of the monitoring program.*

The Proponent has engaged Sonus Pty Ltd (Sonus) to prepare a Noise Compliance Test Plan (NCTP) and Post Construction Noise Monitoring Results report (PCNMR) to address Conditions 12 and 14 of the Planning Permit, in particular that the noise levels from the wind energy facility comply with the requirements of the *New Zealand Standard 6808:2010 Acoustics – Wind Farm Noise* (NZS 6806:2010).

Arup Pty Ltd (Arup) has been commissioned by the Proponent to undertake an environmental audit of the NCTP and the PCNMR against the relevant requirements of the Planning Permit and to provide an Environmental Auditor’s Declaration (Declaration). Note that the Declaration addresses both Conditions 12 and 14.

This audit has been undertaken in accordance with the requirements of the Planning Permit, and the *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria* (DELWP, January 2016) (Guideline). The Guideline (page 30) states that the assessment of compliance is to consist of two documents;

- A Declaration by the EPA Appointed Environmental Auditor that the noise assessment meets the requirements of:
  - The appropriate standards;
  - The Guideline (as it relates to noise); and
  - The Planning Permit (or other regulatory instrument).
- A report accompanying the Declaration consistent with EPA Auditor requirements, and “thorough but concise” as noted in the Guideline.

With respect to the Guideline, the audit has been undertaken in a manner and format consistent with the accepted EPA Auditor requirements<sup>3</sup>.

In this report;

- Section 2 provides a summary of the information that has been reviewed.
- Section 3 provides a description of the relevant planning framework and associated standards and guidelines.

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<sup>3</sup> *Environmental auditor guidelines for appointment and conduct*, Environment Protection Authority Victoria, Publication 865.12. December 2016.

- Section 4 provides a technical review of the pre-development noise assessment and proposed NCTP.
- Section 5 provides a technical review of the PCNMR.

## 2 Information Reviewed

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The following project documentation has been reviewed;

- Planning permit PL06/304.01, Moyne Planning Scheme, 29/02/2016
- *Background Noise and Compliance Limit Assessment for The Salt Creek Wind Farm*, GL Garrad Hassan Report 45539/PR/01 Rev B, 23 February 2012.
- *Salt Creek Wind Farm, Noise Compliance Test Plan for submission to Council*, Sonus Pty Ltd Report S5168C2, July 2018.
- *Salt Creek Wind Farm, Noise Compliance Test Plan*, Sonus Pty Ltd Report S5168C2, July 2018.
- *Salt Creek Wind Farm, Noise Compliance Test Plan*, Sonus Pty Ltd Report S5168C2, January 2019.
- *Salt Creek Wind Farm, Post Construction Noise Monitoring – Interim Results*, Sonus Pty Ltd Report S5168C16, June 2019.
- *Salt Creek Wind Farm, Post Construction Noise Monitoring*, Sonus Pty Ltd Report S5168C17, August 2019.
- *Salt Creek Wind Farm, Post Construction Noise Monitoring*, Sonus Pty Ltd Report S5168C18, August 2019.

### 3 Planning Requirements

The planning policy for wind farms in Victoria is given in *Victoria Planning Provisions for Wind Energy Facilities* Clause 52.32<sup>4</sup>. The application of the planning provisions is described in the general *Policy and Planning Guidelines for Development of Wind Energy Facilities in Victoria*<sup>5</sup>.

For the Salt Creek Wind Farm, specific planning conditions are provided in the Planning Permit (Permit No. PL06/304.01) issued under the Moyne Planning Scheme (29/02/2016).

The planning provisions which underlie these planning conditions require the noise assessment for wind farm projects to be undertaken in accordance with NZS 6808:2010<sup>6</sup> (amendment VC78<sup>7</sup>, 15 March 2011) (NZS 6808). This standard has been adopted because it addresses the unique requirements for the prediction, measurement and assessment of sound from wind farms and because the usual measurement and assessment standards adopted in Victoria (such as AS 1055<sup>8</sup> and SEPP N-1<sup>9</sup>) are unsuitable.

There are other standards and guidelines such as AS 4959, the draft National Guidelines<sup>10</sup>, the UK ETSU-R-97<sup>11</sup> and the Annual Report of the National Wind Farm Commissioner<sup>12</sup> that can provide helpful background information and secondary guidance that can also assist with the assessment of projects where the New Zealand Standard does not provide detailed or explicit guidance.

In particular, NZS 6808:2010 states that it does not set limits that provide *absolute* protection for residents from audible wind farm sound, but rather provides guidance on noise limits that are considered *reasonable* for protecting sleep and amenity from wind farm sound at noise sensitive locations.

<sup>4</sup> Victoria Planning Provisions, Wind Energy Facility, Clause 52.32.

<sup>5</sup> *Policy and planning guidelines for development of wind energy facilities in Victoria*, Victoria State Government, January 2016.

<sup>6</sup> New Zealand Standard 6808:2010 *Acoustics – Wind farm noise*, Standards New Zealand, 2010.

<sup>7</sup> Advisory Note 35, Amendment VC 78 Wind energy facility provisions – Clause 52.32, March 2011.

<sup>8</sup> AS 1055.1-1997 *Acoustics - Description and measurement of environmental noise - General procedures*, Standards Australia, 1997.

<sup>9</sup> *State Environment Protection Policy (Control of Noise from Commerce, Industry and Trade) No. N-1*, Victoria Government Gazette No. S31, 1989.

<sup>10</sup> *National Wind Farm Development Guidelines – Draft*, Environment Protection and Heritage Council, July 2010.

<sup>11</sup> *The Assessment and Rating of Noise from Wind Farms*, UK Department of Trade and Industry, ETSU-R-97, September 1996.

<sup>12</sup> *Annual Report to the Parliament of Australia*, Office of the National Wind Farm Commissioner, 31 March, 2017.

## 4 Technical Review – Noise Compliance Test Plan (NCTP)

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The technical review that follows addresses the NCTP in response to the Planning Permit conditions.

The NCTP has been prepared by Sonus in order to document the approach that will be adopted by the project to respond to Conditions 12 and 14 of the Planning Permit.

The NCTP documents separate near field measurements to confirm the modelling input assumptions and intermediate testing to determine the character of the wind farm noise, where necessary.

Nearfield testing would be limited to two (2) turbines, which is appropriate. The proposed sound power compliance measurements will be undertaken in general accordance with IEC61400-11<sup>13</sup>. The nearfield and intermediate testing (undertaken where necessary) will also be used to assess special audible characteristics (SACs).

Compliance measurements are proposed at 3 locations, H1, H8 and H6, as shown in the figure (page 7) of the NCTP report. Due to a change in nomenclature, and as noted in the Sonus report, these proposed locations are the same as locations H3, H12, and H22, adopted previously for noise monitoring in the Background Noise Assessment (GL Garrad Hassan Report 45539/PR/01 Rev B, 23 February 2012).

We agree that these 3 proposed locations are the most critical non-stakeholder dwellings, with H8 being representative of exposure at dwellings within Woorndoo (H9, H11, H12, H13, H14, H15, H16, H17, H18, H19). We are therefore satisfied that additional measurements at H15 and H18, which were measured by GL Garrad Hassan, are not necessary.

The measurements are proposed to be undertaken for 12-months at each location as required by the Planning Permit. The proposed method is in compliance with the requirements of NZS 6808:2010.

Condition 12 b) of the permit introduces an additional requirement to assess compliance based on whether the night-time (10pm–7am) noise limit is exceeded for 10% or more of the night-time period. As noted in the NCTP, there is no accepted standard or procedure for undertaking such an assessment. Furthermore, it has been demonstrated that adopting the simple regression approach recommended in NZ6808:2010 to try and determine compliance with this condition is likely to result in substantial breaches of the 10% night-time noise criterion during ambient conditions (ie even in the absence of any wind-farm sound).

Therefore, in order to avoid any perverse or unintended assessments of non-compliance in relation to this condition, it is necessary to adopt a more

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<sup>13</sup> IEC61400-11 Wind turbine generator systems – Part 11: Acoustic noise measurement techniques.

sophisticated method of measuring compliance. Sonus has proposed to limit the selection of assessment data to only the 10% of data points collected when the wind direction is closest to downwind (based on the direction of the closest turbine to the noise logger). This is in order to ensure that the data points where the contribution of noise from the wind farm is the highest are adopted in the assessment, and that data points where noise levels are most likely to be unrelated to the wind farm are, as far as practicable, excluded from the analysis.

We believe that this method is reasonable, and in-keeping with the intent of Condition 12 b). It is likely to result in more reasonable objective measurement of compliance against Condition 12 b).

Finally, where compliance cannot be positively demonstrated from the standard approaches, it is proposed to adopt 'on-off testing'.

In terms of testing for Special Audible Characteristics (SACs), tonality testing is proposed only if the Stage 1 (near-field) or Stage 2 (intermediate screening) tests demonstrate tonality. Amplitude Modulation (AM) testing will be undertaken at the residences.

The proposed test methodologies are;

- Tonality, in accordance with Appendix B2.2 of NZS6808:2010
- Amplitude Modulation (AM), using *interim test method*, of NZS 6808.

These tests are acceptable, but it is noted AM testing could also be undertaken adopting the more recent UK Institute of Acoustics Amplitude Modulation Working Group (AMWG) Hybrid Method (August, 2016)<sup>14</sup>.

The proposed timing of the commissioning and associated reporting complies with the requirements of the Planning Permit.

<sup>14</sup> IOA Noise Working Group (Wind Turbine Noise) Amplitude Modulation Working Group, Final Report, A Method for Rating Amplitude Modulation in Wind Turbine Noise, Version 1, UK Institute of Acoustics, 9 August 2016.



## 5 Technical Review – Post Construction Noise Monitoring Results (PCNMR)

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Measurements of wind farm noise have been undertaken in accordance with the NCTP (reviewed in Section 4, above) and Condition 12 of the Permit.

The PCNMR report has been prepared considering the requirements of NZS 6808:2010, and provides the necessary details in accordance with *S8.3 Compliance Assessment*, with the exception of a detailed description of the atmospheric conditions in accordance with S8.3(j). That being said, since the measurements have covered a whole year of operation, rather than just the two-week minimum mandated in the standard, the measurements can be expected to cover a wide range of typical seasonal and short-term weather conditions.

The sound monitoring equipment adopted for the measurements is appropriate for use, and was within calibration.

The measurement locations at the dwellings are appropriate, noting that a slightly different location was adopted at H6 at the request of the residents. As noted in the test plan, both near-field and intermediate measurement locations have also been adopted to assist in demonstrating compliance in conditions where the usual ‘at-residence’ measurements have been unable to positively demonstrate compliance due to high background noise levels.

Data analysis approach is reasonable, and reasonably addresses Condition 12 b) to assess night-time noise levels in particular, adopting the methodology developed in the NCTP.

The primary measurements at the residences indicate that wind farm sound levels at H1, H6 and H8 generally comply with the noise criteria, except for during the night-period at H6 at wind speeds of 11–13 m/s. Under these conditions compliance has been able to be determined from the primary measurements. Measurements in the near-field of the turbines (Section 4.2) indicate that this is likely to be due to the influence of high background noise levels at H6, rather than due to noise from the turbines. This assumption is tested further in Section 5 of the PCNMR.

An alternative ‘on-off’ test methodology is therefore adopted in accordance with Section 7.7 of NZS6808:2010. Additional ‘on-off’ measurements were undertaken at the receiver location (H6) where compliance was unable to be positively confirmed, and an intermediary position subject to less background noise. This is similar to the ‘derived point’ approach adopted in Victoria’s industrial noise policy (SEPP N-1<sup>15</sup>)

These ‘on-off’ tests confirm that compliance of the wind farm noise at H6 at wind speeds of 8, 9 and 10 m/s, but again compliance was not able to be positively demonstrated at wind speeds of 11–13 m/s due to environmental conditions on the night of testing. The ‘on-off’ tests have also been used to provide a good estimate

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<sup>15</sup> State Environment Protection Policy (Control of Noise from Industry, Commerce and Trade) No. N-1., 1989.

of the sound level difference between the intermediate and ‘at-residence’ locations (4 dB), which can be applied later to help demonstrate compliance.

Three separate alternative methods have therefore been adopted to demonstrate compliance at H6 between 11–13 m/s;

1. Overlaying the wind farm sound level curve measured in the near-field of the turbine (in Section 4.2 of the PCNMR) onto the noise levels measured at H6 at 8, 9 and 10 m/s to extrapolate expected wind farm levels at 11, 12 and 13 m/s (Section 6.1, Figure 7).
2. Re-correlating measurement data from H6 that excludes data which is higher at H6 than the ‘derived’ level calculated from the intermediate location minus the measured propagation loss (4 dB) for the same time periods (Section 6.2). This indicates the measured level at H6 is likely to be corrupted by background noise from other sources, and
3. Applying the measured propagation loss to the intermediary measurements of wind turbine sound levels to estimate the level at the H6 receiver thereby minimising the influence of the background noise at H6.

Alternative methods (1) and (3) above both indicate that the wind turbine noise level at the H6 residence complies with the criteria at 11–13 m/s.

Method (2) results in so few unexcluded data-pairs that it is unable to be used to positively demonstrate compliance at H6 between 11–13 m/s, but does show compliance at lower wind speeds, and serves to reinforce the fact that noise levels measured directly at H6 are largely influenced by background noise, rather than noise from the wind farm.

Special audible characteristics of tonality and Amplitude Modulation (AM) are examined in Section 7 of the report. The methods adopted for analysis of tonality and AM are in accordance with the requirements of the New Zealand Standard and are acceptable.

Again, due to the significant influence of background noise at the actual receiver locations, the approach adopted has been to analyse tonality in both the near-field and intermediate locations, and use those results to infer compliance at the receiver location. This approach is expected to be conservative, since relatively high ambient and background noise at the receiver locations is likely to further mask tonality of wind farm sound. This approach is therefore acceptable.

The tonality measurements at the intermediate locations at H1 and H6 identify 27 and 2 occurrences of tonality respectively, but, when penalised, the tonal periods do not result in any significant change to the overall wind farm sound correlation curve. This indicates that tonality, where it does occur, is relatively rare, and is not considered to be significant.

The test for amplitude modulation shows relatively low levels of amplitude modulation in the wind farm noise measurements, which do not exceed the limits given in the test. No penalties for AM are therefore required.



The report demonstrates that independent post-construction monitoring has been undertaken in accordance with Condition 14. We are satisfied that Sonus Pty Ltd has relevant experience in acoustic measurement and analysis of wind turbine noise, and the programme of noise measurement has been carried out in accordance with NZS6808:2010.

The report and measurements therefore demonstrate that the sound from the Salt Creek Wind Farm complies with the requirements of NZS 6808:2010, and therefore meets Conditions 12 and 14 of the Planning Permit.

## 6 Conclusion

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The NCTP that has been prepared outlines a methodology that is in compliance with the requirements of Conditions 12 and 14 of the Planning Permit No. PL06/304.01.

The wind farm noise measurements documented in the PCNMR report have been undertaken in accordance with the requirements of Condition 14, and indicate that the wind farm noise emissions are in compliance with the requirements of Condition 12, that is, that the noise emissions from the facility have been demonstrated to comply with NZS 6808:2010.