BEFORE THE BOARD OF INQUIRY
COASTAL RESOURCES LIMITED MARINE CONSENT APPLICATION

IN THE MATTER	of the Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012
AND	
IN THE MATTER	of a decision-making committee appointed to consider a marine consent application made by Coastal Resources Limited to Dispose of Dredged Material at the Northern Disposal Site

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SUPPLEMENTARY STATEMENT OF EXPERT EVIDENCE OF SIMON JOHN CHILDERHOUSE FOR COASTAL RESOURCES LTD
Dated: 23 November 2018

MAY IT PLEASE THE COMMITTEE

1. INTRODUCTION

1.1. My full name is Simon John Childerhouse. I confirm my qualifications and experience as provided in my previous Statement of Evidence dated 25th October 2018.

1.2. I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2014 and that I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person; this evidence is entirely within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

1.3. This Supplementary Evidence covers issues related to noise from the proposed activity and potential impacts on marine mammals. Discussion on these issues was not able to be completed at the facilitated meeting. A record of the agreements at that meeting are reported in the Joint Statement of Experts in the field of Marine Mammals dated 21st November 2018.

2. POTENTIAL IMPACTS OF NOISE ON MARINE MAMMALS

2.1. Without knowing the specific noise characteristics (i.e. loudness and frequency spectra) of the tug and/or barge, it is not possible to accurately determine the potential level of impact or the distance over which this impact may occur. Vessels such as tugs, generally have a dominant low frequency noise component which has the potential to overlap with the low frequency vocalisations and hearing of various baleen whale species.

2.2. While there will also be mid- and high-frequency components to the noise produced by the activity, given what has been reported in the literature about the frequency spectra of noise from tugs, this component is likely to have considerably less energy and will propagate over much shorter distances. Therefore, baleen whales are more likely to be impacted than other marine mammals such as dolphins which generally vocalise and hear in the mid- and high-frequency bands.

2.3. I reviewed the international literature for examples of noise produced by tugs and tugs towing barges. The data is provided in **Appendix 1**. The noise produced by a tug towing a barge will be highly variable depending on a range of factors including vessel size, engine size, hull type, propeller type and speed. The noise produced will propagate to differing distances depending on a range of factors at any location including bathymetry, coastline, ambient noise levels and temperature/salinity. Given these uncertainties, it is not possible to accurately predict either the noise that will be produced by the activity nor how far the noise will propagate. This makes the accurate assessment of potential noise impacts particularly challenging.

2.4. While we don't know what the actual noise level will be, based on international studies of tugs, it is possible that the source level could be in the order of 170-180 dB re µPa @ 1m, with a maximum source level recorded for tugs of 192 dB re µPa @ 1m (**Appendix 1**). Taking into account NOAA standards for acoustic impacts on marine mammals, and assuming a source level of 170-180 dB re µPa @ 1m, behavioural disruption to marine mammals could be possible up to several kms from the vessel and at even greater distances if the source level is higher than this.

2.5. This is broadly consistent with results from Pine et al. (2016) who found that the potential effects of commercial shipping noise in the Hauraki Gulf through the masking of marine mammal communication were conservatively estimated to occur within 280m of the vessel within the noisy, Inner Gulf and within 2,270m of the vessel in the quieter, outer Gulf although ranges up to 4,220m were also estimated for the most noisy vessels.

2.6. Given that the noise source level of the vessels to be used in the activity is unknown, it is useful to review the international literature for context. However, based on advice from CRL, it is clear that the vessels that are likely to be used in this activity are significantly smaller (i.e. 21m vs. 30-40+m), travel at slower speeds (i.e. 6 knots vs. 8-12 knots) and/or have significantly smaller engines (i.e. <1,000 BHP vs. 6-7,000 BHP) than the vessels characterised in the international literature (**Appendix 1**).

2.7. Based on these direct comparisons, it is therefore likely that the estimated source level data for tugs in the literature is considerably higher than what would be expected from the vessels that will be used in this activity. It therefore follows that the zones over which masking and/or behavioural disruption are possible, are also likely to be significantly smaller than the distances identified above.

2.8. It is also important to put the noise from this activity in context of other anthropogenic noise activities in the Hauraki Gulf. The operation itself will generate considerably lower levels of noise compared with other anthropogenic noise sources such as ferries, container and cargo vessel traffic (**Appendix B**), and pile driving operations all occurring in the Hauraki Gulf. This is primarily because the operation utilises considerably smaller and slow-moving vessels (e.g. tugs, barges) travelling at an average of 6 knots[1].

2.9. Travelling at these slow speeds is known to generate low levels of noise in comparison to faster moving, larger vessels and therefore, the acoustic foot print of this operation will be considerably smaller and quieter than most other large commercial vessel traffic operating in the Hauraki Gulf (**Appendix B**). In addition, given that the vessels will be constantly moving, there will be no sustained noise within any area.

2.10. Under the existing dumping approval, a total of 545 trips to the dump site have been undertaken as of 1 October 2018. Professor Jeffs, in his Evidence of 27th October 2018, estimates that with a round trip taking between 15 – 25 hours, the existing permitted operation over the last six years has contributed an estimated accumulation of over 10,000 hours of underwater noise injected into the Hauraki Gulf Marine Park.

[1] Hemmera (2014) found that vessel source level decreased by ~0.5 dB per 1 knot decrease in speed, increased 0.1 dB per 1 metre in width, etc.

2.11. While this statement is reasonable, it needs to be put in context of total vessel traffic in the Hauraki Gulf. Overall, there are as many as 400,000 vessel (e.g. shipping, fishing, ferries, tourists, navy, private)[2] movements through the Hauraki Gulf annually. The maximum number of dumps permitted per day under the proposed consent is 2 which equates to a potential maximum number of 730 trips per year, although it is highly unlikely that the maximum number will be utilised given operational constraints. Therefore, the additional 635 maximum potential trips per year allowed under this new consent represents an 0.2% increase in the existing overall traffic levels for the Hauraki Gulf.

2.12. I also note that during discussions with Professor Jeffs, he has indicated that he has commissioned some new noise modelling work to investigate the potential impact of noise on marine mammals but that the results of this work were not available at time this Evidence was written and, therefore, I may have additional comments when that work becomes available.

2.13. In conclusion and based on the following facts:

a. Given that the vessels to be used in this operation are small (i.e. 20-40m) with relatively low power (i.e. ≤ 1,000HP) and that they will be transiting at slow speeds (i.e. 6 knots), they are likely to have noise levels considerably lower than tugs reported in the literature;
b. Given that the vessels will be constantly moving, there will be no sustained noise within any area;
c. That the noise produced by this activity is likely to be significantly less than noise levels for existing ferries, container and cargo vessel traffic and pile driving operations already operating in the Hauraki Gulf;
d. The maximum number of trips per year allowed under this application represents less than 1% of total vessel movements already occurring in the Hauraki Gulf annually; and
e. While masking and/or behavioural disruption to marine mammals are possible from this activity, they will be limited to the area immediately around the vessel/s;

[2] Data compiled from a range of sources including Auckland Transport (2014) Ferry Development Plan; Maritime New Zealand (2016) Summary of Recreational Boating Research; Game changes (2017) Recreational Boating Participation Research; POAL (2018) website

2.14. Therefore, I conclude that the risk of impact on marine mammals from underwater noise from the proposed activity is low.

Dr. SIMON JOHN CHILDERHOUSE
23 November 2018

REFERENCES

Auckland Transport (2014) Ferry Development Plan. 25 November 2014.

Maritime New Zealand (2016) Summary of Recreational Boating Research carried out by Research New Zealand. September 2016.

Game changes (2017) Recreational Boating Participation Research. May 2017.

POAL (2018) Ports of Auckland website. www.poal.co.nz

GOAG (2011) Review and Assessment of Underwater Sound Produced from Oil and Gas Sound Activities and Potential Reporting Requirements under the Marine Strategy Directive Framework. Consultants report for the Department of Energy and Climate Change.

Hemmera et al. (2014) Roberts Bank Terminal 2 Technical Data Report. Underwater Noise Ship Sound Signature Analysis Study. Report prepared for Port Metro Vancouver. November 2014.

Pine M, Jeffs A, Ding W, Radford C (2016) The potential for vessel noise to mask biologically important sounds within ecologically significant embayments. Ocean & Coastal Management 127: 63-73.

Veirs S, Viers V, Wood J (2016) Ship noise extends to frequencies used for echolocation by endangered killer whales. PeerJ 4: e1657; DOI 10.7717/peerj.1657.

APPENDIX A: ESTIMATES OF NOISE PRODUCED BY TUGS

Estimates of noise source levels and associated sizes of tugs reported in the international literature					
Reference	**Source level (dB re µPa @ 1m)**	**Speed (knots)**	**Size (m)**	**Engine Power (BHP)**	**Notes**
GOAG 2011	191.5	?	38	?	
Hemmera 2014	189.1	12	30	6000	
Hemmera 2014	mean = 179.3	8.7	various	various	mean of 650 tug recordings
Hemmera 2014	171.3	7.5	30	6000	
Veirs et al. 2016	mean = 170 ± 5 (SD)	8	various	various	mean of 337 tug recordings
GOAG 2011	160.0 (rms)	?	47	7200	
Typical vessels likely to be used in the proposed activity					
Vessel name	**Source level (dB re µPa @ 1m)**	**Speed (knots)**	**Size (m)**	**Engine Power (BHP)**	**Notes**
Christine Mary	unknown	mean = 6	21	1000	largest tug likely to be used
Soundcem	unknown	max = 8	46	360	self-propelled barge

APPENDIX B: MEASURED NOISE LEVELS FROM OTHER VESSELS FROM PINE ET AL. (2016)

Table 2
A comparison of different vessels and their acoustic characteristics.

	Source level (dB re 1 μPa @ 1 m)	Peak frequency (Hz)	Band width (Hz)	Citation
Small craft and boats				
Class 1 power boat	180	200	<5000	Amoser et al., 2004
Griffon 2000TD Hovercraft (12 m long, 40 km h^{-1})	133	87	10–10,000	Blackwell and Greene 2005
Zodiac with outboard engine	162	–	20–20,000	Erbe 2002
Motorboat with inboard engine	159	–	–	Erbe 2002
Arete Cabin Cruiser, (8 m long, 24 km h^{-1})	172	400, 2000	50–20,000	Kipple and Gabriele 2004
Cabin cruiser, (8.5 m long, 11 km h^{-1})	152	100	300–10,000	Codarin et al., 2009
Fishing vessel, (12 m long, 13 km h^{-1})	150	300	250–1000	Hildebrand 2004
Small boat outboard engine, (37 km h^{-1})	160		1000–5000	Hildebrand 2009
R.V. Hawere (15 m long, 28 km h^{-1})	184	70, 100–800	70–2000	This study
R.V. Yellow Naiad (4.5 m long, 43 km h^{-1})	188	200, 2001–5000	50–10,000	This study
Kawau Kat ferry (20 m long, 28 km h^{-1})	191	80, 200, 500	80–2000	This study
Superflyte ferry (39 m long, 46 km h^{-1})	185	100, 1000	80–1200	This study
Medium sized ships				
Spirit of Alaska tour vessel, (44 m long, 19 km h^{-1})	180	200, 5000	70–20,000	Kipple and Gabriele 2004
Nunatak, Naval vessel, (20 m long, 26 km h^{-1})	169	400–630	50–20,000	Kipple and Gabriele 2003
HMNZS Wellington Naval vessel, (85 m long, 15 km h^{-1})	172	50, 400	50–5000	This study
Large sized ships				
Golden Bay container vessel, (98 m long, 24 km h^{-1})	192	100–400	100–800	This study
Maersk Batur container vessel, (290 m long, 15 km h^{-1})	186	100–400	100–1200	This study
Buxlink container vessel, (206 m long, 11 km h^{-1})	159	800–2000	100–2000	This study
Container vessel, (173 m long, 29 km h^{-1})	192	–	40–100	Hildebrand 2009
Container vessel, (270 m long)	198	23	5–100	Hildebrand 2004
Coal carrier vessel, (173 m long, 29 km h^{-1})	192	50–100	–	Arveson and Vendittis 2000

Table 2 from Pine et al. (2016) The potential for vessel noise to mask biologically important sounds within ecologically significant embayments. Ocean & Coastal Management 127: 63-73.