Attachment 19

Noise Assessment

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Mr Paul Botha
Meridian Energy Limited
Wellington Office
WELLINGTON

Dear Paul,

Proposed Hayes Wind Farm Project
Noise Assessment : RMA s.92, Request For further Information

Further to our discussions, we provide the following information in relation to a RMA s.92 further information request regarding noise matters, as requested by Central Otago District Council.

Background To NZ Standard NZS6808:1998

The noise assessment report accompanying the consent application for the Hayes Wind Farm Project is based upon the recommendations of New Zealand Standard *NZS6808:1998 "Acoustics - The Measurement & Assessment Of Sound From Wind Turbine Generators*" (WTGs).

This Standard was developed by an expert committee in 1998 specifically to provide technical guidance on the measurement and assessment of noise from WTGs. The methods were based on comprehensive overseas experience with notice taken of where problems had been experienced overseas, and developing noise assessment methodologies that would suit wide application in the New Zealand environment. The committee agreed on methodology that particularly targets the potential for significant noise to be received in quiet sheltered locations, where exposed ridgelines and hilltops receive significant wind for driving the WTG. This is in fact a common situation around wind farms. The methods set out in NZS6808:1998 specifically targets these situations by requiring full account be taken of the ambient sound levels at these "quiet" sheltered locations at times when the wind speed at the WTG location is above the cut-in threshold. While there will be some quiet times at sheltered locations when there is sufficient wind at the WTG to drive the turbine (and thus require assessment as per NZS6808:1998), there will other significant periods of quiet times where there is insufficient wind at the location of the WTGs to allow the turbines to operate, and hence there would be no noise from this source.

NZS6808:1998 has been widely adopted within resource consents and environment court proceedings relating to wind farms in New Zealand[1]. In some cases this Standard has come in for some minor criticism from some quarters, however the Standard has been shown to remain the most appropriate and relevant Standard for assessing noise with RMA processes.

The evidence for this is that during 2004, in response to concerns it raised about the Standard NZS6808:1998, the Energy Efficiency and Conservation Authority (EECA) promulgated a

[1] NZS6808:1998 has been referred to in RMA consents for wind farm projects in both the north and south islands, and include the following: Trustpower's Tararua Wind Project (stages 1 and 2), TrustPower's " T3 " Tararua project, Meridian Energy Ltd's Te Apiti & White Hill wind farm projects, the Unison's Hawkes Bay wind farm project, and Genesis's Awhitu wind farm.

"scoping group" meeting of wind energy and environmental noise experts to assess possible faults with the Standard and to agree whether the Standard needed revision or not. On 17 November 2004 the scoping group (which included some non-technical members of groups opposing wind farms) agreed that based on experience to date, NZS6808:1998 is an adequate Standard however it would be desirable to monitor the ongoing use and implementation of the Standard so that in about 2 years another assessment can be made.

Based on this 2004 agreement among the experts, there can be no doubt that NZS6808:1998 is an appropriate Standard to follow in the current proceedings. In my view, the recommendations of NZS6808:1998 represent a reasonable and appropriate basis for assessing wind farm noise.

Re-Presentation Of Noise Assessment Findings

The s.92 request received from Council seeks clarification of the noise assessment information set out in Appendix I to the AEE, specifically the presentation of the ambient sound levels (L95) and the differences between these ambient levels and predicted cumulative wind farm sound levels.

We have therefore re-examined existing information on measured ambient sound levels, and the predictions of future wind farm sound levels. Three new tables have been produced, which are summarised as follows;

Table 1:
This table presents the predicted cumulative wind farm sound levels for 19 nearby residences[2], and presents these levels alongside night time average ambient L95 background sound levels, based on ambient noise level monitoring in the area (and described within the original noise AEE report). Key aspects of this table are;

- The comparisons are provided for the following wind speeds at the wind farm site: < 3 m/sec, 5 m/sec, 6 m/sec, 8 m/sec 9.5 m/sec and > 10 m/sec. This range covers the critical wind speed range of below, at , and just above cut-in wind speed for a modern WTG. Comparisons are also provided where wind farm wind speeds are 9.5 m/sec and >10 m/sec which are higher wind speeds where the WTGs achieves rated output. Noise emission from WTGs does not increase beyond these higher wind speeds.
- Using only night time ambient sound levels is a worse case scenario, as night time (10 pm to 7 am) levels are generally lower and less affected by extraneous sounds such as birds, farm animals and man-made sources such as vehicles.
- The distant receiving positions will receive very little (if any) sound from the wind farm. These are marked " < 20 dBA"
- The night time ambient sound level does not increase significantly with increasing wind speed occurring at the wind farm. Again, this makes this assessment a worse case (conservative) assessment.

[2] Noise assessment locations used here are the 19 residences and locations (including Paerau School) referred to in the original AEE noise report, as shown in the map comprising Figure 4 of that report.

Table 1: Comparison of NIGHT TIME L95 (dBA) with Predicted Windfarm Sound levels (dBA)

		LESS THAN 3 m/sec		4 to 6 m/sec		6 to 7 m/sec		7 - 9 m/sec		9 - 10 m/sec		>10 m/sec	
House	Rapid number	NIGHT TIME Ambient L95 @ <3 m/sec	Windfarm Sound level @ <3 m/sec, dBA	NIGHT TIME Ambient L95 @ 5 m/sec	Windfarm Sound level @ 5 m/sec, dBA	NIGHT TIME Ambient L95 @ 6 m/sec	Windfarm Sound level @ 6/m/sec, dBA	NIGHT TIME Ambient L95 @ 8 m/sec	Windfarm Sound level @ 8m/sec, dBA	NIGHT TIME Ambient L95 @ 9.5 m/sec	Windfarm Sound level @ 9.5 m/sec, dBA	NIGHT TIME Ambient L95 @ 9.5 m/sec	Windfarm Sound level @ max. power, dBA
Carrickmore	2084 Styx Patearoa Road	27.0	0.0	27.0	<20	30.0	<20	32.0	<20	28.0	<20	28.0	<20
Paerau	Taieri Paerau Road	27.0	0.0	27.0	<20	30.0	<20	32.0	<20	28.0	<20	28.0	<20
	323 Upper Taieri Paerau Road	27.0	0.0	27.0	24.4	30.0	28.2	32.0	30.8	28.0	33.4	28.0	33.4
Loganbrae	435 Upper Taieri Paerau Road	27.0	0.0	27.0	27.4	30.0	31.2	32.0	32.9	28.0	34.6	28.0	34.6
Paerau School + house	Upper Taieri Paerau Road	27.0	0.0	27.0	25.4	27.0	29.2	28.0	30.9	28.0	32.6	28.0	32.6
Logan Burn	629 Upper Taieri Paerau Road	27.0	0.0	27.0	27.9	30.0	31.7	32.0	33.4	28.0	35.1	28.0	35.1
Logan Leith	701 Upper Taieri Paerau Road	27.0	0.0	27.0	30.7	30.0	34.5	32.0	36.2	28.0	37.9	28.0	37.9
	879 Upper Taieri Paerau Road	30.0	0.0	30.0	30.2	30.0	34.0	30.0	35.7	30.0	37.4	36.0	37.4
Glenayr	917 Upper Taieri Paerau Road	30.0	0.0	30.0	29.4	30.0	33.2	30.0	34.9	30.0	36.6	36.0	36.6
	1197 Upper Taieri Paerau Road	30.0	0.0	30.0	32.5	30.0	36.3	30.0	38.0	30.0	39.7	36.0	39.7
Lammermoor	Upper Taieri Paerau Road	30.0	0.0	30.0	30.4	30.0	34.2	30.0	35.9	30.0	37.6	36.0	37.6
	971 Linnburn Runs Road	27.0	0.0	27.0	<20	30.0	<20	32.0	<20	28.0	<20	28.0	<20
	963 Linnburn Runs Road	27.0	0.0	27.0	<20	30.0	<20	32.0	<20	28.0	<20	28.0	<20
	883 Linnburn Runs Road	27.0	0.0	27.0	<20	30.0	<20	32.0	<20	28.0	<20	28.0	<20
Omoa	755 Linnburn Runs Road	30.0	0.0	30.0	<20	30.0	<20	30.0	<20	30.0	<20	36.0	<20
Lynbrook	579 Linnburn Runs Road	30.0	0.0	30.0	<20	30.0	<20	30.0	<20	30.0	<20	36.0	<20
Burnbrae	421 Linnburn Runs Road	30.0	0.0	30.0	<20	30.0	<20	30.0	<20	30.0	<20	36.0	<20
Rocklands Station	Rocklands Road	22.0	0.0	24.0	<20	25.0	<20	27.0	<20	28.0	<20	28.0	<20
Rocklands Manager	Old Dunstand Road	22.0	0.0	24.0	<20	25.0	<20	27.0	<20	28.0	<20	28.0	<20

Note: See Glossary (section 6) of the original AEE noise report for definitions of the terms “L95” and “dBA”.

Table 2:

This table presents the cumulative wind farm sound levels for 19 nearby residences, and presents these alongside the NZS6808:1998 recommended upper noise limit (ambient L95 + 5 dBA, or 40 dBA, whichever is the higher, see original AEE noise report). Key aspects of this table are;

- The comparison with NZS6808 limits are provided across the following wind speeds at the wind farm site: < 3 m/sec, 5 m/sec, 6 m/sec, 8 m/sec, 9.5 m/sec and > 10 m/sec. This range covers the critical wind speed range of below, at, and just above cut-in wind speed for a modern WTG. Comparisons are also provided where wind farm wind speeds are 9.5 m/sec and >10 m/sec which are higher wind speeds where the WTGs can achieve rated output. Noise emission from WTGs does not increase beyond these higher wind speeds.
- Only night time ambient sound level data has been used to define the NZS6808:1998 noise limit set out in Table 3. Using only night time ambient sound levels in this compliance assessment again makes this assessment a worse case (conservative) assessment.
- Ambient levels are low. Only the few shaded cells in table 2 indicate where the average L95 ambient sound level + 5 dBA is expected to increase above 40 dBA.
- At all wind speeds ranges the recommended upper limit of NZS6808:1998 is complied with at all times, across all 19 sites.

Table 2: Comparison Of Windfarm Sound (dBA) with NZS6808 noise limit (dBA)

	LESS THAN 3 m/sec		4 to 6 m/sec		6 to 7 m/sec		7 - 9 m/sec		9 - 10 m/sec		>10 m/sec		
Rapid number	Windfarm Sound level @ <3 m/sec, dBA	Compliance Level NZS6808 (dBA)	Windfarm Sound level @ 5 m/sec, dBA	Compliance Level NZS6808 (dBA)	Windfarm Sound level @ 6/m/sec, dBA	Compliance Level NZS6808 (dBA)	Windfarm Sound level @ 8m/sec, dBA	Compliance Level NZS6808 (dBA)	Windfarm Sound level @ 9.5 m/sec, dBA	Compliance Level NZS6808 (dBA)	Windfarm Sound level @ max. power, dBA	Compliance Level NZS6808 (dBA)	COMPLIES With NZS6808 at ALL wind Speeds?
2084 Styx Patearoa Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	Yes
Taieri Paerau Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	Yes
323 Upper Taieri Paerau Road	0.0	40.0	24.4	40.0	28.2	40.0	30.8	40.0	33.4	40.0	33.4	40.0	Yes
435 Upper Taieri Paerau Road	0.0	40.0	27.4	40.0	31.2	40.0	32.9	40.0	34.6	40.0	34.6	40.0	Yes
Upper Taieri Paerau Road	0.0	40.0	25.4	40.0	29.2	40.0	30.9	40.0	32.6	40.0	32.6	40.0	Yes
629 Upper Taieri Paerau Road	0.0	40.0	27.9	40.0	31.7	40.0	33.4	40.0	35.1	40.0	35.1	40.0	Yes
701 Upper Taieri Paerau Road	0.0	40.0	30.7	40.0	34.5	40.0	36.2	40.0	37.9	40.0	37.9	40.0	Yes
879 Upper Taieri Paerau Road	0.0	40.0	30.2	40.0	34.0	40.0	35.7	40.0	37.4	40.0	37.4	41.0	Yes
917 Upper Taieri Paerau Road	0.0	40.0	29.4	40.0	33.2	40.0	34.9	40.0	36.6	40.0	36.6	41.0	Yes
1197 Upper Taieri Paerau Road	0.0	40.0	32.5	40.0	36.3	40.0	38.0	40.0	39.7	40.0	39.7	41.0	Yes
Upper Taieri Paerau Road	0.0	40.0	30.4	40.0	34.2	40.0	35.9	40.0	37.6	40.0	37.6	41.0	Yes
971 Linnburn Runs Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	Yes
963 Linnburn Runs Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	Yes
883 Linnburn Runs Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	Yes
755 Linnburn Runs Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	41.0	Yes
579 Linnburn Runs Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	41.0	Yes
421 Linnburn Runs Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	41.0	Yes
Rocklands Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	Yes
Old Dunstand Road	0.0	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	<20	40.0	Yes

Note: See Glossary (section 6) of the original AEE noise report for definitions of the terms “L95” and “dBA”.

Shaded cells (above) indicate where the average L95 ambient sound level + 5 dBA increases above 40 dBA, which has the effect of increasing the NZS6808 recommended limit, in this case to 41 dBA.

Table 3:

This table presents a comparison of the difference between predicted cumulative wind farm sound levels for 19 nearby residences, and average night time average ambient L95 background sound levels, based on ambient noise level monitoring in the area (and described within the original noise AEE report). Key aspects of this table are;

- The comparison covers the following wind speed range at the wind farm site: < 3 m/sec, 5 m/sec, 6 m/sec, 8 m/sec 9.5 m/sec and > 10 m/sec.
- Using only night time ambient sound levels is a worse case scenario, as night time (10 pm to 7 am) levels are generally lower and less affected by extraneous sounds such as birds, farm animals and man-made sources such as vehicles.
- The distant receiving positions will receive very little (if any) sound from the wind farm. These are marked " < 20 dBA".
- The night time ambient sound level does not increase significantly with increasing wind speed occurring at the wind farm. Again, this makes this assessment a worse case (conservative) assessment.
- The 'significance' of the possible increase over average night time ambient sound levels has been noted, adopting the following arbitrary scale:

NIL	Calc. of increase over ambient not possible where wind farm sounds are < 20 dBA
LOW	Low or negative increase over normal night time ambient by up to 2 dBA
MINOR	Normal night time ambient exceeded by 3 dBA to 5 dBA
NOTICEABLE	Normal night time ambient exceeded by 5 dBA or more

Table 3: Estimated Wind farm Sound Compared to Night Time Ambient L95 (dBA), With Significance Noted

		LESS THAN 3 m/sec		4 to 6 m/sec		6 to 7 m/sec		7 - 9 m/sec		9 - 10 m/sec		>10 m/sec	
House	Rapid number	Potential INCR. OVER NIGHT TIME Ambient L95 (dBA)	Significant?	Potential INCR. OVER NIGHT TIME Ambient L95 (dBA)	Significant?	Potential INCR. OVER NIGHT TIME Ambient L95 (dBA)	Significant?	Potential INCR. OVER NIGHT TIME Ambient L95 (dBA)	Significant?	Potential INCR. OVER NIGHT TIME Ambient L95 (dBA)	Significant?	Potential INCR. OVER NIGHT TIME Ambient L95 (dBA)	Significant?
Carrickmore	2084 Styx Patearoa Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
Paerau	Taieri Paerau Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
	323 Upper Taieri Paerau Road	n.a.	n.a.	nil	low	nil	low	nil	low	5.4	noticeable	5.4	noticeable
Loganbrae	435 Upper Taieri Paerau Road	n.a.	n.a.	0.4	minor	1.2	minor	0.9	minor	6.6	noticeable	6.6	noticeable
Paerau School + house	Upper Taieri Paerau Road	n.a.	n.a.	nil	low	2.2	minor	2.9	minor	4.6	minor	4.6	minor
Logan Burn	629 Upper Taieri Paerau Road	n.a.	n.a.	0.9	minor	1.7	minor	1.4	minor	7.1	noticeable	7.1	noticeable
Logan Leith	701 Upper Taieri Paerau Road	n.a.	n.a.	3.7	minor	4.5	minor	4.2	minor	9.9	noticeable	9.9	noticeable
	879 Upper Taieri Paerau Road	n.a.	n.a.	0.2	minor	4.0	minor	5.7	noticeable	7.4	noticeable	1.4	minor
Glenayr	917 Upper Taieri Paerau Road	n.a.	n.a.	-0.6	low	3.2	minor	4.9	minor	6.6	noticeable	0.6	minor
	1197 Upper Taieri Paerau Road	n.a.	n.a.	2.5	minor	6.3	noticeable	8.0	noticeable	9.7	noticeable	3.7	minor
Lammermoor	Upper Taieri Paerau Road	n.a.	n.a.	0.4	minor	4.2	minor	5.9	noticeable	7.6	minor	1.6	minor
	971 Linnburn Runs Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
	963 Linnburn Runs Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
	883 Linnburn Runs Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
Omoa	755 Linnburn Runs Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
Lynbrook	579 Linnburn Runs Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
Burnbrae	421 Linnburn Runs Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
Rocklands Station	Rocklands Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20
Rocklands Manager	Old Dunstand Road	n.a.	n.a.	nil	<20	nil	<20	nil	<20	nil	<20	nil	<20

Note: See Glossary (section 6) of the original AEE noise report for definitions of the terms “L95” and “dBA”.

Discussion

Tables 1, 2 and 3 indicate generally low levels of wind farm sound are expected in the area, with wind farm operation producing at times, modest increase over typical night time ambient sound levels in some identified locations. These excursions above typical night time ambient sound levels at certain times, being quite low in level, are entirely expected and normal, as provided for within the recommendations of NZS6808:1998. The original noise AEE and the new analysis discussed above shows the recommended guidelines of NZS6808:1998 are complied with under all conditions.

An increase over typical night time ambient background sound levels (L95) is not in itself a negative effect. There are no rules or guidelines based on whether a sound can be detected in the environment or not. The approach to assessing environmental noise in New Zealand is to take account of amenity impact, but to do so pragmatically with any increase over ambient L95 properly constrained to less than 10 dBA, which is adopted as a general guideline within NZS6802:1991 (a standard referenced in the District Plan). There are no applicable guidelines or standards indicating the presence of detectable sounds (at times) such as from a wind farm, can be classified as anything other than a minor effect.

Under District Plan rules, normal permitted activities in the rural zone must comply with an upper limit of 40 dBA L10 at night time which may, at times, represent an increase over typical night time ambient levels. The 40 dBA limit will appropriately protect sleep during night periods and is a reasonable limit based on World Health Organisation guidelines. As per NZS6808:1998, the limit of wind farm noise can be increased at times of elevatedL95 ambient levels, so that the limit of "average ambient L95 + 5 dBA" is an appropriate limit at times when ambient levels rise above L95 40 dBA. Thus, the noise limit criteria recommended within NZS6808:1998 are technically appropriate which if adopted as consent conditions, will provide the necessary protection against the adverse effects of WTG noise.

Summary

Malcolm Hunt Associates have provided certain information in response to a RMA s.92 request for further information. The further information has specifically addressed the appropriateness of NZS6808:1998, and has re-presented noise assessment information contained in the original noise AEE document.

Tables and commentary are provided showing noise assessment for 19 nearby properties to more clearly indicate the modest extent of expected noise impact. New tables have been prepared to present a worse-case assessment (compared to the original noise AEE report) as tables 1, 2 and 3 (above) only consider night time ambient sound levels, being generally quieter than if whole day average background sound levels had been employed in the analysis.

Overall, the emission of sound from the Hayes Wind Farm will be constrained to local areas, although wind farm sounds may be detected in the wider area at times. At all times the upper limits recommended by NZS6808:1998 will be fully complied with. This Standard provides a suitable basis for conditions governing noise, and will ensure the emission of noise form the wind farm remains reasonable. Please advise if you require any further information.

Your sincerely,

Malcolm Hunt
B.Sc. M.E.(mech) Dip Public Health