LAND COURT OF QUEENSLAND

REGISTRY: Brisbane

NUMBER:

Applicant:	**New Acland Coal Pty Ltd CAN 081 022 380**
	AND
Respondents:	**Frank Ashman & Ors**
	AND
Statutory Party:	**Chief Executive, Department of Environment and Heritage Protection**

ADDITIONAL REPORT

Noise monitoring during Court inspection

1 June 2016

Prepared for the Land Court of Queensland by:

Mr John Savery, advising Respondent objector, Oakey Coal Action Alliance

1 INTRODUCTION

1 I refer to my joint expert report with Mr Elkin dated 22 February 2016 and to my further statement of evidence dated 24 March 2016 in this matter (further statement).

2 This additional report is in relation to noise monitoring conducted by NAC at the Acland monitoring site during the Court night inspection of the existing mine and surrounding area (site inspection).

3 I have been engaged as an expert witness in this matter by EDO Queensland (EDO), in accordance with the letter attached as Annexure A to my further statement. I understand my duty to the Land Court in accordance with rules 24E to 24I.

4 On 15 April 2016, EDO sent me the site inspection noise data and reports that NAC provided to the Court that same day. However, I noted that it did not include the spectral frequency data from the relevant monitoring.

5 On 4 May 2016, EDO sent me the relevant spectral data that was provided to the Court the same day.

6 On 10 May 2016, EDO advised me that the Court had indicated that it would be asking the noise experts for an explanation of the site inspection material that NAC had lodged on 15 April 2016. I have prepared this report on that basis.

7 My report on the noise monitoring is based on my review of the following material.

a. Noise data (csv) disclosed by NAC related to noise monitoring conducted at the Acland Sentinex noise monitoring station on the 8th to 10th March, 2016; and
b. Two Sentinex noise level versus time plots (based upon 10 minute samples) dated 2016/03/09 and 2016/03/10.

2 SUMMARY

8 The mine noise was found to be non-compliant with the night noise limit of 40dBA for 2hours 50minutes commencing at 10:00pm on 8th March 2016 when assessed in accordance with the $L_{Aeq\ LF\ 1\ hour}$ levels and the NAC 2 dB rule.

9 The exceedance of the night noise limit of 40dBA occurred for a total of 5hours 20minutes on the night commencing at 10:00pm on 8th March 2016 when the 2dB rule was not applied.

10 The mine noise component of the ambient noise can be clearly identified in the night period

using a one-third octave frequency sonogram, even using the very coarse 10minute long sample duration.

11 The sonogram shows clearly the time when the mine is not operating and when engine noise is a dominant noise contributor. It also shows clearly in the evening and night periods when insect noise is a significant contributor to measured noise levels.

12 No assessment of sleep disturbance against the WHO criteria is possible because the noise monitor does not record any noise data of the form required to assess sleep disturbance in terms of the WHO criteria.

3 ANALYSIS

13 The csv noise data files for 8th and 9th March 2016 were inspected to determine whether the $L_{Aeq\ LF\ 1hour}$ noise levels, assumed by NAC to represent mine noise, exceeded the noise limits at the Acland monitoring location. The inspection showed that:

a. Mine noise was compliant with 50 dBA during the day period (7am to 6pm);
b. Mine noise was compliant with the 45dBA for the evening period (6pm to 10pm); and
c. Mine exceeded the noise limit of 40dBA in the night period from 10:00pm on the 8th March until 1:50am on 9th March, 2016, as well as from 05:30am to 07:00am on 9th March 2016. The exceedance ranged from 1 to 4dB above the 40dB noise limit.

14 If the NAC 2dB rule is applied, $L_{Aeq\ 1\ hour} - L_{Aeq\ LF\ 1\ hour} \leq 2dB$ then the night time noise exceedance occurred for reduced duration as follows: 10:00pm on 8th March until 00:50am on 9th March 2016, i.e. a continuous period of 2 hours 50minutes above the noise limit of 40dBA. Note, I am not endorsing the 2dB rule but simply applying it to reach the conclusion that NAC would reach from analysis of this data.

15 There is no sleep disturbance noise limit specified in the transitional environmental authority noise conditions in terms of the WHO guidelines using $_{max}L_A$ levels. The highest sound levels measured in each 10 minute noise sample during the night period were in the range of 42 to 74dBA with an average maximum level of 56dBA. The source of the maximum levels in each 10 minute noise sample is not known. No conclusions regarding sleep disturbance can therefore be reliably drawn from this data.

16 Two Sentinex noise level versus time plots (based upon 10 minute samples) dated 2016/03/09 and 2016/03/10 were provided which show:

a. the variation of the equivalent continuous noise level (L_{Aeq}) (red trace);
b. the equivalent continuous noise level with a low pass filter below 600Hz ($L_{Aeq\ LF}$) (green trace), and
c. the equivalent continuous noise level in the mining sector (L1-AO) (from the

direction noise monitor)(light blue trace).

17 A Sentinex plot for the period of noise exceedance indicated during the night commencing on the 8th March 2016 was not disclosed by NAC. The two Sentinex plots disclosed by NAC are included as Attachment A to this report.

18 The noise level versus time plots are overlaid with the approved noise limits for each of the standard daily periods from the transitional Environmental Authority for the Stage 2 mining operations, as well as the noise limits proposed by NAC for the proposed Stage 3 operations.

19 Each point on each plot represents a 10 minute logarithmic average of all of the sound energy that occurred within that 10 minute period. No information is provided about how the noise level varied within that 10 minute period, i.e. how the maximum noise level varied over that 10 minute period.

20 The overall level (red) trace and the low frequency (green) trace exceed the existing noise limits on some occasions throughout the forty-eight hour period represented by the noise data.

21 Using the 1 hour assessment period and assuming that the mine noise is the predominant cause of noise in the LF level, then non-compliance with the existing night noise limit is shown at 23:00(green plot) and between 06:00 and 07:00 on the plot dated 2016/03/09. Similar LF levels that are non-compliant are indicated between 22:00 to 00:00 and also 06:00 to 07:00 on the plot dated 2016/03/10.

22 The Sentinex plots illustrate why an assessment period of 1 hour is too long to provide protection to the amenity of sensitive receptors. An assessment period of 1 hour is to long for the assessment of a time varying noise because it allows loud noisy periods to be neutralised by other quiet periods during the one hour assessment (refer to the peaks at 21:00, 1:00 and 4:00 shown on the plot dated 2016/0310 where the overall and $L_{Aeq\ LF}$ levels exceed the noise limit but not for 1 hour).

23 The noise limit of L_{Aeq} 40 dBA at night is too high to provide acoustic amenity protection to the sensitive receptors located at Acland or elsewhere in locations surrounding the mine site. This is because the instantaneous LF noise level is not measured by the monitoring station and is likely to be 5-8dB higher (or more) than the average LF levels. This means that the actual levels are likely to be exceeding the noise limit regularly at sensitive receptor locations but still will achieve compliance with the 40dBA noise limit. The proposed 15 minute assessment duration of the proposed future noise limits is much more suitable for the protection of amenity for sensitive receptors because there is less scope for averaging of excessive levels over the shorter period.

24 The reasons or cause of the noise exceedences of the noise limits shown on the Sentinex plots

are not known from the noise versus time plots alone.

25 Meaning can be provided to the points on the noise plots, however, when the corresponding noise frequency data is also inspected. The best way to obtain an overview of the noise spectral frequency changes with time is by preparation of a sonogram plot. A sonogram plot is a three-dimensional plot of the noise data which has one-third octave frequency bands on the y-axis, the date and time on the x-axis and the noise level in each band as a colour (yellow is generally the highest colour in the sonogram plot shown, being approximately 45dBA).

26 I have prepared a sonogram for the csv data provided for the 8th and 9th of March 2016 (see Attachment B). The sonogram provides a spectral "signature" of the spectral and level variations over each day. The 10 minute data recorded by NAC provides a very coarse sonogram compared to standard sonogram methods when the time samples are generally much shorter in duration (e.g. 1/8sec = FAST, 1s = SLOW, or 1 minute (for very long noise measurements)). In spite of the coarseness of the sample noise data from NAC (10 minutes duration) the sonogram still provides important insights into the noise environment at the Acland sensitive receptor location when the mine is operating.

27 I will point out in the following paragraphs some salient features of the noise environment at the monitoring location that can be gleaned from the sonogram.

28 Firstly, the mine appears to be operating a shift that finishes at approximately 1am and restarts again at approximately 6am (refer to the horizontal scale to identify the approximate time locations). This is shown by the lessening of noise between 1am and 4am and the mainly blue vertical band indicating generally low noise levels between approximately 3am and 4am.

29 In the period from approximately 3am to 4am where there is only a minor contribution from other noise sources, apart from insect noise. This period provides an indication of what the background noise level would be during the quietest part of the night at this location without the contribution from mining noise. The noise level time plot indicates a background noise level with insects included of approximately 35dBA. With insect noise filtered out the level is likely to reduce to approximately 32-33dBA. The background noise level would be lower except for the mechanical noise contribution observed in this quiet period.

30 The low-mid frequency horizontal noise bands in the period between 3am and 4am when the main mining noise is absent, suggests that there is still some mechanical equipment operating at the mine, or at the adjacent dwelling, or at the monitoring station itself. The noise levels are very low but can be seen in the 200-250Hz bands and the 400-500Hz bands. The source of this noise is not known but it is expected to be mechanically sourced noise.

31 The insect noise is the dominant noise level in this period (3am to 4am) and can be seen as the

horizontal band centred upon 4kHz (refer to vertical scale on left hand side of the sonogram). The sound level of the insects in this quiet period is (30-35dBA, green colour on right hand scale).

32 Insect noise is a noticeable source of noise at this location. Insect noise typically occurs in the evening and night at its highest levels, but may be noticeable in a sonogram at other times of the day as well. In this sonogram, insect noise at noticeable levels can be seen in the following one-third octave bands:

- 2.5kHz – commences at approximately 10pm and goes through to 2:30am
- 3.15kHz – commences at approximately 5:30pm, is very loud at 6:45 to 7:30pm, continues until 2:30am, another short burst from 3am to 3:45am
- 4kHz – commences at approximately 5pm and continues through until 5am
- 6.3kHz – appears to be generally continuous from 7am to 9pm
- 10kHz – Short burst of sound at approximately 9:30pm

33 It is not known which insect type is the cause of the noise in each frequency band. It could be multiple insect types as these continuous bands are typical of insect noise from many insect species.

34 It should be noted that the apparent continuous nature of the insect noise may not be actual because the data points are 10 minutes apart; this is why shorter sample periods are generally appropriate when trying to identify noise sources from sonograms. Nevertheless, the insect characteristics shown in this sonogram are so characteristic of the times and durations of insect noise that there is no mistaking the sources represented by the identified bands above.

35 The mine related noise can be clearly identified in the period from approximately 5:30pm to 1am in the green bands in the frequency range of 160 to 800Hz. In this period, apart from insect noise, the mining noise is a very noticeable contributor to the noise levels. Between 9:00pm and 1:00am the mining noise is more dominant than the insect noise (green bands compared to blue for insects – refer to right hand scale for approximate levels).

36 Diesel engine noise generally has characteristic one-third octave frequencies of 80Hz, 125Hz, 160Hz and 250 to 630Hz. Diesel engine noise is apparent in the sonogram intermittently throughout the day and night up to 1:00am, but particularly during the afternoon and night period.

37 Bird chorus normally occurs at the beginning of the day and can be seen in the sonogram in the high levels at 5:30am to 6:00am in the one-third octave bands in the range 630Hz to 2kHz with some higher bands up to 8kHz prior to 7:00am. Between 7:00am and 9:30am the bird noise is

noticeable in the bands 1.25Hz to 2kHz, and up to 5kHz.

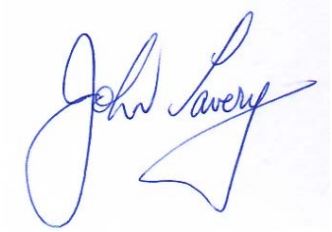
38 There may be other characteristics that could be identified from the sonogram. However, it could be speculative to make those opinions without the benefit of listening to the audible recording or without knowing the operational schedule of the mine at particular times of the day, evening and night, or the prevailing meteorological conditions at that time.

39 For example, the noise event that occurs at approximately 2pm for three 10 minute samples, with the central sample being dominant, could be attributed to a thunderstorm, or to a helicopter or another aircraft flyover due to the very low to very high frequency range of the affected one-third octave noise bands. If the noise had occurred for only one sample then perhaps it could be attributed to a short very loud event, such as a blasting event. Without listening to the audio record the source of the other characteristic "signatures" contained within the sonogram are unable to be identified with certainty from the data provided.

7 STATEMENT OF COMPLIANCE

In preparing this Statement of Evidence, I confirm that

(a) The factual matters included in the statement are, as far as I know, true; and
(b) I have made all enquiries considered appropriate with the information disclosed by NAC. Provision of audio and meteorological files from NAC would assist me to further analyse and identify signatures from the sonogram; and
(c) The opinions included in the statement are genuinely held by me; and
(d) The statement contains references to all matters that I consider significant; and
(e) I understand my duty to the court and have complied with that duty; and
(f) I have read and understood the Land Court Rules 2000, as far as they apply to me; and
(g) I have not received or accepted instructions to adopt or reject a particular opinion in relation to an issue in dispute in the proceeding.



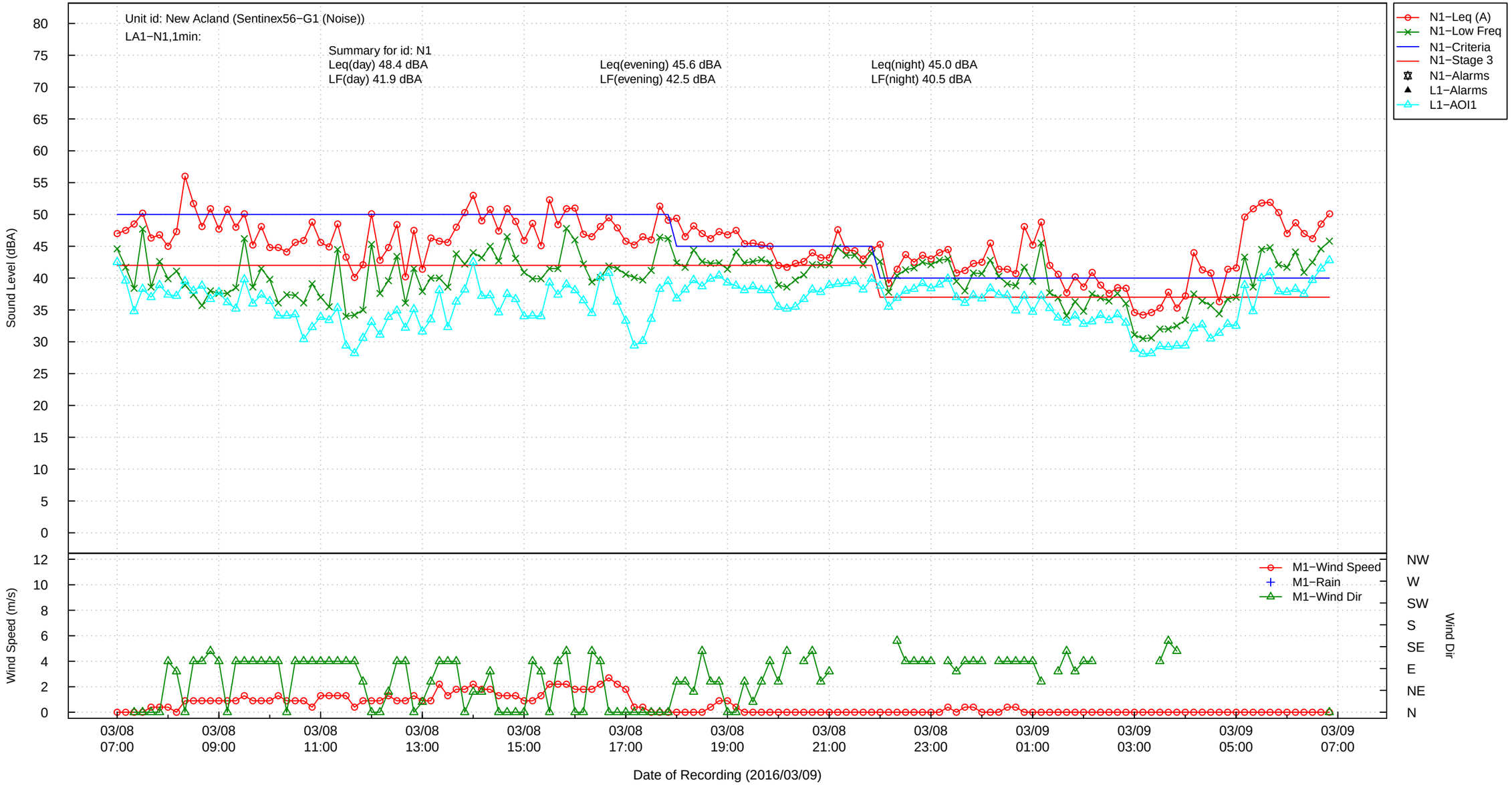
John Savery
Date: 1 June 2016

Attachment A - Sentinex noise plots

Daily Noise Monitoring Summary

Chart Modules

- N1: SVAN979
- L1: Quattro
- M1: Vantage Pro



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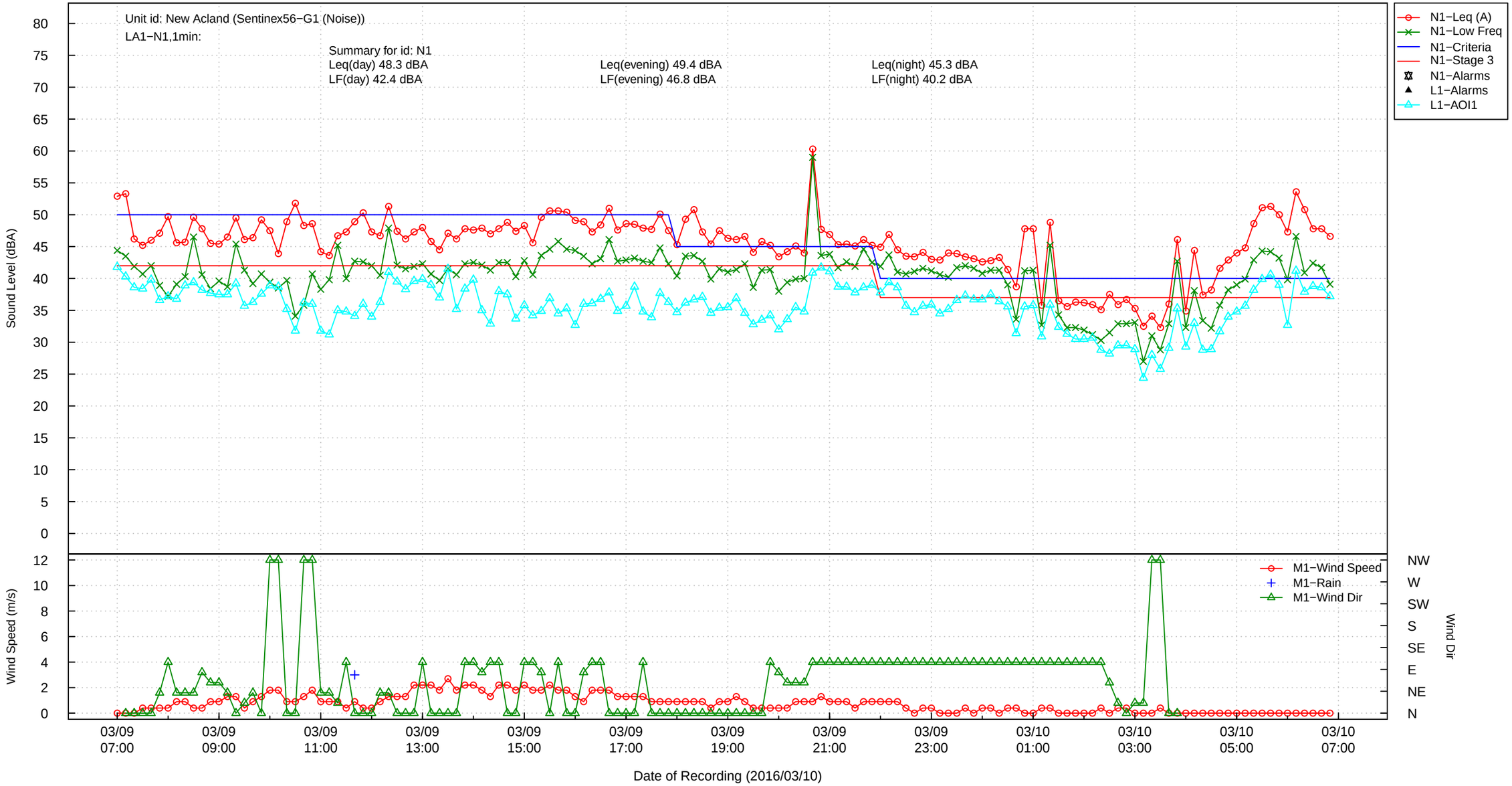

Attachment B – Sonogram analysis

New Acland (Sentinex56-G1)