BOARD OF INQUIRY

HAUĀURU MĀ RAKI WIND FARM PROPOSAL

In the matter	of the Resource Management Act 1991
And	
In the matter	of resource consent applications by Contact Wind Limited in respect of the Hauāuru mā raki Wind Farm Proposal
And	
In the matter	of notices of requirement and a resource consent application by Contact Energy Limited for transmission infrastructure related to the Hauāuru mā raki Wind Farm Proposal

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REBUTTAL EVIDENCE OF TOM MORTEN RESPONDING TO THE EVIDENCE OF RJ KINNEY

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Introduction

1. My name is **Tom Morten**. I am a Project Manager at Beca AMEC (Beca) and have specialist knowledge and experience in explosives engineering and blasting for construction, mines, and quarries.

2. I have the following qualifications and experience relevant to the evidence I shall give:

   (a) I hold Master of Engineering (Management) and Bachelor of Engineering (Mechanical) degrees;

   (b) I am a member of the Institute of Professional Engineers New Zealand and of the International Society of Explosives Engineers;

   (c) I have spent eight years working in the explosives industry as a shot firer, blast surveyor, blasting engineer, and blasting superintendant in New Zealand and Indonesia;

   (d) I previously worked for Orica Mining Services, during which time I attended its Safe and Efficient Blasting (SEB) course twice as a participant and several times as an educator (I note that the evidence of Mr Robert Kinney for Ravensdown Fertiliser Co-operative Limited (Ravensdown) relies on an extract from the Orica SEB Manual); and

   (e) I have held a number of relevant explosives qualifications, including a Quarry and Mining Shot Firing Certificate (Unrestricted) and a Construction Shot Firing Certificate (Above Ground).

3. I confirm that I have read the 'Code of Conduct for Expert Witnesses' contained in the Environment Court Consolidated Practice Note 2006. My evidence has been prepared in compliance with that Code in the same way as I would if giving evidence in the Environment Court. In particular, unless I state otherwise, this evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

4. The purpose of this brief of evidence is to respond to the evidence of Mr Kinney for Ravensdown. In his evidence Mr Kinney raises various issues in relation to the proposed transmission line for the HMR wind farm project, including the proximity of the line to the Ravensdown property and the risk of damage to the line from fly-rock caused by the use of explosives as part of the quarrying operations.

5. Mr Kinney's evidence is that fly-rock can travel up to 400m from the rock face and, as a result, Ravensdown seeks to have the proposed transmission moved to the east to create a 500 metre buffer from the property boundary to the transmission line.

No fixed safe separation distances

6. Minimum safe separation distances from quarry blasting operations are not fixed under New Zealand regulations or stated in the applicable standard (AS/NZS 2187). Rather, safe separation distances are recommended to be determined by a specific risk analysis for each site, and for each blast. Such a risk analysis would normally consider the probability of damage to items in the vicinity of the blast, and the likely consequences of damage occurring.

7. The probability of damage depends on various factors such as the number of blast holes, blast geometry (such as whether the blasted rock can move laterally or is forced upwards), the explosives charge per blast hole, the amount of stemming used (being the inert material, such as drill cuttings or crushed stone, used in a blast hole to confine the gaseous products of detonation), the initiation sequence and timing, the properties of the rock, and the nature of the items in the vicinity at risk of damage.

8. Most sites with which I am familiar have adopted a safe exclusion zone for people of approximately 500 to 1,000 metres, but of significantly less than that for machinery, including fragile equipment.

Potential for damage to transmission lines

9. It is certainly conceivable that blasting could damage transmission lines in certain circumstances, either through excessive ground vibration or fly-rock.

Ground vibration

10. Ground vibration attenuates quickly with distance, and after approximately 50 metres vibration levels are ordinarily unlikely to be an issue for transmission pole design (depending on the specific geology of the site and the blast design used).

Fly-rock

11. As explained by Mr Kinney, fly-rock is shrapnel caused by a blast and can travel several hundred metres, although more commonly fly-rock will travel between 20 and 100 metres from the blast. If the blast is executed competently then approximately one in ten blasts might throw a few rocks up to 100 metres.

12. While this will depend on the parameters of the particular blast, the physics of rock blasting dictate that smaller rocks tend to fly further than larger ones. In my experience it would be unlikely for rocks of a few hundred kilograms to travel more than 20 metres or for a rock of 20 to 30 kilograms to travel more than 50 metres.

13. Further, in my experience it would be infrequent for a one- to two-kilogram rock to fly further than 100 metres. A rock of this size might cause damage to transmission lines by, for example, breaking an insulator, parting a cable, or damaging a pole.

Mitigation measures to reduce the risk of fly-rock

14. I have previously conducted blasting beneath transmission lines, with appropriate safeguards, which illustrates that it is possible to reduce the risk of fly-rock hitting transmission lines and pylons. I set out below a number of possible measures to achieve this.

15. First, the blasting parameters used can be changed to reduce the probability of fly-rock – that is, stemming depths can be increased, less explosives can be used, and quality control can be improved (i.e. by making sure that holes are fully stemmed and not overloaded). In critical locations blast mats can be used, although such mats are not economically viable for all types of blast.

16. Further, laser face profiling and bore tracking of holes can be used to detect areas of the blast with insufficient burden, which may lead to instances of fly-rock. Such preparatory work allows appropriate mitigation actions to be taken.

17. Berms or other barriers can be constructed between the blast and the transmission lines to block the direct path of fly-rock. In the case of transmission line pylons, these can be located to take advantage of screening from terrain. In the case of the Ravensdown quarry, I understand from my colleague Ms Yorke that the transmission line may be partly shielded by pine trees at the nearest point to the quarry. I understand further that the proposed location of the transmission line structures is on a topographical contour such that they will be between 50 and 75 metres above the level of the quarry.

Orientation of the quarry face

18. Moreover, because vertical blast holes are initiated from a detonator at the bottom of the blast hole, fly-rock is usually more prevalent in front of the quarry face. I understand that in the case of Ravensdown's quarry, the quarry face looks to the west. I note from Mr Kinney's evidence that the quarry operations are moving towards the east, so I infer that the working face of the quarry will keep pointing westwards. It follows that fly-rock from

the quarry face is more likely to be thrown to the west, away from the proposed transmission line.

Appropriate separation distance for transmission lines

19. In my experience, and assuming competently-executed blasting, generally speaking damage to transmission lines at a distance of 150 metres from the blast would be unlikely. This is because the incidence of rocks being thrown at that distance is low and the probability of them actually hitting the transmission lines and other structures – which after all have a relatively small surface area – is also low.

20. Therefore, while it is impossible to eliminate entirely the risk of damage to the transmission lines, in my view a separation distance of approximately 150 metres between a quarry face and transmission lines would normally be sufficient to control that risk, if standard blasting techniques are adopted and competently executed.

21. This estimate does not take into account the specifics of the site in question. Here, the local topography (i.e. the fact that the transmission corridor is on significantly higher ground than the quarry), the shielding effect of the pine trees and the orientation of the quarry face towards the west are likely to further reduce the risk of damage to the transmission lines.

T Morten