Before the Hearing Commissioners
appointed by the Grey District Council and
West Coast Regional Council

Under	the Resource Management Act 1991
In the matter of	Resource consent applications by TiGa Minerals and Metals Ltd to establish and operate a mineral sands mine on State Highway 6, Barrytown (RC-2023-0046; LUN3154/23)

Statement of evidence of Thomas John Lawson

19 January 2024

Applicant's solicitors:
Alex Booker/Alex Hansby
Anderson Lloyd
Level 3, 70 Gloucester Street, Christchurch 8013
PO Box 13831, Christchurch 8140
p + 64 27 656 2647
alex.booker@al.nz

anderson lloyd.

Qualifications and experience

1 My full name is Thomas John Lawson.

2 I have a Bachelor Degree in Mechanical Engineering from the University of Central Queensland, Australia. I have worked in the Mineral Sands Mining and Processing Industry since 1995 developing process solutions, separation equipment, and mining equipment as well as managing the design and delivery of mineral sands process plants in more than 10 countries.

3 I am currently employed as the Business Development Manager for IHC Mining Australia and have held that position since June 2022.

4 My previous work experience includes 24 years with Mineral Technologies working initially as a Research Engineer developing mineral process equipment and key roles as the Operations Manager responsible for equipment development, production, mineral process solution development and mineral sands process plant design, construction and commissioning.

5 My role in relation to TiGa Minerals and Metals Limited's (**TiGa**) application to establish and operate a mineral sands mine, Barrytown (**Application and Application Site**) has been to provide leadership of the IHC Mining Australia (**IHC**) process development for extracting a Heavy Mineral Concentrate (HMC) from the mined ore and the design of the plant to deliver that developed process.

6 My assessment is based upon the project description attached to the evidence of Ms Katherine McKenzie as Appendix 1.

7 In preparing this statement of evidence I have considered the following documents:

(a) the AEE accompanying the Application;

(b) submissions relevant to my area of expertise; and

(c) the statements of evidence prepared by Mr. Miller and Mr. Rekker.

8 I became involved in the project from August 2022, shortly after joining IHC Mining. I have not been to the site but have discussed the visit to the site by Mr. Brad Robbins of IHC Mining who visited the site and was leading the technical design of the process plant when I became involved. I have then been involved continuously guiding and leading the metallurgical and engineering design of the process plant for the site and engaged in discussion on water management within the process design for the site.

9 During my time working on the project, I have been involved in discussions with John Berry or TiGa, Stephen Miller, Jens Rekker, and Graeme Ridley in relation to

the water management within the process and the connection of that water system into the broader water management plan for the site. I developed the water balance of the mining and mineral separation processes, in consultation with Mr Miller and Mr Rekker. The design has been adjusted to the water coming into the process and water released from the process.

Code of Conduct for Expert Witnesses

10 While this is not a hearing before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023 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 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.

Scope of evidence

11 I have prepared evidence in relation to the water design of the process plant on the site and the interconnections of the process with the site water management. I have also prepared evidence in relation to the Hours of Operation of the designed plant. This design has been relied on by Dir. Mike Fitzpatrick, Mr. Stephen Miller, Mr. Graeme Ridley, and Mr. Jens Rekker assessing the impact of environmental effects of the operation.

Process Plant Water Design Summary

12 The Process plant consists of two major elements being the Mining Unit Plant (MUP) and the Wet concentrator Plant (WCP) both utilising conventional processing and water management methodologies.

13 The MUP (Figure 1) is located on the bench ahead of the mining pit receives damp ore from the mining equipment during its day time only operation. The MUP also receives process water from the Mine Water Facility (clean water dam). The MUP screen and cyclone units remove, and return to the mining pit, the ore >2mm in size and most of the ore <45 micron. The sand ore sized between 45 micron and 2mm is pumped to the WCP at a relatively high density of 50% solids to limit power consumption and return most (two thirds) of the water to the mine pit.

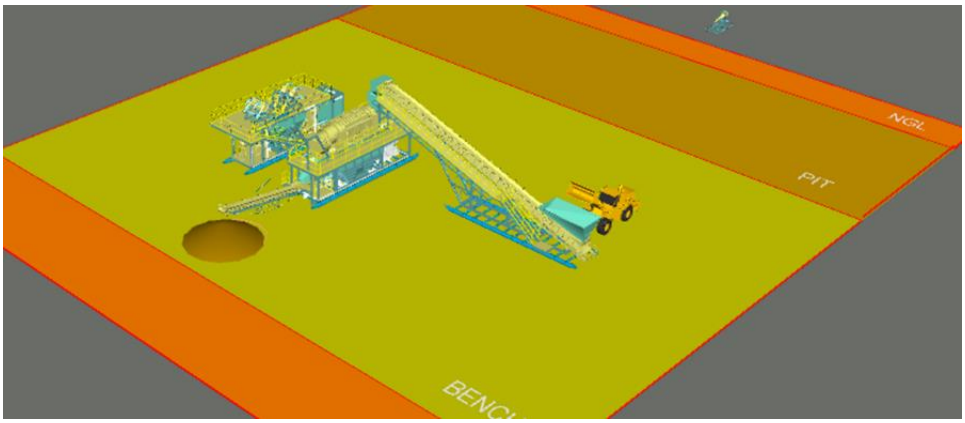

Figure 1: MUP Layout adjacent to Mine Pit

14 The sized sand ore received at the WCP is passed through centrifugal gravity separation to recover any gold content. It then splits into a Constant Density (CD) tank to feed the process during day time and a night stockpile to feed the WCP when the MUP is not running (refer Figure 2 – Note that Process Building is fully enclosed with cladding and only shown without here for clarity). The CD tank feeds a multiple stage spiral gravity separation process which concentrates the heavy minerals into a concentrate (HMC). The HMC is stacked inside the clad building to return most water to the process leaving only 10% by mass in the HMC (that is 100 litres of water per 1 tonne of HMC) which is nominally 5m3/h of water leaving the process via the HMC stockpile. The HMC is transported off site from this pile.

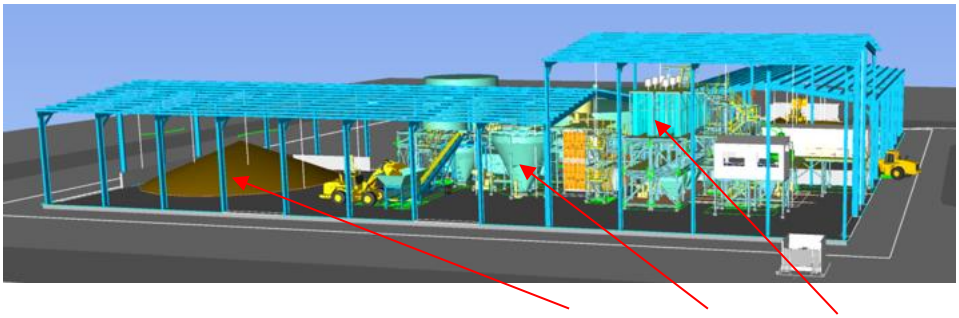

Figure 2: WCP Building (no cladding), Night Pile, CD Tank, Spirals

15 The WCP (Figure 3 and 4) has its own water system with process water tanks for storage of water and a thickener which receives return streams from the process. Utilising a bio-degradable flocculant, the thickener agglomerates the fine solids in the return water and overflows clean water back to the process water tanks. The thickener concentrated fine solids are pumped into the tailings bin from the gravity processes and the mixture of tailings is pumped back to the mine pit at approximately 50% water by mass where the solids are placed to refill the mined area and most of the water is recovered into the mine void.

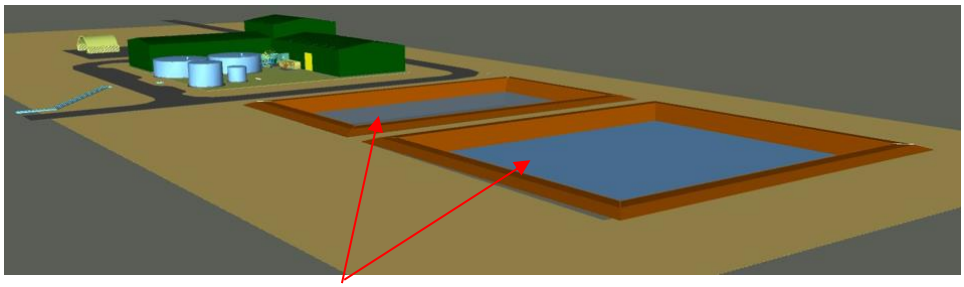

Figure 3: WCP with Mine Water Facility (Pond 1 and 2) in the Foreground

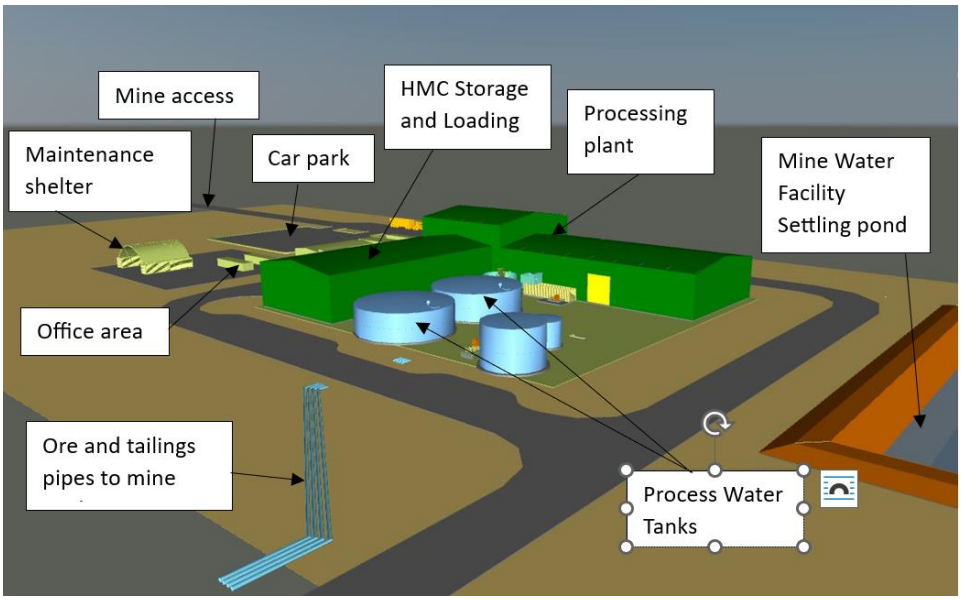

Figure 4: WCP, Process Water Tanks, Admin/Maintenance in Background

16 At the mine pit, the return water from the MUP, and the water from the WCP tailings, are mixed with the water ingress from the Mining Limits. This water in the mine pit is pumped to the mine water facility (dirty water dam) using a pump set up in a sump in the floor of the mine pit. The pump flowrate can be varied to maintain a target water level in the pit.

17 The mine water facility (Figure 3) provides the primary removal of solids from the process water receiving the bulk incoming water from the mine void into the dirty water dam, settling out solids through the application of flocculants and decanting clean process water to the clean water dam. Any excess water accumulated at the mine water facility is pumped to the WCP process water tanks (Figure 4) for storage.

18 At the WCP, the process water tanks are sized to accommodate the variable water balance across the day and night operations. During the day time MUP operations, incoming water from the MUP, the thickener overflow and the mine water facility excess is accumulated in the tanks. During night operations, there is no water from the MUP coming in, but thickener overflow and mine water facility excess may still

occur. The process water tanks at the WCP are sized to accommodate variability in water ingress to the mine void.

19 The net water excess over the entire process is the balance of water ingress at the mine void less the small amount of water in the HMC departing the site and any evaporation from the stockpiles at the WCP. This excess water will be from the process water tanks overflowing to the site drainage system.

20 While this process water is typically free from solids content having come from the mine water facility clean water dam or the thickener overflow, as an additional layer of protection, if required the overflow will pass through a clarifier. The clarifier collected solids will be pumped back to the thickener for recovery into the tailings system. The clarifier overflow will be clean water (up to 300m3/h) containing Total Suspended Solids of not more than 20 mg/l (or ppm) Turbidity as typical for a clarifier unit.

Hours of Operation

21 The design of the process plants maximises day time operations and minimises operations during the hours of darkness to only functions that need to run continuously.

22 The MUP in Figure 1 works with the mining equipment so the MUP does not operate during the hours of darkness.

23 The WCP has several processes that require continuous operation and is therefore operated 24 hours a day.

24 The CD tank contains a bed of solids used to maintain the constant density. To stop the CD tank it will be flushed free of solids and taken to an empty condition.

25 The spiral separators must be kept wet for consistent separation performance which cannot be achieved if they are stopped overnight as the separation surface will need to be run in again.

26 The thickener which receives the water streams with fine sand and clay from the processes needs to be continuously stirred and pumps circulate flow. If this cannot be achieved, the thickener needs to be pumped out and clean of solids or a hard cake will form requiring long delays to dig it out.

27 If the WCP was to be stopped daily during the hours of darkness, the restart time each day to achieve optimal, continuous operation could typically be up to 50% of the day time operations. This is not practical or efficient so the WCP is typically run continuously and only stopped for a monthly maintenance day.

28 The WCP is designed to have key processes within the clad building to limit light emission during the hours of darkness.

Slimes

29 The ore removed from the ground does contain a small proportion of fine clay particles (called Slimes) which will tend to flow with the water throughout the process. The process design may utilise biodegradable flocculants in the mine water facility and the WCP thickener to agglomerate and settle fine particles out of the water flows for return of the Slimes to the mine void. Excess water from the process will overflow from the process water tanks via a clarifier to the central drain. The clarifier further provides a removal of particles from the water entering the central drain minimising total suspended solids to <20mg/l.

Conclusion

30 The Process water design for the Process plant is based on having a closed water system for each of the MUP and the WCP. Once operational, the water entering these systems is from ingress at the mine void from ground water or rain. The water in the process water system manages solids from the mine void at the mine water facility, and further at the WCP Thickener/Process Water Tanks. Excess water in the process system is rejected from the Process Water Tanks via a clarifier to the Central Drain at up to 300m3/h flowrate and a Total Suspended Solids of <20mg/l.

31 The MUP will not operate during the hours of darkness while the WCP does operate 24 hours per day as it contains processes that require this type of operation.

Thomas John Lawson

Dated this 19th day of January, 2024.