



Technical Review

To:	Danielle Ter Huurne	Date:	29/06/2023
Authority:	Otago Regional Council	Ref:	23009.6
Consent:	RM23.474 Hawkeswood Mining Limited		
From	Role in Audit	Internal Reviewer	
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1 Project Summary

Hawkeswood Mining Limited are seeking a range of consents associated with an alluvial gold mining activity at 1346-1536 Teviot Road, Millers Flat, including construction of a bore (the mine pit), dewatering and discharge to land for a seven year term. The water take is described as a non-consumptive take.

The site hydrology is complex and difficult to assess due to the Clutha River boundary extending along the southern and western boundary of the site, the Tima Burn flowing along the eastern boundary, a closed landfill to the north of the site, and historic mining being completed along the southern boundary in the past. The Clutha River provides a complex recharge boundary due to rapid water level fluctuations caused by hydropower generation. Aquifer parameters were derived from previous aquifer testing of a bore situated in mine tailings (Parker aquifer test associated with RM19.310.01). Due to the complexity of the site hydrology, the aquifer testing is difficult to interpret however Environmental Associates states that this aquifer test was previously accepted by ORC. Some limited assessment of trial dewatering of the mine pit was completed, though no piezometer was installed to monitor drawdown outside the pit. No data from this test was provided, only the final drawdown within the pit which was then used to calculate transmissivity using Theis analysis of drawdown at an effective radius with an assumed storage value equivalent to that of the Parker test.

2 Audit Questions

Q:	Is the technical information provided in support of the application robust, including being clear about uncertainties and any assumptions? Yes, or no. If not, what are the flaws?
R:	<p>The application is very difficult to follow with the different sections being confused within the document.</p> <p>There are maps within the report that show drill hole locations and purport to show basement depths, however the provided logs do not provide any stratigraphic information or water level information (only gold content), and the well IDs do not match the numbers on the maps. The maps are also mostly illegible and therefore it is very difficult to verify any of the provided information regarding the saturated thickness of the aquifer, basement depths, depths of unsaturated materials overlying the groundwater.</p> <div data-bbox="427 1034 1091 1675" data-label="Figure"> </div> <p>Figure 2.3 Piezometric Contour Map</p> <p>The piezometric contour map was interpolated from HML logs and estimated land surface. It is not clear how many points were used for this interpolation; it seems unlikely that groundwater flows entirely normal to the flow of the Clutha River parallel to site.</p>

The provided map of saturated thickness indicates that the aquifer is very thin adjacent to Teviot Road, however the mapped aquifer used to assess the likely drawdown (below) is shown to extend to the break in slope 1 km to the east of Teviot Road. The limited aquifer boundary will provide a barrier boundary to flow that will result in increased drawdown as a result of the mining activity (note that this may also result in less water needing to be pumped which would offset the additional drawdown). The barrier boundary was not included in the assessment of drawdown.

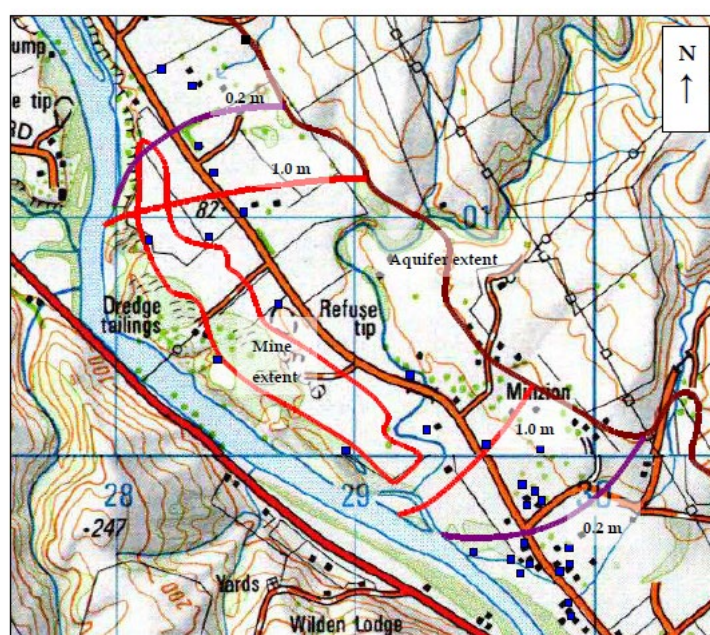


Figure 6.1 Potential Extent of Maximum Transient Drawdown External to the Mining Area

The groundwater analysis assumes different transmissivities for mining areas adjacent to mining tailings (and therefore different mine pit yields). It states that there are limited areas of mining adjacent to mine tailings, and that none of the mine tailings will be reworked, but also that discharge will be into sediments overlying mining tailings. It is unclear how this will be achieved as the areas of mining tailings are not mapped at all. GNS 1:250K mapping of geological units across the site indicates that these may be extensive, and therefore much of the mining may be adjacent to or even within mining tailings.

Whilst the analysis assumes the transmissivities are different, these are based on the specific yield (storage values) of the aquifer being uniform, regardless of the difference in transmissivity of the native and previously worked areas, which seems unlikely.

	<p>The conditions of the mine pit dewatering trial are not well documented within the AEE (discharge location, monitoring methods, data etc). The mining pit acts as a very large diameter bore with high well storage. Use of the Thies method to calculate transmissivity based on drawdown measured at the edge of the mining pit and an effective radius does not appear to be valid. Given that the drawdown was measured within the mine pit itself and not within the aquifer material, this method overestimates the drawdown that would occur at that radius away from the pit and therefore would underestimate the transmissivity.</p>
Q:	<p>Are there any other matters that appear relevant to you that have not been included? Or is additional information needed? Please specify what additional info you require and why [please explain]</p>
R:	<p>The Tima Burn has been dismissed as an ephemeral watercourse, however no evidence has been provided for this assessment. The Tima Burn has a catchment area of 44 km² and the modelled MALF is 0.11 m³/sⁱ. The REC modelled allocation for the Tima Burn is 0.021 m³/s Whilst this may be entirely lost to groundwater during dry seasons, there is no evidence that the watercourse is entirely disconnected from groundwater. G43/0193, situated near the Tima Burn had a standing water level of 2.5 m below ground at the time of drilling. Actual observed flow conditions of the Tima Burn should be presented and any effects on the stream assessed more thoroughly, and the possible impacts on any ecological values.</p> <p>Contamination from the closed landfill to the north of the site has not been addressed in the groundwater AEE. A PSI by EC Otago was provided in the application for the closed landfill, but no groundwater monitoring was undertaken, and very limited discussion was provided regarding historic sampling within the PSI.</p> <p>The AEE states discharge will be into areas of mine tailings, but there will be limited dredging adjacent to areas of mine tailings. It also states that there</p>

ⁱ [NZ River Maps \(niwa.co.nz\)](http://niwa.co.nz), accessed 23/06/2023

	<p>is 10 m of unsaturated thickness in which to discharge water across the site beneath 2 m deep discharge ponds. To determine whether this is feasible, a map of discharge locations and depth to groundwater with mine tailing extents would be helpful. Note that the AEE by MacDonnell Consulting assumes the overburden from the initial mine pit of 150 x 100 m dimension will total 80 000 m³ which equates to only 5 m depth of overburden.</p>
Q:	<p>If granted, are there any specific conditions that you recommend should be included in the consent?</p>
R:	<p>Whilst out of the scope of this review, an erosion and sediment control plan should be provided as part of the environmental management plan for the site to ensure that topsoil stockpiles, overburden and runoff on the site is managed in a responsible manner, noting that the site extends across multiple catchments. Site rehabilitation plans should also be clarified.</p> <p>Given the difficulty of confidently predicting drawdown in neighbouring bores, affected party approval should be obtained from all users possibly affected.</p> <p>Dedicated monitoring bores should be installed on the site boundaries, with monitoring of turbidity, TSS and landfill contaminant indicators (likely NH₄-N, Cl, metals – review of the landfill monitoring thus far would be helpful to improve understanding). This monitoring would also provide an indication of the propagation of the drawdown cone and any contamination and early warning to groundwater users should monitoring indicate that they might be impacted, enabling provision of alternate water supply in a timely fashion. Trigger levels will need to be considered based on neighbouring bore depths and comparison with drinking water guidelines.</p> <p>Monitoring of groundwater levels adjacent to the Tima Burn to assess normal conditions and effects on the Tima Burn.</p>
Q:	<p>Does the application appropriately identify sensitive areas including affected water bodies (surface, ground and coastal water), wetlands, bores, drinking water supplies and potential effects on those areas? Yes/no. If no, why not?</p>
R:	<p>No, the Tima Burn has not been adequately assessed. Neighbouring bores have been assessed, however the potential for contamination to be mobilised and impact water users has not been considered. Impacts on neighbouring users may be greater due to the limited extent of the aquifer.</p>

Q:	Has the applicant correctly calculated draw down? Using methods in RPW.
R:	Drawdown at the site will be very complex due to the variable rate pumping, recharge boundaries and small aquifer extents and whilst the groundwater AEE has attempted to be conservative, sensitivity analysis would be helpful to determine whether this is the case. Given that Table 6.1 in the groundwater AEE assumes the drawdown will exceed the extent of the aquifer, the barrier boundary must be considered when calculating drawdown extents. In addition, the method for calculating transmissivity from the mine pit does not appear to provide valid aquifer test results.
Q:	Has the applicant appropriately assessed the risks being nearby discharges or contaminated land? And if so has the applicant proposed appropriate methods to limit contaminants entering groundwater
R:	No. See discussion in earlier questions.
Q:	Has the effect on groundwater users been appropriately assessed? Yes/no
R:	Given that Table 6.1 in the groundwater AEE assumes the drawdown will exceed the extent of the aquifer, the barrier boundary must be considered, and the possibility that the drawdown will extend further and affect more users. The possibility of contamination has not been adequately addressed.
Q:	Have the cumulative effects of the discharge activity been appropriately assessed? Do you concur with the assessment? Yes/No
R:	No. Contamination potential has not been assessed. It is unclear where the discharge will occur.
Q	Is the description of the sensitive areas attributes potentially affected by the activity accurate?
R	No, impacts on the Tima Burn have not been adequately assessed, however it was noted in the AEE by MacDonnell Consulting that it is a significant habitat for kōaro.
Q	Based on the proposed mitigation methods (if any are proposed) are the mitigation measures proposed by the applicant appropriate in this circumstance? If no, why not?
R	Providing alternative water supply to neighbouring groundwater users is appropriate if required. However, it is assumed that the pumped water will be suitable as an alternative supply or connection with the Millers Flat supply.

Given the potential for both sediment and landfill contamination, pumped supply from the mine pit may not be suitable and the ability to obtain alternative supply should be confirmed.