

Chiles Ltd

Private Bag 55037, Christchurch 8154

13 September 2013

Ref: 130701b

Blueskin Resilient Communities Trust
31 Hill Street
Waitati 9085

Attention: Scott Willis

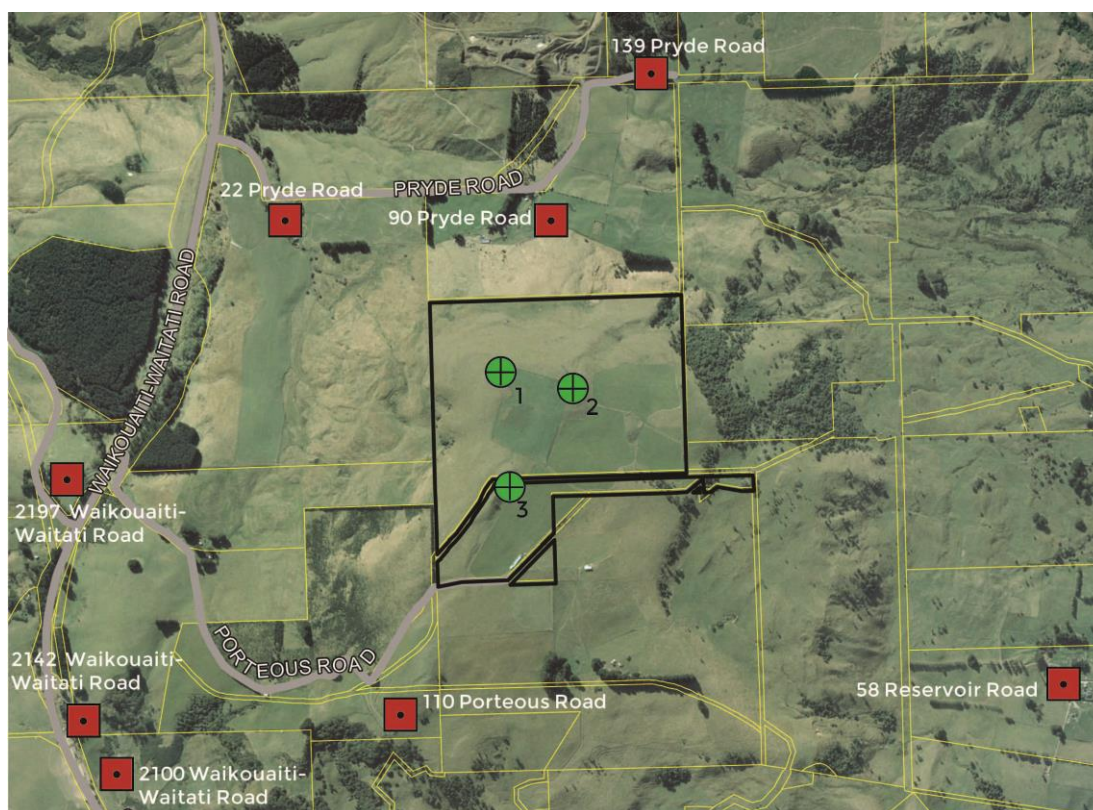
Dear Scott

Subject: Blueskin wind cluster – acoustics assessment

Introduction

Chiles Ltd has been appointed by Blueskin Resilient Communities Trust (BRCT) to make an acoustics assessment of a proposed wind cluster in the vicinity of Blueskin Bay, to the north of Dunedin. This assessment has been based on modelled sound levels provided by BRCT. The project is for three wind turbines to be installed on Porteous Hill. The locations of the proposed wind turbines (green circles) and the nearest residential neighbours (red squares) are shown in Figure 1.

Figure 1 Turbine and receiver locations



Criteria

Dunedin City District Plan

The proposed wind cluster and neighbouring houses are in the rural zone of Dunedin City as shown in maps 8, 9 and 12 of the current district plan.

There is no specific reference to wind farm noise limits in the district plan. Rule 21.5.1 of the district plan sets general noise limits for permitted, controlled and restricted discretionary activities with reference to Noise Maps. Noise limits apply at the notional boundary 50 metres from houses in the rural zone. South of the wind cluster the area is covered by Noise Map 68 (Warrington) and noise limits are 55 dB L_{A10} during the day and 40 dB L_{A10} at night. To the north of the wind cluster the area is not shown on a specific Noise Map so in accordance with the Noise Map index sheet the noise limits are 50 dB L_{A10} during the day and 40 dB L_{A10} at night.

These general noise limits are typical of many district plans and are generally appropriate for rural areas. The relevant objectives and policies in the district plan have been reviewed and nothing has been found that identifies the area around the proposed wind cluster as having unusual or special acoustic amenity.

The requirements of Rule 21.5.1 do not allow for the measurement and assessment of sound in the presence of significant wind, which is inherently present when a wind turbine is operating. Therefore these noise limits cannot be directly applied to the proposed wind cluster. It is considered that due to these technical constraints, it would be appropriate to apply the criteria in New Zealand Standard NZS 6808 *Acoustics – Wind farm noise* to this proposal.

The Dunedin City Council has developed preferred options for the Second Generation Plan for Dunedin that will ultimately replace the existing district plan. The preferred options do not represent an established or settled position, but it is noted they do include the use of NZS 6808:2010 as a performance standard for the assessment of noise from wind turbines.

New Zealand Standard NZS 6808

New Zealand Standard NZS 6808:2010 and its predecessor NZS 6808:1998 have been used for all recent wind farm projects in New Zealand. The latest 2010 version has been accepted by the Environment Court in several recent cases such as Meridian's Project Hurunui Wind in North Canterbury. The fundamental methodology is well accepted internationally. The Standard includes a noise limit of 40 dB L_{A90} , which can increase at higher wind speeds to 5 dB above the background sound level.

The key feature of NZS 6808 compared to the district plan noise limits is that the L_{A90} metric is used, which avoids undue effects of wind. Also, allowing the noise limit to rise above the background sound at higher wind speeds enables positive measurements to be obtained.

The noise limits in NZS 6808 have been designed to provide protection from sleep disturbance and to maintain reasonable residential amenity. It is considered this is the appropriate basis for assessing potential noise effects from the proposed Blueskin wind cluster.

Sound level predictions

Sound level modelling of the proposed wind cluster has been provided by BRCT. Input data used in the model and results are detailed below.

Wind turbines

Details of the indicative wind turbine type used for the modelling are given in Table 1.

Table 1 **Wind turbine data**

Parameter	Value
Wind turbine make and model	Gamesa G58
Rated power	850 kW
Power regulation	Pitch control
Number of turbines	3
Maximum A-weighted sound power level	103.6 dB
Special audible characteristics	None
Turbine hub height (AGL)	Up to 74 m
Maximum turbine blade tip height (AGL)	Up to 103 m

The three wind turbines have been modelled at the co-ordinates in Table 2. The co-ordinates are in terms of the New Zealand Map Grid. The wind turbines have been modelled at hub height (74 m AGL).

Table 2 **Turbine locations**

Turbine	Base height (m)	Easting (m)	Northing (m)
1	394 m	2321570	5499259
2	388 m	2321736	5499140
3	394 m	2321567	5498950

Noise sensitive locations

BRCT has identified eight noise sensitive locations (dwellings) in the area near the proposed wind cluster, which are shown on Figure 1 above and have been modelled at the co-ordinates shown in Table 3.

Table 3 Receiver locations

Ref	Receiver	Height (m)	Easting (m)	Northing (m)	Nearest turbine
1	22 Pryde Road	214 m	2321043	5499687	679 m
2	90 Pryde Road	281 m	2321726	5499703	471 m
3	139 Pryde Road	289 m	2321971	5500084	917 m
4	2197 Waikouaiti-Waitati Road	212 m	2320499	5499050	1073 m
5	2142 Waikouaiti-Waitati Road	210 m	2320524	5498416	1172 m
6	2100 Waikouaiti-Waitati Road	201 m	2320619	5498327	1134 m
7	110 Porteous Road	339 m	2321334	5498451	551 m
8	58 Reservoir Road	110 m	2323041	5498495	1456 m

Model settings

NZS 6808 refers to ISO 9613-2:1996 as an appropriate method for calculating wind farm sound levels. Predictions for the Blueskin wind cluster have been conducted in accordance with that standard, implemented in WindFarmer software. The ISO 9613-2 prediction method used for this assessment gives results for light downwind conditions in all directions simultaneously. While this is not physically possible, it provides a conservative assessment. Results quoted here are without terrain screening, and with ground absorption of 0.5 as recommended in NZS 6808.

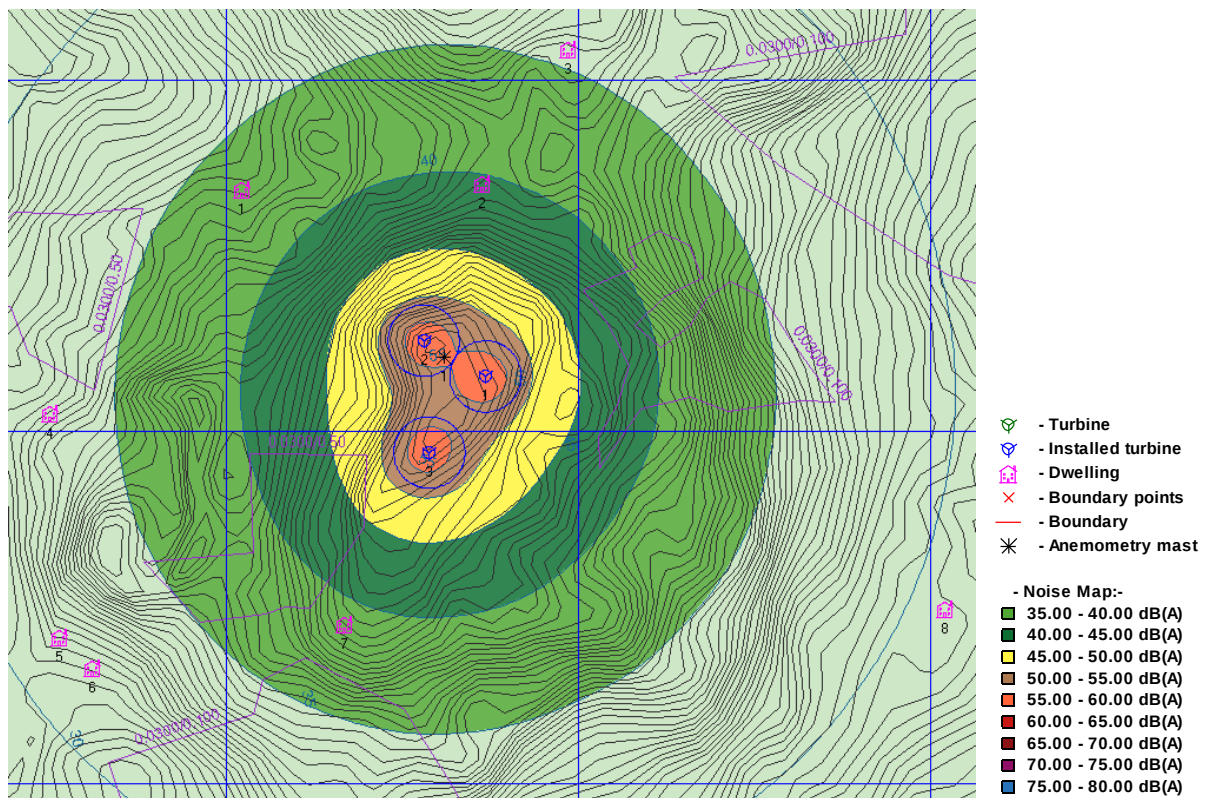
Results

The predicted wind farm sound levels for all three wind turbines operating simultaneously at the maximum sound power are given in Table 4 and are shown in Figure 2.

Table 4 Predicted sound levels

Ref	Receiver	Predicted sound level
1	22 Pryde Road	37 dB
2	90 Pryde Road	41 dB
3	139 Pryde Road	34 dB
4	2197 Waikouaiti-Waitati Road	33 dB
5	2142 Waikouaiti-Waitati Road	31 dB
6	2100 Waikouaiti-Waitati Road	32 dB
7	110 Porteous Road	39 dB
8	58 Reservoir Road	29 dB

Figure 2 Predicted sound levels



Assessment

All predicted wind farm sound levels comply with a 40 dB L_{A90} noise limit, other than an exceedance of less than 1 dB at one location. From our experience at other wind farms, it is likely the daytime background sound will be at least 36 dB L_{A90} during this wind farm operation, which would result in compliance with the 'background + 5 dB' noise limit. Therefore, at all locations it is expected the wind cluster would comply with the NZS 6808 noise limit of 40 dB L_{A90} or the background sound plus 5 dB. In the event there was not compliance at a location, such as at night, the wind turbines could potentially be programmed to reduce the sound levels (at the expense of power output) to maintain compliance with the noise limits.

As the noise limits have been set in NZS 6808 to provide protection from sleep disturbance and maintain reasonable residential amenity, it is therefore concluded the predicted wind farm sound levels will result in acceptable noise effects.

Conditions

Should consent be granted for the wind cluster, the following conditions relating to operational wind farm sound are recommended. The assessment locations have been set as the three receivers predicted to be exposed to over 35 dB L_{A90} . These receivers are spread around the wind farm and compliance in these locations will also ensure compliance at all other locations. The conditions are based on the examples included in NZS 6808.

1. *The consent holder shall ensure that, at the specified assessment positions, at any wind speed, wind farm sound levels do not exceed:*
 - (a) *A noise limit of 40 dB $L_{A90(10 \text{ min})}$, provided that the following noise limit shall apply in the circumstances stated in (b);*
 - (b) *When the background sound level is greater than 35 dB $L_{A90(10 \text{ min})}$, the noise limit shall be the background sound level $L_{A90(10 \text{ min})}$ plus 5 dB.*
2. *Wind farm sound shall be measured and assessed in accordance with NZS 6808:2010.*
3. *The assessment positions shall be outside at the noise sensitive locations, defined in accordance with NZS 6808:2010, at:*
 - (a) *22 Pryde Road*
 - (b) *90 Pryde Road*
 - (c) *110 Porteous Road*
4. *A compliance assessment report shall be submitted to the Dunedin City Council in accordance with Section 8.4.1 of NZS 6808:2010.*
5. *A prediction report shall be submitted to the Dunedin City Council in accordance with section 8.4.2 of NZS 6808:2010, unless the selected wind turbine layout is the same as a layout for which predictions were provided in the application, and the selected wind turbines have sound power levels no greater than the levels used in those predictions.*

Conclusions

Chiles Ltd has assessed sound from the proposed Blueskin wind cluster on Porteous Hill. The Dunedin City district plan does not include noise rules that can be applied to a wind farm. Therefore, the assessment has been based on the New Zealand wind farm noise standard NZS 6808.

A computer model has been used to predict sound levels for the maximum sound power of the indicative wind turbines. The wind farm sound levels at most houses are predicted to comply with a 40 dB L_{A90} noise limit. At one house there is a marginal exceedance of less than 1 dB, although this should comply with the 'background + 5 dB' component of the noise limit recommended in NZS 6808.

On the basis that predicted sound levels should comply with NZS 6808, which recommends limits to protect health and reasonable amenity, the acoustics effects of the Blueskin wind cluster are considered to be acceptable.

If consent is granted, it is recommended that conditions from NZS 6808 should be imposed to ensure noise effects are in accordance with this assessment.

Yours sincerely

Chiles Ltd

A handwritten signature in black ink, appearing to read 'Stephen Chiles', is written over a horizontal line.

Dr Stephen Chiles

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