Dear Inquiry and Advisory Committee members,

Thank you for the opportunity to make a supplementary submission to the Fingerboards Mineral Sands Project on the matter of the inclusion of centrifuges to the Fingerboards project.

Unfortunately, the Bendigo District Environment Council at this time it is not able to make a formal submission on this matter and requests to provide the following explanation –

a. The IAC has chosen to limit the supplementary submission to only a discussion regarding centrifuges. If reference is made to the mine model as discussed in amended Chapter 3 of the EES and the draft Work Plan it can be seen that the proponent attempts to include the function of centrifuges to reduce the water content of the slimes to the stage where they can be placed directly in the mine pits and in doing so have initiated a fundamental change to the mine model. The BDEC in their original submission (#429) referred to the fact that the proponent would not be able to dry mine pits in a timely manner so that rehabilitation could occur at the required rate. The incorporation of centrifuges will require major changes to the draft Work Plan and changes to several of the major Reports provided by the proponent. Any sensible discussion would require changes to the major reports, including changes to the draft Work Plan, be facilitated by the proponent lodging new Reports where required.

b. BDEC have previously described why several of the major Reports lodged by the proponent were not fit for purpose. The lack of rigour in these major Reports has two drivers. Firstly, the proponent placed estimates or gave data for which a demonstratable source is not available, or gave directions or guidance to their consultants that were incorrect or not realistic. Secondly, the proponent failed in their diligence to satisfy themselves that the Reports provided by their consultants were integrated and consistent with each other.

c. There has now been a proliferation of further documentation from the proponent, in various forms, including technical notes, to describe the incorporation of the centrifuges, and to respond to concerns raised by submitters or the IAC, or to attempt to respond to fallibilities in the original Reports. This additional documentation since the promulgation of the initial reports has now contributed to a condition where in the past there were inconsistencies between the Reports, but there is now conflict between the original consultants Reports and the more recent Reports and technical notes. This allows that a submitter wishing to make comment on a particular aspect of the project, for instance the centrifuges incorporation, is confronted with a choice of mine models and Reports from which data can be extracted selectively to provide a choice of possible outcomes.

Therefore, BDEC feel it is unreasonable to attempt to provide a supplementary submission on centrifuges. However, with the caveat, as appears within the content of most of the proponent's consultants reports, that is, that the author does not wish to take responsibility for the content of the report if the basic information as supplied by the consultant was found to be incorrect or inadequate, then BDEC is prepared to offer the following only as observations that should not be relied on for any other use.

1. It is unlikely that centrifuges, alone, based on the performance of the commercial model suggested by the proponent would be able to dewater the slimes so that they could be directly placed in the bed of mine pits, mixed with coarse sand and then conditioned to the circumstance where, in a timely fashion they could accept overburden and permit the continuation of the rehabilitation process.

The test data provided by the proponent, and quoted in Technical Note 1 incorporation of centrifuges, indicates that the slimes will be dewatered to a 65% solid or 'spadeable' condition. The proponent also describes that course sand, the larger component of the fine/course sand mix, which will be used to fill the lower level of each pit, will also have a moisture content which will be 65% solid content.

It is reasonably agreed in engineering literature, depended on the grain size of the sand, and other silt or content of the slimes, then to use regular earthmoving equipment to blend these two materials and to allow truck movement on the base of the pit, that the material would need to be introduced to the mine pit at approximately 85% solid (15% water). The capacity to dry slimes or coarse sand in the bed of a mine pit is considerably determined by the difference between precipitation and evaporation (the PAN evaporation rate). Considering the effect of wind shielding provided by the depth and form of the mine pit it is unlikely that natural drying of the mine pit would be more than the equivalent of several hundred millimetres of water height per annum. Access to the pit base by dump trucks would be unlikely and the use of a rotary conveyor would be required to distribute sand across the base of the pit.

A possible engineered solution is to distribute the slimes/coarse sand mix over available surfaces within the project area to a depth of 300 or 400mm and condition this material with the aid of mudmasters or amphirols and with exposure to the atmosphere until the moisture content permits recovery and transport to the mine pits. Dependent on seasonal variation it is likely that ~ 300 hectares of surface would be required to provide sufficient fill for a 60 hectare mine pit over a one year period.

2. The mining industry has developed an alternate to the use of centrifuges, due to the cost of operation and the risk to the human operators of centrifuges. The alternative plant is described as plate filters. The use of this plant would need research before consideration for use within mineral sands projects in Australia.

3. There are multiple examples of sand tailings dams at gold mine sites in central Victoria (Ham St, Kangaroo Flat and the Tsf2 at Stawell are two) where the mine operators have not succeeded in drying tailings to the condition where they can accept overburden. The proponent in this case has suggested de-watering each layer of the combined sands by using a deep depression on the surface to decant water and by providing a drainage system in the base of pits. Where this has been used in Central Victoria this has not been a definitive or timely solution. If the proponent was to install a substantial network of base of pit drainage pipes, how then would this drainage system ultimately be recovered, so that it did not interfere with the normal movement of groundwater in the final landform?

4. The condition and the structure of the slimes is not well understood. This in part is because the proponent has chosen not to proceed with the Test Pit as described in a Report by their consultant GHD. This test pit would have provided valuable information to the proponent and their consultants on the variability within the orebody, and therefore the likelihood as to whether a suitably consistent feed stream would be available to the centrifuges to allow for reliable and safe operation.

5. The proponent has variously described the number of centrifuges to be installed and the manner of the operation. One iteration suggests that centrifuges would be installed in two groups of three operating and one standby in each set, and that two sets would be installed.
The proponent has been unable to determine an example from within the Australian mining industry where a centrifuge has been used at a mineral sands project for de-watering of tailings. The proponent has suggested that their centrifuges will operate at 1800 rpm, approximately 3/4 of their maximum design speed and at approximately 50% of the designed maximum power input. The available data suggests that more than six centrifuges in total would probably be required to achieve the 330 tonnes/hour throughput of slimes as required by the proponent's mine model.

6. A continuous flow turbine type centrifuge, by its nature, will be very susceptible in its performance to the condition of the slimes, that is the viscosity and shear strength of the infeed slimes. Each centrifuge would then require careful monitoring of the condition of the incoming slimes. That is, the amounts of fine silt or other material that may be included in the slimes along with the quantity of additional or supplementary feed water used to pre-condition the slimes. This

would need to be continuously monitored and the quantity of flocculent would need to be continuously adjusted, possibly through a pre-programmed algorithm, along with the quantity of pre-conditioning water, to enable stable operation of a centrifuge. If there is a failure in the control system to correctly adjust the inflow streams, a manual override and operator would be required for each centrifuge. If there is a momentary failure in the control loop there is a risk that the slimes load firms prematurely and becomes locked between the inner and outer turbine rotor, or the outer rotor becomes locked against the skin. In these circumstances there are several possible negative outcomes. This can include the bursting of the centrifuge chamber, or that rotational energy of the centrifuge unit detaches the centrifuge from the mounting base and the centrifuge moves in precession within the building or escapes the building and travels in the wider landscape. If the motor control system is unable to divert the electrical energy developed in a rapidly decelerating centrifuge this energy may cause the destruction of the motor control equipment and allow an energy surge to be shunted into the power grid. This may have implications for control and switching equipment within the power grid and any users with a requirement for a continuous supply, such as hospitals

7. Report A000 describes that flocculant will be used to dose the slimes incoming to the centrifuge at a rate of 370 or 400 grams/tonne. Most of this flocculant will ultimately be transported with the slimes to mine pits, along with a lesser component of 130 grams/tonne used in the initial separation of mine ore. Therefore, the combined sands as they are returned to the mine pit will carry a combined quantity of flocculant somewhat greater than 1000 tons per year, or approximately 1000 tonnes for each mine pit. The various expert witness statements have suggested that the outcome of placing this volume of flocculant in a mine pit is unknown, that is what it will mean to the function of the subsoil, or whether the flocculant will be mobile and able to move through the base of the mind pit to pollute groundwater or a local aquifer. Landscape scale experiments as to the fate or pollution risk of flocculants are not acceptable.

8. The water stream from the centrifuge will ultimately be recycled and re-used. This water will have some turbidity and also include a minor component, perhaps less than 1%, of flocculant. The volume of this flow is considerable, approximately 3 Gigalitres/day. The addition of flocculant is cumulative. The proponent’s consultants are firstly, not suggesting how this water might be treated, for instance in settling dams, prior to transport to the water treatment plant, and secondly how the increasing content of flocculants in the processing water stream might be managed.

9. Each centrifuge will provide a static load onto the foundation of more than 50 tonnes and high dynamic loads onto the foundation as each centrifuge is accelerated or decelerated or if there is an out of balance malfunction. As most of the project area hosts highly dispersive soils there is the risk that the soil below the centrifuge foundations could be susceptible to liquification during periods of high soil moisture. It may eventuate that the design of each foundation, which is required to support four or possibly more centrifuges, may require the driving of piles to bedrock. The proponent, as we understand, has not test drilled to bedrock, so the capacity of local bedrock to provide foundations for centrifuges, or elsewhere dam walls, is unknown.

10. The proponent in a technical note has suggested they have now contacted the power supply authority to request a design for the provision of power. It is of concern firstly, if the proponent has described the dynamic nature of the electrical load associated with an industrial centrifuge installation, and secondly, if the proponent can provide to the satisfaction of the electrical supply authority, that they can manage the start-up and wind down electrical loads for these centrifuges. As there would be two centrifuge installations on separately remote locations, the opportunity exists for attempts to concurrently start a centrifuge at each site and subsequent missteps and recycling of loads with a risk to the power feeder and other customers.

11. Centrifuge installations should not be sited in the vicinity of dam walls due to the risk that out of balance vibration may be transmitted into the structure of the dam wall. This might not normally be a consideration, excepting that the proponent has not provided any rigour to their research for suitable material for construction of dam walls that can be ‘won’ from the site and confidence in their dam’s viability must be limited.

12. There is concern that the proponent may not have considered that in the insulated structures designed to incorporate the centrifuges, that noise levels could be in the vicinity of 110dB and therefore verbal communication between staff in these building will not be possible and alternate communication systems will be required.

13. The centrifuges may provide a considerable sound energy that is monotone as related to human receptors. In other words, in a rural environment, without a background noise source such as traffic noise in a city, a constant monotone noise can become distressing at a level less than that of a legal noise threshold. An example of this is at livestock feedlots, where grain mills operate at sound levels far less than that of a centrifuge, but these grain mills are capable of producing a monotone noise which is pervasive and distressing and disrupts sleep.

14. There is likely to be a high maintenance cost in the operation of the centrifuges, where turbine blades and the skin are continuously abraded with sand particles. The manufacturer notes that they use duplex (a form of stainless steel) and tungsten (a steel used on the wear surfaces of mining equipment) in the manufacture of their centrifuges. However, zircon and silica are both primary components in the manufacture of industrial abrasives and the centrifuges will likely have extensive periods of downtime for maintenance, which after a period will likely require their re-manufacture.

15. Each centrifuge is intended to have a production capacity of 55 tons per hour. There will be an obvious logistics problem in the loading of slimes to tip trucks which will firstly require stockpiling and then double handling of the slimes. The proponent’s advice that slimes will not be trucked at night will require a further stockpiling of each night’s production of slimes for transport the following day.

16. The high level of uncertainty that centrifuges can be successfully used for de-watering of sand tailings suggests that the proponent is likely, in practice, to revert in some form, to the use of a tailings storage facility. It has been well demonstrated, in Victoria, after an EES and Work Plan has been provided to a proponent, that ERR will provide a Work Plan variation to a mine operator without requiring that operator to engage in any form of community consultation and without the community having access to that variation when the work activity becomes known. Therefore the IAC should be required to place a descriptive limit to those activities that can be incorporated into the mine model beyond those described by the proponent in the EES Reports, without referral to a Supplementary EES.

Although the BDEC will not rely on any of the above observations in argument before the IAC it is requested that this document is accepted as a statement and placed on the listing of pre-hearing documents.

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