Supplementary Witness Statement

NAME

Dr Rob Loch
Landloch Pty Ltd
P.O. Box 57
HARLAXTON QLD 4350

AREA OF EXPERTISE

1. I have over 45 years experience working in soil science, land management and mine site rehabilitation.

2. I am a member of Soil Science Australia, and am a Certified Professional Soil Scientist (CPSS).

3. My other academic qualifications, work experience and technical publications are set out in my curriculum vitae at Appendix A.

4. I am sufficiently expert to make this statement because I have over three decades of experience in reviewing, planning and implementing rehabilitation strategies for mine sites and disturbed lands around Australia and internationally, including three mines in Victoria.

SCOPE

5. I have been instructed by White & Case, on behalf of Kalbar Operations Pty Ltd (Kalbar), to prepare a supplementary witness statement for the inquiry and advisory committee (IAC) hearing that sets out my expert views about the potential impact of the Kalbar Operations' proposal to adopt centrifuge treatment of tailings on the views expressed in my initial witness statement dated 29 January 2021.

6. I have read the technical note provided by Kalbar Operations (FINGERBOARDS MINERAL SANDS PROJECT INQUIRY AND ADVISORY COMMITTEE TECHNICAL NOTE, dated 18 January 2021). I have seen no other information with respect to the adoption of centrifuges for tailings and water management.

SUMMARY OF OPINIONS

7. My opinions are largely focused on impacts on rehabilitation of the mine site.

8. The use of the centrifuges is expected to eliminate the need for tailings storage facilities (TSFs) containing fine tailings (often called slimes). I expect eliminating the need for those TSFs will have several benefits for rehabilitation works and outcomes.

9. The elimination of TSFs will eliminate the delay required for each TSF to be filled and dried, with the result that filling of the pits will be completed and rehabilitation works will be able to be initiated earlier after completion of mining. That may enable some reduction in the area of land disturbed at any time, and it is possible that stockpiling of topsoil during the first years of mining will be reduced.

10. Elimination of TSFs containing fine tailings will mean that the final pit area will not contain layers of relatively impermeable fine (and compacted) tailings with possible potential to impact on sub-surface water movement (both lateral and vertical). As the overburden placed in the pit is likely to also be of low permeability (both before and after mining), I am not sure whether the tailings layers would have had significant impact or not.

11. Elimination of the TSFs would avoid having drainage from the tailings dams mound under the dams during the period of placement and drying, which would also be desirable.

12. I have not been advised by Kalbar Operations whether preparation of a manufactured subsoil using a mixture of fine and coarse tailings will use fine tailings from the centrifuges or not. If it does, then a procedure of breaking the dried lumps of fine tailings to a finer particle size distribution suitable for mixing with the sand tailings will need to be developed. (That would be required only for the small proportion of fine tailings used in manufacturing subsoil for rehabilitation works.) It is likely that the mixing of dry fine tailings of suitable particle size (probably in the order of <5 mm) with sand tailings could achieve good (thorough and even) mixing. .

13. I understand that flocculation of the fine tailings will use polyacrylamide. I am aware of widespread use and placement of polyacrylamides for surface treatment of soils. It has been generally understood that such compounds break down under microbial action and general exposure to atmospheric conditions without releasing any toxic compounds (such as the acrylamide monomer). However, I am not aware of any information on the long-term mobility, persistence, or breakdown products from such compounds if placed at significant depth in the soil. Nonetheless, I would expect that the placement of dried tailings from the centrifuge would deliver considerably less polyacrylamide into the pit than would be the case with wet fine tailings being placed into a TSF.

DECLARATION

31. 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 IAC.

Signed 

Dr Robert Loch
6 February 2021

APPENDIX A – CURRICULUM VITAE OF DR ROBERT LOCH

Academic qualifications

B.Agr.Sc. Univ. of Queensland, 1972, Major in Soil Science
B.A. Univ. of Queensland, 1978
Ph.D. Resource Engineering Dept, Univ. of New England, Armidale, 1990
CPSS (Certified Professional Soil Scientist)

Professional awards and positions

- Publication medal 1984 – Australian Society of Soil Science
- Honorary Research Consultant, Dept Agriculture, Univ. Queensland (1994 - 1999)
- Member of the Editorial Advisory Committee for the Australian Journal of Soil Research (1996-2001)
- Honorary Research Fellow, University of Southern Queensland
- President (1999-2000 FY), Qld Branch of the Australian Society of Soil Science
- Member of the CPSS (Certified Professional Soil Scientist) Accreditation Committee for Soil Science Australia (2012-2013)
- Chair of a CPSS sub-committee developing competence standards in Soil Erosion Assessment and Management for CPSS-accredited soil scientists (2012-2013)
- Member (2019 - present) of a committee developing competence standards in Land Rehabilitation as a sub-accreditation for Certified Environmental Practitioners for the Environmental Institute of Australia and New Zealand.

PROFESSIONAL CAREER

Department of Primary Industries, Queensland, 1972 – 1996. Research scientist focussing on soil and tillage management and soil erosion studies.

Landloch Pty Ltd, 1996 – present. Principal Consultant responsible for technical leadership and development, staff management and mentoring. (Landloch currently has offices in Toowoomba, Newcastle, and Perth, and erosion study facilities in Arizona and South Africa. I have worked in all Australian states and territories except Tasmania, and internationally in the Pacific, Asia, Africa, and south America.

As well as the Fingerboards project, I have worked for the following Victorian sites:

- Ballarat Gold mine (rehabilitation)
- Alcoa's Anglesea Mine (rehabilitation and closure)
- Hazelwood Mine (rehabilitation and closure)

Areas of expertise

Specific areas of expertise and experience include:

- Soil erosion measurement, prediction, and control
- Landform design for minesite waste landforms
- Soil/land/minesite rehabilitation
- Land management in agricultural/pastoral industries.

Soil erosion

I have been one of Australia's leading soil erosion researchers and consultants for over 30 years. My work and work areas include:

- Use of simulated rain to study infiltration and erosion in both field and laboratory, both nationally and internationally
- Methods for measurement of soil erodibility for a wide range of soils, wastes, and conditions
- Techniques for measuring sediment properties affecting both erosion rates and off-site movement
- Computer modelling of erosion using a range of soil erosion and landform evolution models
- Tunnel erosion assessment and control, with major emphasis on constructed landforms
- Gully erosion and control, including work in the Lower Cotter Catchment after the Canberra bushfire in 2004
- Use of rocky capping layers to control surface erosion risk
- Impacts of vegetation on runoff and erosion rates
- Acceptable rates of erosion for rehabilitated land in the Pilbara region
- Soil erosion and sediment movement on feedlots, forests, forest roads, minesites, and agricultural and pastoral land.

Minesite landform design

Developments and improvements in minesite landform began with work by myself and Professor Garry Willgoose in the late 1990's, applying erosion models to combine material and climate information to deliver more stable and sustainable landforms. This included the inclusion of natural landform elements into designs, modification of materials used in construction, and amendment of soils to provide better site stabilisation by vegetation.

In recognition of my work, I was invited to be an author of the leading practice publications:

- Mine Rehabilitation (first and second editions); and
- Progressive Mine Rehabilitation in Queensland.

Landloch clients have won industry awards for excellence in mine rehabilitation, including a Golden Gecko[1] to Minara Resources in 2008, and an Excellence Award to Cristal Mining for *Going Beyond Best Practice* from the NSW Minerals Council in 2012.

Soil/land/minesite rehabilitation

I have been widely involved in promoting the importance of characterising mine wastes and topsoils to enable better management. This includes the amendment of acidic and dispersive soils and wastes, and the use of fertilisers to restore depleted/degraded soils.

I also carried out studies of soil changes following rehabilitation, and of the importance of those changes in achieving a stable, sustainable final ecosystem.

Landloch staff (under my supervision) regularly provide analysis and recommendations for the management of soils from a wide range of mining, construction, and infrastructure projects.

As well, Landloch staff (under my supervision) have carried out assessments of minesite rehabilitation success across a wide range of sites over the last 15 years, meaning that I have had extensive experience in assessing the success or failure of rehabilitated sites, and in the factors governing success.

I have also been involved in a number of river reach studies considering riparian zone condition and potential for additional works to enhance ecological function.

Land management under agricultural and pastoral uses.

I grew up on a farm in the eastern Darling Downs, Queensland, and have been involved with agriculture throughout my professional career. I currently own and operate a small farm on the Darling Downs, growing crops and grazing cattle, and have wide experience with planting grain, fodder, and pasture crops and managing grazing animals through a range of seasonal conditions.

Training and webinars

I regularly provide industry training, presentations to conferences, and – more recently - webinars to various interest groups.

Webinars that I have presented recently include:

- *Stable landforms, fire, and recovery – a workshop for the Gippsland region*. Organised by Federation University Australia, Gippsland Campus , September 3, 2020.
- Workshop session on *Expert perspectives – lessons learned*, presented to *Expert Witness Masterclass*, organised by Environmental Institute of Australia and New Zealand, September 4, 2020.
- *Planning minesite landforms: making the most of opportunities to reduce costs and difficulty*. Joint presentation with Evan Howard (Landloch) to BHP's international closure, planning, and engineering groups. October 28, 2020.
- *Risk Management of Hydromulched Slopes*. Organised by The Australasian Chapter of the International Erosion Control Association, October 29, 2020.

[1] Western Australia's leading mining environmental award

- *Validating landform designs for Progressive Rehabilitation and Closure Plans: which model is appropriate for your site?* Joint presentation with G. Sharp (Landloch) to meeting of the Central Queensland Mine Rehabilitation Group, 19 November, 2020.

Publications related to areas of expertise/experience

Soil erosion

Loch, R.J. (1996). Using rill/interrill comparisons to infer likely responses of erosion to slope length. Implications for land management. *Australian Journal of Soil Research* 34: 489-502.

Loch, R.J., Slater, B.K., and Devoil, C. (1998). Soil erodibility (K) values for some Australian soils. *Australian Journal of Soil Research* 36: 1045-1056.

Costantini, A., **Loch, R.J**., Connolly, R.D., and Garthe, R. (1999). Sediment generation from forest roads: bed and eroded sediment size distributions, and runoff management strategies *Australian Journal of Soil Research* 37: 947-964.

Loch, R.J., Espigares, T., Costantini, A., Garthe, R., and Bubb, K. (1999). Vegetative filter strips to control sediment movement in forest plantations: validation of a simple model using field data. *Australian Journal of Soil Research* 37: 929-946.

Loch, R.J. (2000). Effects of vegetation cover on runoff and erosion under simulated rain and overland flow on a rehabilitated site on the Meandu Mine, Tarong. *Australian Journal of Soil Research* 38: 299-312.

Loch, R.J., Connolly, R.D., and Littleboy, M. (2000). Using rainfall simulation to guide planning and management of rehabilitated areas: II. Computer simulations using parameters from rainfall simulation. *Land Degradation and Development* 11: 241-255.

Loch, R.J. (2001). Settling velocity – a new approach to assessing soil and sediment properties. *Computers and Electronics in Agric*. 31: 305-316.

EJ Howard and **RJ Loch** (2019). Acceptable erosion rates for mine waste landform rehabilitation modelling in the Pilbara, Western Australia. In Mine Closure 2019 - AB Fourie & M Tibbett (eds), ISBN 978-0-9876389-3-9 © 2019 Australian Centre for Geomechanics, Perth.

Vacher, C.A., **Loch, R.J**., and Raine, S.R. (2004). Identification and management of dispersive mine spoils. Final Report Project **R54,** Australian Centre for Mining Environmental Research.

Minesite landform design

Hancock, G.R., **Loch, R.J.**, and Willgoose, G.R. (2003). The design of post-mining landscapes using geomorphic principles. *Earth Surface Processes and Landforms* 28: 1097-1110.

Loch, R.J. and Vacher, C.A. (2006*). Assessing and managing erosion risk for constructed landforms on minesites*. Proceedings Goldfields Environmental Management Workshop 2006, Kalgoorlie-Boulder.

Loch, R.J. and Lowe, S.M. (2008). *A logical framework for design, construction, and rehabilitation of minesite waste rock dumps.* A. Fourie (Editor), Proceedings of the First International Seminar on the Management of Rock Dumps, Stockpiles, and Heap Leach Pads, 5-6 March 2008, Perth, Australia, pp 257-265, Australian Centre for Geomechanics.

Loch, R.J. (2010). Sustainable landscape design for coal mine rehabilitation. Final report, ACARP Project C18024 (Australian Coal Association Research Program).

H. Squires, M. Priest, I. Sluiter, **R. Loch** (2012). *Leading practice waste dump rehabilitation at the Ginkgo mineral sands mine*. In Mine Closure 2012 — A.B. Fourie and M. Tibbett (eds) © 2012 Australian Centre for Geomechanics, Perth, ISBN 978-0-9870937-0-7

Soil/land/minesite rehabilitation

Loch, R.J. and Orange, D.N. (1997). Changes in some properties of topsoil at Tarong Coal – Meandu Mine coalmine with time since rehabilitation. *Australian Journal of Soil Research* 35: 777-784.

Loch, R., Stevens, T., Wells, G., and Gerrard, R. (2006). Development of key performance indicators for rehabilitation, Murrin Murrin Operation. Fourie and Tibbett (Editors), Proceedings of the First International Seminar on Mine Closure, 13-15 September 2006, Perth, pp. 569-576, University of WA.

Loch, R.J., Vacher, C.A., and Lowe, S.M. (2008). Topsoil organic carbon and nutrient considerations for waste dump rehabilitation. Proceedings, Goldfields Environmental Management Workshop, 2008, Kalgoorlie, pp. 102-108.

Loch, R.J. (2016). *Function and performance targets in ecological rehabilitation*. In Mine Closure 2016 – AB Fourie and M Tibbett (eds), © 2016 Australian Centre for Geomechanics, Perth, ISBN 978-0-9924810-4-9

R J Loch and E J Howard (2018*). Material characterisation – avoiding unnecessary costs and failures*. In From start to finish: a life-of-mine perspective, AusIMM

Polyacrylamide research

Vacher, C.A., **Loch, R.J**., and Raine, S.R. (2004). Effect of polyacrylamide additions on infiltration and erosion of disturbed lands. . *Australian Journal of Soil Research* 41: 1509-1520.