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Memorandum

To	Vicki Morrison-Shaw	Page	1
CC			
Subject	TTRL - Questions		
From	Darran Humpheson		
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Please find detailed below my response to questions posed by Ruby Haazen. Where applicable, I have stated where the question is outside my expertise.

Q. Do you accept that confidence intervals should be added to the noise map in the AECOM report or best, worst and most likely case maps provided?

Response: Confidence intervals would only be used where there is uncertainty in the assessment work. This typically occurs when there is a variance in the measured source level data and a range of source levels have been calculated. In my report I cited work undertaken by Erbe et al. The work involved the surveying of offshore oil production vessels. Their results included a statistical approach to noise level estimation due to the fact that '*the operations on the FPSOs varied over the period of recording, and were sometimes unknown'*. In my assessment I back calculated what the source level of the combined IMV and crawler would have to be to achieve the 135 dB RL (receiver level) at 500m. My maps are therefore the absolute, maximum allowable noise level contours. There is no requirement to undertake a statistical assessment as any further contour would be smaller in scale than those in my report.

Q. Do you accept that range (minimum to maximum) and 95% confidence interval for the different frequency components of the noise should have been provided to the DMC?

Response: A range of frequency spectra could have been produced each with a different spectral character. However the requirement is to achieve Condition 12, whether it is in the three frequency bands (total contribution in each band of 130 dB RL) or the overall 135 dB RL across all frequency bands. TTRL will be required to achieve these limits and will have to take into account the frequency content of the noise produced by the proposed activities. This information will only be known once a detailed engineering design has been commissioned.

Q. Do you accept that there is a need to measure ambient (natural, background) noise off Taranaki and seafloor characteristics and other environmental features that will affect noise propagation

Response: The calculation of noise is independent of the ambient noise environment. The influence of the ambient noise environment is only a consideration when determining how far from the activity the ambient noise environment will mask the noise of TTRL's proposed mining activity. I have included an analysis of masking noise in my report.

The other factors will influence underwater sound level propagation, such as sea floor composition, temperature, tidal currents and salinity. As explained to the DMC by myself and Dr Alec Duncan any underestimation of the sea floor attenuation may lead to a change in received sound levels by at most

several (two) decibels. Therefore there is no requirement to undertake any further assessment work as this variance is very low.

Q. Do you accept that presenting one (average) scenario for noise propagation fails to take into account natural variation in ambient noise and in the noise expected to be produced by the proposed mining operation?

Response: The single scenario I have presented is the absolute maximum receiver level that would be produced by the activities. It is not an average and is based on the maximum allowable source level. In practice, measured noise levels will be less than those calculated at different distances due to the inclusion of 'engineering headroom', which could account for a 3 dB 'safety margin'.

The natural variation in sound level is only a consideration when determining whether the noise will be masked. I am confident that the data acquired by NIWA/JASCO is representative of the ambient noise environment as it spanned a 6 month period and has good statistical variance.

Q. Do you accept that a stationary, more or less continuous source of noise over a lengthy time period (several decades) is more serious in terms of habitat degradation than shipping noise caused by ships moving through the area relatively quickly?

Response: I cannot state the potential effects of a continuous noise on habitat degradation as this is outside my expertise.

Q. Do you accept that it would have been helpful add marine mammal distribution "layer" to the noise map?

Response: Not my expertise.

Q **Do you accept that 135 dB at 500 m. an arbitrary cut-off level, not supported by research on injury or behavioural responses of marine mammals to noise, simply derived from the 2014 pre-hearing discussions? Do you agree that more information has been gained since 2014? And that it was based on measurements of ambient noise off Taranaki that proved to be erroneous and have been withdrawn? And that more data on marine mammals in the South Taranaki Bight (STB) has been gathered and presented during the hearing and pre-hearing discussions in 2017?**

Response: Not my expertise.

Q. Are you aware of , a review published in 2016 which concluded that whale and dolphin responses to noise were highly variable and not predictable on the basis of simple acoustic exposure (e.g. received sound level)?

Response: Not my expertise.

Q. Do you accept Mr van Helden's evidence that Professor Wursig (one of the three marine mammal experts involved in the 2014 expert discussions) no longer supports the proposed 135 dB condition? And that in 2017 three of the four marine mammal experts (Slooten, Torres and van Helden) do not support the proposed condition?

Response: Not my expertise.

Q. Do you accept that Noise produced by several components of the mining operation have been underestimated by AECOM (e.g. crawler source levels and frequency spectra) due to a variety of errors that are detailed in the Curtin University report?

No. My assessment is based on a back calculation from the 135 dB RL at 500m. My assessment used the likely frequency content of the crawler with corrections for the smaller particle size being transported up the riser.

Professor Christine Erbe acknowledged in her oral statements that she now understood how the 171dB and the subsequent assessment had been undertaken and was not reliant on the actual measured De Beers / IMT data.

Q. Do you accept that the proposed condition of 135 dB at 500 m, is likely to be exceeded most of the time except for short periods of time when there is little mining activity?

Response: No. If there is little mining activity then noise levels from TTRL's activities will be well below 135 dB RL at 500m.
It will be a requirement of TTRL to achieve the project's noise limit. The crawler and IMV will have to be designed to meet the noise limit. TTRL will need to commit resources to ensure that the acoustic emissions of their proposed activities achieve the project's noise limits.