Marshall Day Acoustics Pty Ltd
ABN: 53 470 077 191
6 Gipps Street
Collingwood VIC 3066
Australia
T: +613 9416 1855
www.marshallday.com

7 May 2021

Deleted: 8 February

Kalbar Operations Pty Ltd
48 Bailey Street
Bairnsdale VIC 3875

Attention: Chris Cook

Dear Chris

FINGERBOARDS MINERAL SANDS PROJECT - CENTRIFUGE DESIGN PROPOSAL ENVIRONMENTAL NOISE EVIDENCE ADDENDUM

INSTRUCTIONS

As instructed by White & Case by email on 29 January 2021, a letter[1] was submitted as an addendum to my evidence statement[2], presenting an assessment of the environmental noise implications of a design proposal for the Fingerboards Mineral Sands Project (the Project) which incorporates centrifuges in lieu of tailings storage facilities. The assessment was based on:

Deleted: this
Deleted: is provided
Deleted: and presents

- Information detailed in Technical Note TN 01 Implementation of centrifuges for water recovery and tailings management dated 18 January 2021
- Centrifuge locations provided in digital format by White & Case on 3 February 2021.

In the time since the addendum was issued, the following additional information relating to the proposed centrifuge option has been provided:

- Revised centrifuge locations provided in digital format by White & Case on 24 April 2021 and reflected in a revision of TN 01 dated 3 May 2021.
- Location of haul routes used to transport the dried cake from each centrifuge plant.

This letter has been prepared for submission as an updated addendum, accounting for the additional information described above.

[1] Lt 001 20200942 - *Fingerboards Mineral Sands - Noise Evidence - Addendum for Centrifuge Option* dated 8 February 2021

[2] Ev 001 R01 20200942 *Fingerboards Mineral Sands - Acoustic evidence* dated 30 January 2021

DESCRIPTION

In the time since the MDA report[3] was prepared, Kalbar Operations Pty Ltd (Kalbar) has been investigating design options to address water balance matters for the Project.

This has led to a proposed design change which would involve the development of two centrifuge plants, as detailed in Technical Note TN 01 *Implementation of centrifuges for water recovery and tailings management* dated 18 January 2021 (revised on 3 May 2021).

The centrifuge plant eliminates the need to construct the temporary tailings storage facility (TSF) and the in-pit fines TSF and, in turn, eliminate the need for the Amphirol plant which are the primary noise sources associated with the TSF.

Each centrifuge plant would consist of four centrifuges (three operational and one standby) enclosed within a cladded building to provide noise mitigation. The centrifuge plant would operate 24 hours a day, seven days a week (in contrast the Amphirol plant which were proposed to operate during the day only). The centrifuge plant is to comprise a demountable configuration which enables each plant to be periodically relocated as the Project progresses.

The following additional noise sources are associated with the centrifuge plant:

- Front end loader operations for handling dried cake stockpiles at each centrifuge plant
- Ancillary transformers at the exterior of each centrifuge plant
- Haul truck movements for transporting dried cake from each centrifuge plant.

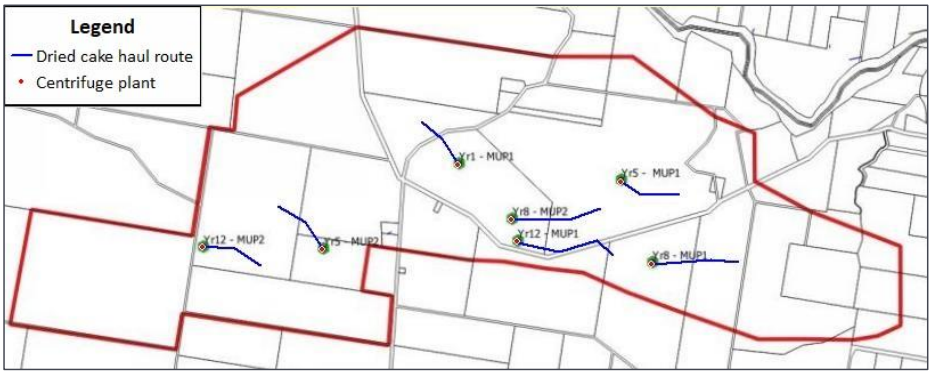
The above sources would also operate 24 hours a day, seven days a week, with the exception of the haul trucks which would only operate during the NIRV day period.

It is understood that development of the centrifuge plant would also result in a reduction in haul route movements compared to the operations modelled in the MDA Report.

ASSESSMENT BASIS

A simplified and conservative assessment has been carried out by conducting revised operational noise modelling for the primary noise source changes. Specifically, the modelling accounts for the removal of the Amphirol plant, and the addition of the noise sources associated with operation of the centrifuge plant, as presented in Figure 1.

Figure 1: Locations of centrifuge plant and dried cake haul route (based on Figure 8 of TN 01)



[3] Rp 001 R12 20170182 *Fingerboards Mineral Sands – EES Noise and Vibration Assessment* dated 25 August 2020

Deleted: .

Deleted: .

Deleted: changes to

Deleted: for handling fine tailings

Deleted: ¶

Deleted: .

Deleted: MDA Report

The modelling approach is conservative on account of the following:

- The centrifuge plant has been modelled without the benefit of the noise reduction associated with the proposed enclosure for the plant

  The design would need to be developed in further detail to provide a reliable basis for modelling the effect of the enclosure (to account for building configuration, material selections, and envelope penetrations). However, a basic lightweight enclosure with acoustically designed penetrations would reduce the noise of the centrifuge plant by at least 5 dB, and alternative material selections including demountable insulation panels would readily enable enclosure reductions of at least 15 dB.

- The haul trucks transporting the dried cake from each centrifuge has been modelled as a point source near to each centrifuge plant without any duration correction

  This approach is considered conservative (resulting in higher noise levels) as the total sound energy of the haul truck is located at a fixed point instead of being spread along the proposed haul route.

  This approach has been adopted to provide a conservative appraisal of the updated information in advance of a finalised haul route for this option. Specifically, the terrain data provided by Kalbar for noise modelling purposes represents the project design at the time of preparing the MDA Report; some of the terrain features were not compatible with the potential dried cake haul routes (i.e. the haul route would, at times, cross other haul routes, or cut through earth bunds), and would therefore be subject to further detailed design. This detailed design process is expected to involve the relocation of earth mounds to provide screening of the haul routes which would reduce noise levels.

- The noise contribution of the haul routes modelled in the MDA Report is assumed to result in the same noise levels

  The centrifuge plant would result in changes to haul routes and their usage relative to the Project design involving TSFs. However, advice from Kalbar suggests that there would be a net reduction in distance travelled for haul routes compared to the operations modelled in the MDA Report, resulting in comparable and potentially reduced noise generation from haul route traffic. Movements on these haul routes are not the primary contributors to the predicted noise levels at receptor locations near to the proposed centrifuge plant locations; minor changes in their noise contribution would therefore not translate to material changes in total predicted noise levels at receptor locations.

The noise modelling for the centrifuge plant is based on centrifuge noise emission data (sound power levels) provided by Kalbar in Section 8 of Technical Note TN 01. As part of this assessment, the data were reviewed by comparing the levels with manufacturer data from a candidate plant supplier. The review confirmed the data were suitable for noise modelling and assessment purposes.

The sound power level data of the centrifuges and other plant relevant to this noise assessment are detailed in Appendix A. For reference purposes, this includes the sound power data of the Amphirol plant associated with the TSFs.

Deleted:

Deleted: haul route

Deleted: the

Deleted: was

Deleted: purpose

Deleted: ¶

PREDICTED NOISE LEVELS

The predicted noise levels for the Centrifuge option for each of the four (4) scenario years assessed in the MDA report are tabulated in Appendix B, together with applicable NIRV criteria. For comparison, the tabulated data includes the predicted noise levels for the TSF-based configuration of the Project, and the change in predicted noise levels associated with the centrifuge-based configuration.

Appendix B also presents predicted noise levels at receptor R2004, as discussed in the MDA letter[4] dated 22 February 2021 which was included as Appendix 2 of technical note TN 04 *Response to IAC Request for Information – Part 2.8, questions 23 and 24*, revised 19 April 2021.

The predictions are provided for the preferred material transport option for the Project, which involves the development of a dedicated rail siding at Fernbank to the south of the mine.

The results demonstrate:

- The predicted noise levels are below the recommended levels of EPA Publication 1411 *Noise from Industry in Regional Victoria* (NIRV) for the day, evening, and night; and
- The predicted noise levels are generally comparable (within ±1 dB) for the TSF and centrifuge-based configurations of the Project. Marginal increases of up to 2 to 3 dB were calculated for the centrifuge-based configuration at a small number of locations, however the total predicted noise levels for these locations were at least 5 dB below the applicable NIRV recommended levels.

The results therefore demonstrate the viability of the centrifuge-based configuration of the Project with respect to environmental noise levels.

Given the conservative modelling approach, actual noise levels in practice would be lower as a result of the effect of the centrifuge enclosure, and subsequent design work to finalise the haul route for transporting dried cake from the centrifuge. This further supports the viability of this design option. Irrespective, if the centrifuge-based option is developed, all aspects of the centrifuge plant, including the building design, associated ancillary equipment and associated haul route changes, would need to be represented in the design stage noise modelling. Consistent with the wider approach to addressing noise from the site, this design stage modelling would inform:

- the specification and tendering of equipment to meet the noise requirements
- the development of the noise mitigation and management measures to be documented in the Environmental Noise Management Plan.

I have made all the inquiries that I believe are desirable and appropriate and no matters of significance which I regard as relevant have to my knowledge been withheld from the Inquiry and Advisory Committee.

Yours sincerely

Signed .....

Dated 7 May 2021

[4] Lt 002 R01 20200942 *Fingerboards mineral sands project - additional noise sensitive receptors*

Deleted: ,

Deleted: maximum noise

Deleted: (recommended levels)

Deleted:

Deleted: , with

Deleted: dB (typically 1 dB) and reductions

Deleted: up to 4

Deleted: (typically 1 dB).

Deleted: supporting

Moved down [1]: Yours sincerely

Moved (insertion) [1]

Deleted: *<object>*¶

Deleted: 8 February

Deleted: ¶

APPENDIX A NOISE EMISSION DATA

Table 1: Octave band sound power level data

Source	Model/ duty	Notes	Octave Band Centre Frequency (Hz)							Total A-weighted
			63	125	250	500	1k	2k	4k	
Amphirol	Mudmaster	Data as referenced in Table 48 of the MDA report to assess the design incorporating a Tailings Storage Facility (TSF). Based on manufacturer data for similar-sized equipment, with spectrum based on data contained in BS 5228-1[5].	115	115	109	107	106	104	98	111
Centrifuge	Alfa Laval P3-10070	Candidate centrifuge for assessment purposes. Data derived from manufacturer test data[7], and corresponds to the combined total noise emissions of three (3) centrifuges operating simultaneously. Modelled as a point source at a height of 10 m above ground level, and without the noise reduction afforded by the proposed enclosure of the plant.	107	106	105	107	101	101	101	109
Front end loader	9T	Data as referenced in Table 48 of the MDA report, and adopted for modelling activity adjacent the centrifuge plant. Based the on upper range of AS 2436[8] values, with spectrum based on data contained in BS 5228-1. Modelled as a point source at a height of 2 m above ground level. The modelling accounts for the front end loader operating for 50 % of the time during a 30 minute assessment period, consistent with modelled duration corrections for other front end loader.	115	109	108	108	106	104	100	111
Transformer	2 MVA	Empirical data from AS 60076-10:2009[9], with spectrum based on measurements by MDA. The sound power levels include the noise from ancillary plant such as cooling plant. Modelled as a point source at a height of 2 m above ground level	68	79	76	67	58	49	42	70

[5] BS 5228-1:2009+A1:2014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*

[7] Centrifuge derived sound power level data documented in Technical Note TN 01

[8] AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*

[9] AS 60076-10:2009 *Power transformers – Part 10: Determination of sound levels*

Deleted: Front end loader ...

Moved down [2]: the MDA report, and adopted for modelling activity adjacent the centrifuge plant. Based the on upper range of AS 2436[6] values, with spectrum based on data contained in BS 5228-1.¶
Modelled as a point source at a height of 2 m above ground level.¶
The modelling accounts for the front end loader operating for 50 % of the time during a 30 minute assessment period, consistent with modelled duration corrections for other front end loader.

Moved (insertion) [2]

Deleted:

Source	Model/ duty	Notes	Octave Band Centre Frequency (Hz)							Total A-weighted
			63	125	250	500	1k	2k	4k	
Haul Trucks	CAT 785	Data as referenced in Table 48 of the MDA report. Noise level based on manufacturer data, correlated with MDA measurement data for similar-sized equipment. Modelled as a point source at a height of 2 m above ground level. Note – these are the emission values for an unmitigated truck. Section 10.1 of the MDA report outlines requirements for the use of noise reduction kits for specific plant items. In relation to haul trucks, a noise reduction kit providing a 6 dB noise level reduction is specified in Table 27 of the MDA Report. This mitigation was included in the predicted noise levels presented in the MDA report, and has also been included in the predictions for the centrifuge-based configuration of the project.	123	123	120	117	114	112	107	120

APPENDIX B PREDICTED NOISE LEVELS

Table 2: Predicted noise levels, dB L_{Aeq} – Project with Tailings Storage Facility (TSF) option and Project with centrifuge option – Day period

Receptor	TSF option				Centrifuge option				Change in predicted level			
	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12
R1	38	38	39	39	38	40	39	40	-	+2	-	+1
R5	37	36	36	30	38	35	36	32	+1	-1	-	+2
R6	33	33	33	29	34	34	34	30	+1	+1	+1	+1
R7	31	34	36	31	32	36	36	31	+1	+2	-	-
R15	28	33	35	31	28	35	37	31	-	+2	+2	-
R16	25	30	33	29	26	31	34	30	+1	+1	+1	+1
R21	36	34	28	29	36	34	28	30	-	-	-	+1
R23	34	34	34	34	34	34	34	34	-	-	-	-
R29	22	26	29	26	23	27	30	27	+1	+1	+1	+1
R30	24	27	31	30	24	28	33	31	-	+1	+2	+1
R31	29	30	32	32	29	31	33	32	-	+1	+1	-
R43	33	34	26	31	33	34	26	31	-	-	-	-
R44	29	30	29	33	29	31	30	33	-	+1	+1	-
R45	30	32	33	33	30	33	35	34	-	+1	+2	+1
R47	26	29	32	32	26	30	33	32	-	+1	+1	-
R52	37	37	37	37	37	37	37	37	-	-	-	-
R53	36	36	36	36	36	36	36	36	-	-	-	-
R58	29	30	30	30	29	30	30	30	-	-	-	-
R60	37	37	37	37	37	37	37	37	-	-	-	-
R2004	37	36	36	30	38	35	36	32	+1	-1	-	+2
NIRV criteria	46	46	46	46	46	46	46	46				

Table 3: Predicted noise levels, dB L_{Aeq} – Project with Tailings Storage Facility (TSF) option and Project with centrifuge option – Evening period

Receptor	TSF option				Centrifuge option				Change in predicted level			
	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12
R1	38	38	39	39	38	39	39	39	-	+1	-	-
R5	37	36	36	30	37	33	35	30	-	-3	-1	-
R6	33	33	33	29	34	32	33	29	+1	-1	-	-
R7	31	34	36	31	31	34	36	30	-	-	-	-1
R15	28	33	35	31	28	33	36	30	-	-	+1	-1
R16	25	30	33	29	25	30	34	29	-	-	+1	-
R21	36	34	28	29	36	33	27	29	-	-1	-1	-
R23	34	34	34	34	34	34	34	34	-	-	-	-
R29	22	26	29	26	22	26	29	26	-	-	-	-
R30	24	27	31	30	24	27	31	30	-	-	-	-
R31	29	30	32	32	28	30	33	32	-1	-	+1	-
R43	33	34	26	31	32	34	25	31	-1	-	-1	-
R44	29	30	29	33	28	30	29	33	-1	-	-	-
R45	30	32	33	33	29	32	33	33	-1	-	-	-
R47	26	29	32	32	26	29	32	32	-	-	-	-
R52	37	37	37	37	37	37	37	37	-	-	-	-
R53	36	36	36	36	36	36	36	36	-	-	-	-
R58	29	30	30	30	29	30	30	30	-	-	-	-
R60	37	37	37	37	37	37	37	37	-	-	-	-
R2004	37	36	36	30	37	33	35	30	-	-3	-1	-
NIRV criteria	41	41	41	41	41	41	41	41				

Table 4: Predicted noise levels, dB L_{Aeq} – Project with Tailings Storage Facility (TSF) option and Project with centrifuge option – Night period

Receptor	TSF option				Centrifuge option				Change in predicted level			
	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12
R1	33	35	32	35	34	36	33	36	+1	+1	+1	+1
R5	31	29	30	28	32	31	31	29	+1	+2	+1	+1
R6	29	30	29	28	30	31	30	29	+1	+1	+1	+1
R7	25	30	31	27	26	32	32	28	+1	+2	+1	+1
R15	23	31	33	26	24	32	34	27	+1	+1	+1	+1
R16	22	28	33	27	23	29	33	27	+1	+1	-	-
R21	33	31	24	27	33	31	25	28	-	-	+1	+1
R23	31	31	31	31	31	31	31	31	-	-	-	-
R29	19	24	28	24	19	25	28	24	-	+1	-	-
R30	20	24	30	27	20	25	31	27	-	+1	+1	-
R31	24	27	30	29	24	27	31	29	-	-	+1	-
R43	29	33	23	30	29	33	23	30	-	-	-	-
R44	27	30	25	32	27	30	26	32	-	-	+1	-
R45	25	29	29	31	26	30	31	32	+1	+1	+2	+1
R47	22	26	31	28	22	27	31	29	-	+1	-	+1
R52	35	35	35	35	35	35	35	35	-	-	-	-
R53	34	34	35	35	34	34	35	35	-	-	-	-
R58	26	26	26	27	26	26	26	27	-	-	-	-
R60	34	34	34	34	34	34	34	34	-	-	-	-
R2004	27	28	32	27	28	31	33	29	+1	+3	+1	+2
NIRV criteria	36	36	36	36	36	36	36	36				

APPENDIX C SUPERSEDED PREDICTED NOISE LEVELS (AS PRESENTED IN APPENDIX B OF LT 001 20200942 DATED 8 FEBRUARY 2021)

Table 5: Superseded predicted noise levels, dB L_{Aeq} – Project with Tailings Storage Facility (TSF) option and Project with centrifuge option – Day/evening periods

Receptor	TSF option				Centrifuge option				Change in predicted level			
	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12
R1	38	38	39	39	38	39	39	40	-	+1	-	+1
R5	37	36	36	30	37	32	35	30	-	-4	-1	-
R6	33	33	33	29	34	32	32	29	+1	-1	-1	-
R7	31	34	36	31	31	34	36	30	-	-	-	-1
R15	28	33	35	31	28	33	35	30	-	-	-	-1
R16	25	30	33	29	25	30	33	29	-	-	-	-
R21	36	34	28	29	36	33	27	29	-	-1	-1	-
R23	34	34	34	34	34	34	34	34	-	-	-	-
R29	22	26	29	26	22	26	29	26	-	-	-	-
R30	24	27	31	30	24	27	31	30	-	-	-	-
R31	29	30	32	32	28	30	33	32	-1	-	+1	-
R43	33	34	26	31	32	34	26	31	-1	-	-	-
R44	29	30	29	33	28	30	30	33	-1	-	+1	-
R45	30	32	33	33	29	32	33	33	-1	-	-	-
R47	26	29	32	32	26	29	32	32	-	-	-	-
R52	37	37	37	37	37	37	37	37	-	-	-	-
R53	36	36	36	36	36	36	36	36	-	-	-	-
R58	29	30	30	30	29	30	30	30	-	-	-	-
R60	37	37	37	37	37	37	37	37	-	-	-	-
NIRV day/evening criteria	46/41	46/41	46/41	46/41	46/41	46/41	46/41	46/41				

Table 6: Superseded predicted noise levels, dB L_{Aeq} – Project with Tailings Storage Facility (TSF) option and Project with centrifuge option – Night period

Receptor	TSF option				Centrifuge option				Change in predicted level			
	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12	Year 1	Year 5	Year 8	Year 12
R1	33	35	32	35	34	36	32	36	+1	+1	-	+1
R5	31	29	30	28	32	30	30	29	+1	+1	-	+1
R6	29	30	29	28	30	31	29	29	+1	+1	-	+1
R7	25	30	31	27	26	31	32	28	+1	+1	+1	+1
R15	23	31	33	26	24	31	33	27	+1	-	-	+1
R16	22	28	33	27	23	28	33	27	+1	-	-	-
R21	33	31	24	27	33	31	25	28	-	-	+1	+1
R23	31	31	31	31	31	31	31	31	-	-	-	-
R29	19	24	28	24	19	24	28	24	-	-	-	-
R30	20	24	30	27	20	24	31	27	-	-	+1	-
R31	24	27	30	29	24	27	30	29	-	-	-	-
R43	29	33	23	30	29	33	24	30	-	-	+1	-
R44	27	30	25	32	27	30	26	32	-	-	+1	-
R45	25	29	29	31	26	30	31	32	+1	+1	+2	+1
R47	22	26	31	28	22	26	31	29	-	-	-	+1
R52	35	35	35	35	35	35	35	35	-	-	-	-
R53	34	34	35	35	34	34	35	35	-	-	-	-
R58	26	26	26	27	26	26	26	27	-	-	-	-
R60	34	34	34	34	34	34	34	34	-	-	-	-
NIRV night criteria	36	36	36	36	36	36	36	36				

Deleted: :