Quality of the scientific studies submitted by the Proponent for the EES

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Presentation to the IAC as part of Mine Free Glenaladale's submission

Monday 7th June, 2021

Experience in assessing scientific quality:

Over 30 years of experience in assessing research grant applications for:

Australia's peak research funding organizations

- ARC (Australian Research Council)
- NHMRC (National Health and Medical Research Council)
- National Heart Foundation

Overseas peak funding organizations include:

- Medical Research Council (UK)
- Wellcome Trust (UK)
- National Science Foundation (USA)
- Medical Research Council of NZ
- GAČR – Czech Science Foundation
- OKTA – Hungarian Academy of Sciences

Experience in assessing scientific quality:

Editorial Board: Six major international scientific journals

1. *Journal of Physiology (Lond)*
2. *British Journal of Pharmacology*
3. *PLoS One*
4. *Clinical & Experimental Pharmacology & Physiology*
5. *ISRN Vascular Medicine*
6. *Frontiers in Neuroscience*

Refereeing/assessing scientific quality of manuscripts for international scientific journals (around 25 manuscripts/yr) for around 20 different journals

Published in top scientific journals including *Nature*, *Nature Communications*

Drug testing for EU approval

Expert witness in pharmaceutical company disputes

Fundamentals of scientific studies

Sufficient detail must be included so that others can repeat the study in order to test the results and conclusions.

Sufficient numbers of observations must be made in order for sound conclusions to be made.

Appropriate statistical analysis and testing to indicate degree of variability in the data and whether differences are significant.

Methods involved in data acquisition and analysis must be fully transparent.

The assumptions involved in models and data analysis must be clearly stated.

Models should bear some resemblance to the real situation.

Full acknowledgement of conflicts of interest.

Instil a sense of confidence in the results and conclusions.

Lack of confidence in the Proponent's results and conclusions

Major miscalculation in water requirements.

What other errors and miscalculations have been made by the Proponent?

Many examples in the scientific literature where far smaller miscalculations have come to light.

In all reputable, high quality scientific journals, where such errors have come to light, the editors claim to lose all confidence in the work.

Inevitably such works are **retracted.**

Eg *Am J Physiol Gastrointest Liver Physiol* 319: G638, 2020; doi:10.1152/ajpgi.00042.2020.

Am J Physiol Cell Physiol 320: C251, 2021; doi:10.1152/ajpcell.00310.2017_RET

Given the magnitude of the error and the very late stage at which this was announced, it is not possible to have any confidence in any of the scientific studies submitted by the Proponent.

Lack of confidence in studies results in retraction

american physiological society

AMERICAN JOURNAL OF PHYSIOLOGY
HEART AND CIRCULATORY PHYSIOLOGY.

Am J Physiol Heart Circ Physiol 320: H1657, 2021.
doi:10.1152/ajpheart.00304.2020_RET

RETRACTION

Retraction for Zheng et al., volume 320, 2021, p. H969–H979

Zheng S, Gong M, Chen J. Extracellular vesicles enriched with miR-150 released by macrophages regulates the TP53-IGF-1 axis to alleviate myocardial infarction. *Am J Physiol Heart Circ* 320: H969–H979, 2021. First published October 31, 2020; doi: 10.1152/ajpheart.00304.2020. The American Physiological Society is retracting this article. Confidence in the work has been lost, as the authors have not provided original data at the request of the journal.

Lack of confidence in studies results in retraction

Am J Physiol Gastrointest Liver Physiol 319: G638, 2020;
doi:10.1152/ajpgi.00042.2020.

RETRACTION

Zhang Y, Pan Q, Shao Z. Extracellular vesicle-encapsulated microRNA-1228-3p from cancer-associated fibroblasts promotes the chemoresistance of hepatocellular carcinoma cells via PLAC8. *Am J Physiol Gastrointest Liver Physiol.* First published August 5, 2020; doi:10.1152/ajpgi.00042.2020.

The American Physiological Society is retracting the Articles in Press version of this article. Confidence in the work has been lost due to the inclusion of different, non-peer reviewed, results during proof stage.

Given the magnitude of the Proponent's known error in calculating water requirements, and the very late stage at which this was announced, there is a major lack of confidence in the scientific studies submitted by the Proponent.

Inappropriate meteorological observations

Critical issues

- Dust, which depends on wind speed.
- Modelling for dust dispersion depends strongly on wind speed.
- Rainfall, which affects water management issues, including dust suppression.

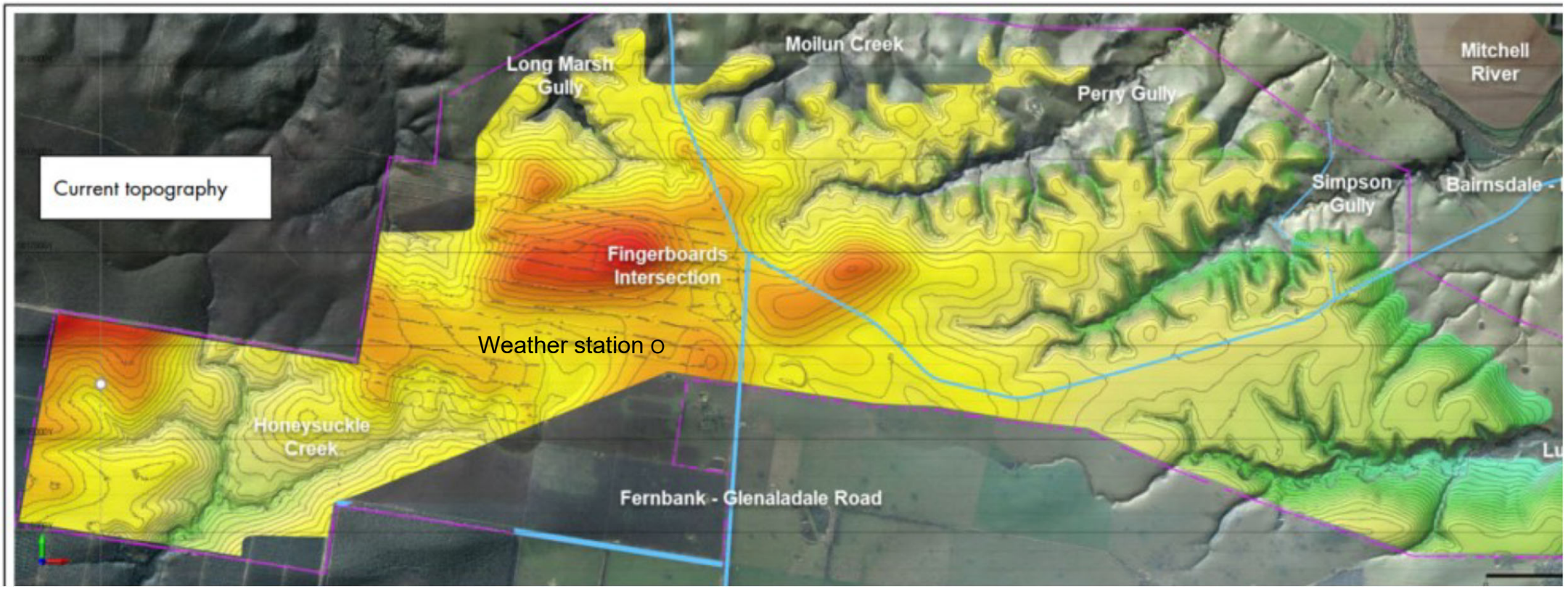
On-site weather station

- Incomplete data for wind speed and wind direction - only 77.3% due to several equipment faults
- Location coordinates not provided
- Location not representative of the proposed mine site
- Located in a hollow
- Downwind of wind break and large forested area

Location of meteorological station

Location of meteorological station

Location of meteorological station



35 Appendix A006 AppE, p. 38, by WaterTechnology Contour interval 2.5 m

Looking uphill to the East from the meteorological station

Looking uphill to the North-East from the meteorological station

Looking South towards trees

Inconsistencies in use of weather data

Mt Moornapa *"considered representative of the climate conditions in the project area. "*

The mean annual rainfall is 864.8 mm" 35 Appendix A006, p.34, by Coffey

Despite an elevation of 480 m (cf Fingerboards at ~ 100 m)

On the other hand:

"The nearest monitoring stations with data available for the 2013 – 2016 period are the Bureau of Meteorology's monitoring stations at Mount Moornapa and Bairnsdale. These sites are not considered representative of the Project site." 38 Appendix A009, p.120 (by Katestone)

Inconsistencies in use of weather data

"Lindenow Station was selected as the most appropriate weather station for daily rainfall records …Records commenced in 1897" "data used from January 1901 to December 2017"

35 Appendix A006AppA p. 11, by EMM

Actual rainfall readings only until 31st Aug, 2015.

"SILO Patched Point Data is based on historical data from the Bureau of Metrology (BoM) rainfall stations, with missing data 'patched' in by interpolating data from nearby operating stations."

5 Appendix A006AppA p. 11, by EMM

Which data were used for "patching"?

Relevance of data from 1901 during this time of climate change?

Mitchell River at Glenaladale site (approximately 4 km away), rainfall records for the site commenced in December 2000, but data not used. Annual rainfall is 663.8 mm (BoM)

"Mitchell River at Glenaladale has not quality controlled by the BoM and is therefore potentially unreliable."

35 Appendix A006AppA p. 11, by EMM

However, all nearby weather stations include at least some data that are not quality controlled.

Weather model validation?

To validate the TAPM model for **wind speed**, data were compared between the TAPM model's prediction and the data from the on-site monitoring station.

"*Figure A3 Wind speed distributions from on-site monitoring station (1 July 2017 – 28 February 2018), TAPM (2016) and the BoM monitoring stations at Mount Moornapa and Bairnsdale (2016)*"

38 Appendix A009, p. 121, by Katestone

Issues:

- Compares different years. 2016 (TAPM) cf on-site 8 months 2017-2018
- Compares different weather conditions. Wet year for TAPM, cf drought for on-site

These are inappropriate comparisons and therefore do not validate the TAPM data used in modelling for the proposed mine site.

Weather model validation?

To validate the TAPM model for **wind direction**, data were compared between the TAPM model's prediction and the data from the on-site monitoring station.

"*Figure A4 Wind direction distributions from on-site monitoring station (1 July 2017 – 28 February 2018), TAPM (2016) and the BoM monitoring stations at Mount Moornapa and Bairnsdale (2016)*"

38 Appendix A009, p. 121, by Katestone

Issues:

- Compares different years. 2016 (TAPM) cf on-site 8 months 2017-2018
- Compares different weather conditions. Wet year for TAPM, cf drought for on-site
- Significant discrepancies in wind directions
    - TAPM predicts more NW winds compared with on-site
    - Thus TAPM would underestimate the dust blown over the river flats

These are inappropriate comparisons and therefore do not validate the TAPM data used in modelling for the proposed mine site. Significant implications for dust spread.

Run-off

"Run-off estimates are based modelling with model parameters assumed to be appropriate for the site." 35 Appendix A006, p.60, by Coffey

"Run-off from the site has not been calibrated against any flow data directly from the site."
35 Appendix A006AppA, p.82, by EMM

Run-off event June 2019: 35 Appendix A006AppA, p.E.1, by EMM

"Automated loggers did not function correctly during this run-off event" ibid p.E.1, by EMM

"The flow event has provided the opportunity for direct measurement of water quality within the ephemeral drainage gullies based on samples collected at three locations. … The results of this monitoring were used by WaterTechnology to estimate median nutrient and metal concentrations in undisturbed or natural surface runoff from the project area."
35 Appendix A006, p.180, by Coffey

Run-off data

Very limited data and includes "assumed" data.

Fails to take into account the very severe drought with very limited vegetation.

Run-off model validation?

"The AWBM rainfall runoff model contained within the water balance model predicted the runoff hydrograph shown in Figure E.1, in which there is no runoff event observed in June 2019. This hydrograph shows no runoff through 2018, … These results indicate that the model has produced a reasonable representation of site runoff through 2018-2019."

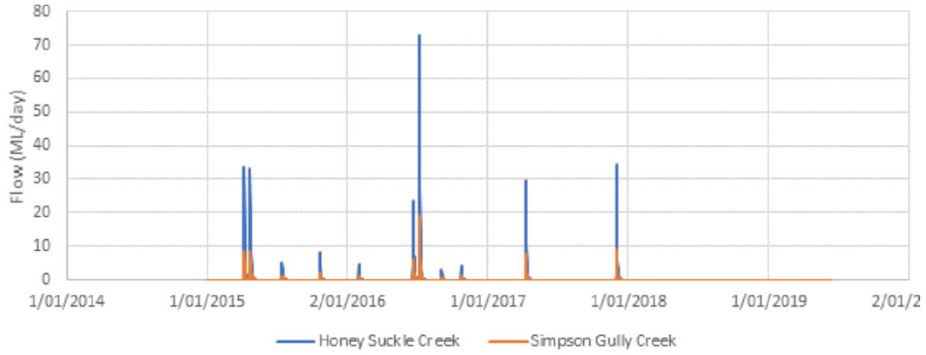


Figure E.1 Modelled runoff at the site

35 Appendix A006AppA, p. E.1, by EMM

Comparing 1 actual event with 0 predicted events cannot be considered a reasonable validation of the model. There is no indication of whether the model prediction was just below threshold for predicting events, or way below threshold.

A reasonable number of actual and predicted events would be required for validation of the model.

Run-off model validation?

"*When simulating the 20 January 2020 event the AWBM model produced a runoff estimate of around 12 mm, which was an order of magnitude greater than the 0.2 mm to 0.8 mm observed*" 35 Appendix A006, p. 147, by Coffey

Thus significant issues with the validation of the AWBM run-off model.

Particulate matter monitoring

"*Meteorological data collected between 1 October 2017 and 30 September 2018 has been analysed and is presented here. Data capture during this period for wind speed and wind direction was 77.3% due to several equipment faults.*" 38 Appendix A009, p.13, by Katestone

On-site particulate monitoring station

"*The reported concentrations of α-quartz and cristobalite in air are presented in Figure 10 and summarised in Table 7. The monitoring data show: • Measurements were not taken between 9 January 2018 and 3 April 2018, and also between 20 April 2018 and 2 June 2018 due to an unavailability of filters for the equipment.*" ibid p. 22

Thus, significant gaps in the background dataset for respirable crystalline silica (RCS) which occur late summer early autumn.

The climatic conditions during this period likely to give higher levels of dust and associated RCS.

Particulate matter monitoring

On-site particulate monitoring station

"*The air quality monitoring equipment is located near the centre of the project site on land owned by Kalbar. The site was selected as it was centrally located among the sensitive receptors and expected to be representative of existing levels of air pollutants in the region.*"

38 Appendix A009, p.18, by Katestone.

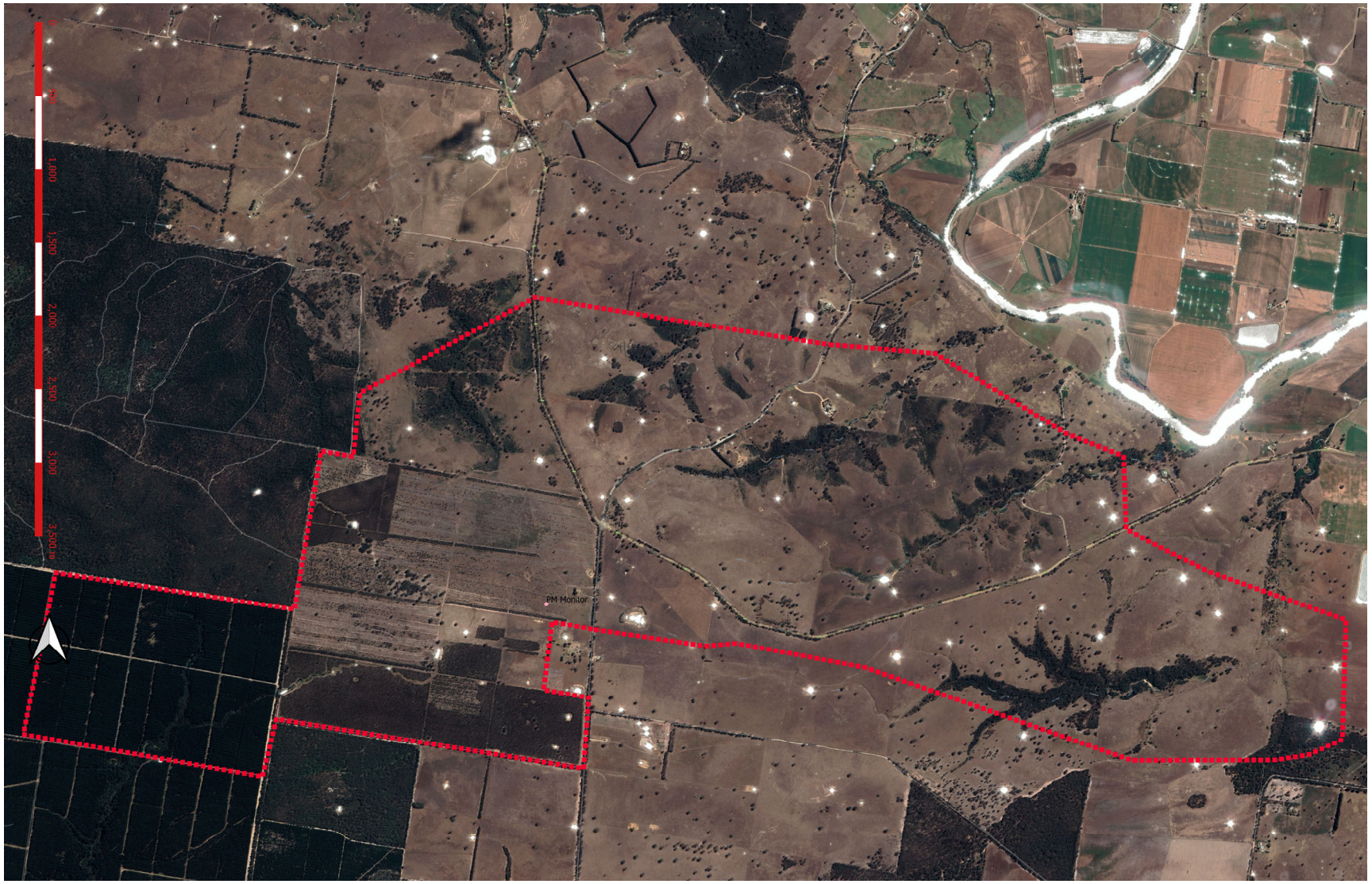
Location not representative of the proposed mine site

Located in a hollow

Downwind of windbreak and large forested area

Ecotech is not NATA accredited for a number of the methods used in the background monitoring. This particularly applies to small particles - PM2.5.

Location of particulate matter monitoring station



Soil samples

"*The topsoil is a loamy sand taken from one location on the north east of the McMahon property*"

51 Appendix A022 p.4 by Landloch

N = 1 is inadequate.

Location not given, so not possible to repeat the sampling

"*Locations of the sonic cores from which samples were taken for analysis are also shown in Figures 18-21*."

30 Appendix A001 p.19, by Landloch

Proponent's map lacks definition to enable repeat sampling

Actual coordinates not given, so not possible to repeat the sampling.

This is a critical issue given the presence of very steep gullies.

Soil samples

"Study of soils present on the project area (Landloch 2020a) found only slight spatial variation in topsoil properties." 51 Appendix A022, p. 4, by Landloch

But Table 8 shows large variations.

Despite this variability, only one sonic drilling site (SD14) was assayed through its different formations.

N = 1 is inadequate

Table 8: Project area topsoil sonic drill hole assays (calculated from assay-by-size data).

Hole ID (Depth (m))	As (ppm)	Bi (ppm)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Hg (ppm)	K (ppm)	Ni (ppm)	Pb (ppm)	Se (ppm)	Th (ppm)	Tl (ppm)	U (ppm)	V (ppm)	W (ppm)	Zn (ppm)
SD01 (0.0-0.1m)	1.0	0.2	ND	1.5	ND	15	ND	1660	6	5.4	ND	7.1	ND	2.3	18.6	3.2	275
SD08 (0.0-0.5m)	3.5	0.2	ND	4.7	97	6	ND	4151	62	8.2	ND	18.5	ND	4.1	62.1	3.0	10
SD10 (0.0-0.2m)	1.1	0.1	ND	1.6	ND	15	ND	1660	10	4.4	ND	18.3	ND	4.4	24.6	3.0	30
SD14 (0.0-0.2m)	3.6	0.1	ND	2.0	24	11	ND	14196	8	5.0	ND	5.3	ND	1.4	28.3	1.9	19
SD25 (0.0-0.3m)	4.7	0.2	ND	7.7	7	8.	ND	3321	15	9.4	ND	12.3	ND	2.9	44.6	3.1	15
SD27 (0.0-0.3m)	5.2	0.3	ND	25.2	24	13	ND	7604	23	9.7	ND	12.0	ND	2.6	59.6	10.0	26
Average	3.2	0.2		7.1	38.0	11.3		5432	20.7	7.0		12.3		3.0	39.6	4.0	62.5
Maximum	5.2	0.3		25.2	97	15		14196	62	9.7		18.5		4.4	62.1	10	275

Conclusions

Very small N-numbers. N = 1 is unacceptable, though occurs multiple times

Multiple equipment failures resulted in incomplete data sets

The EES involves a considerable amount of modelling

Modelling based on very little data, inappropriate data, or none at all in some cases, so conclusions are very weak

Models only as good as the assumptions upon which they are based

Data trumps modelling

Major errors in calculating water requirements

Undermines all confidence in the Proponent's EES studies

The monitoring equipment failures, low quality, and lack of robustness in results and conclusions at this early, critical stage of close scrutiny does not auger well for future monitoring of dust etc following any mining approval