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Mine Waste Management at the Proposed Bendigo-Ophir Gold Project

1. My name is Dr. Steven Emerman.
2. I have been asked by Sustainable Tarras Inc to address the following questions regarding mine waste management at the proposed Bendigo-Ophir Gold Project:
    a. Does the plan involve an appropriate production of waste rock?
    b. Has there been adequate consideration of alternatives to the proposed permanent aboveground tailings storage facility?
    c. Are there adequate controls to prevent neutral or acid mine drainage, as well as metal leaching, from mine waste?

<u>Qualifications and experience</u>

3. I have a B.S. in Mathematics from The Ohio State University, M.A. in Geophysics from Princeton University, and Ph.D. in Geophysics from Cornell University.
4. I have 31 years of experience teaching hydrology and geophysics, including teaching as a Fulbright Professor in Ecuador and Nepal, and I have over 70 peer-reviewed publications in these areas.
5. Since 2018 I have been the owner of Malach Consulting, which specializes in evaluating the environmental impacts of mining for mining companies, as well as governmental and nongovernmental organizations. I have evaluated proposed and existing mine waste management plans in North America, South America, Europe, Africa, Asia and Oceania, and have testified on mine waste management before the U.S. House of Representatives Subcommittee on Indigenous Peoples of the United States, the European Parliament, the United Nations Permanent Forum on Indigenous Issues, the United Nations Environment Assembly, the Permanent Commission on Human Rights of the Chamber of Deputies of the Dominican Republic, the Minnesota Senate Environment, Climate and Legacy Committee, and the Nevada Assembly Natural Resources Committee.
6. I am the former Chair of the Body of Knowledge Subcommittee of the U.S. Society on Dams, one of the authors of <u>Safety First: Guidelines for Responsible Mine Tailings Management</u>, and one of the US representatives to ISO/TC (International Standardization

Organization/Technical Committee) 82/SC 7/WG5 on "Underground Mine Tailings Backfill."

Question 1: Waste rock production

Summary

7. The Bendigo-Ophir Gold Project will involve an excessive production of waste rock, leading to excessive fuel consumption, excessive greenhouse gas emissions, excessive risk of induced seismicity, excessive permanent alienation of land, and excessive risk of contamination of surface water and groundwater.

Discussion

8. Mine waste is primarily composed of waste rock and tailings. Waste rock is the unmineralized rock that must be removed to reach the ore body. Tailings are the wet and crushed rock particles plus chemical reagents and their reaction and degradation products that remain after the commodity of value, such as gold, has been removed from the ore body. While nearly every mining operation seeks to avoid the excessive production of waste rock, the quantity of tailings depends upon the ore grade and is, thus, generally outside of the control of the mining operation. .

9. The excessive production of waste rock can result in the following detrimental impacts on the mining company, society, and the environment:

   a. The excessive production of waste rock is expensive due to the fuel consumption required to drill, blast, excavate, and haul the waste rock.

   b. The excessive fuel consumption required for the drilling, blasting, excavation, and hauling of waste rock results in excessive greenhouse gas emissions.

   c. The excessive excavation results in an excessive removal of overburden pressure, which can result in mining-induced seismicity, especially in areas that already experience high seismic activity.

   d. A significant fraction of the waste rock must be permanently stored aboveground in waste rock dumps, resulting in the permanent alienation of the land from any beneficial use.

   e. The permanent aboveground storage of an excessive quantity of waste rock results in excessive risk of surface water and groundwater contamination.

10. The discussion of surface water and groundwater contamination will be deferred to Question #3, although it should be clear that more waste rock leads to greater risk of environmental contamination.

11. The ratio of the mass of waste rock to the mass of excavated ore is called the stripping ratio. S&P Global Market Intelligence reported that, in 2022, the global average stripping ratio for open-pit gold mines had dropped slightly to 4.24, down from 4.29 in 2021, which was the highest global average stripping ratio for open-pit gold mines ever recorded (Holden, 2023; see Fig. 1). Stripping ratios tend to be far less for underground gold mines, in which waste rock is removed from shafts, declines, and adits, as opposed to the complete removal of overlying rock layers that occurs in open-pit mining. By combining both open-pit and underground gold mines, Nassar et al. (2022) found a global average stripping ratio of 2.86. According to Webb (2021), 37% of gold is produced from underground mines. The estimates from Webb (2021), Nassar et al. (2022), and Holden (2023) can be reconciled if the global average stripping ratio for underground gold mines is 0.51.

12. Stripping ratios for open-pit gold mines in New Zealand have tended to be consistent with global averages. On the high end, the stripping ratio for the OceanaGold Macraes open-pit gold mine has been reported by the company as 10 (OceanaGold, 2017, 2026), although it has also been reported in the range 7 to 7.5 (OceanaGold, 2020). On the other hand, on the low end, the stripping ratio for the OceanaGold Martha open-pit gold mine has been reported to be only in the range 0.7 to 3.1. According to Fitzgerald (1998), "This 1996/97 gold and silver production also meant an associated production of 872,000 tonnes of waste rock, and nearly 1 million tonnes of ore from the open cut - indicating an approximate 1:1 ratio of ore to waste. In previous years this ratio was 3:1 with upwards of 3 million tonnes of waste rock being produced annually." According to Beetham and Anderson (2008), "Waste production is tailored to meet the ore supply and will drop significantly in late 2004 from the current stripping ratio of 3:1 to 0.7:1."

13. According to the Fast-Track Application, the Bendigo-Ophir Gold Project will produce 203.7 million metric tons of waste rock (EGL, 2025; see Fig. 2). The Fast-Track Application further states the ore production from the Rise-and-Shine Open Pit and the combined Srex and Srex East Open Pits as 11.9 million metric tons and 1.428 million metric tons, respectively, for a total of 13.328 million metric tons (Matakanui Gold Limited, 2026a; see Figs. 3 and 4a-b). The Fast-Track Application does not state the ore production from the Come-In-Time Open Pit, nor the total ore production for the entire Bendigo-Ophir Gold Project. A bar chart of ore production per year includes only the

Rise-and-Shine Open Pit, the Rise-and-Shine Underground Mine, and the Srex Open Pit (Matakanui Gold Limited, 2026a; see Fig. 5).

14. As expected, the production of waste rock from the Rise-and-Shine Underground Mine will be only 1.6 million metric tons (see Fig. 2), meaning that 202.1 million metric tons of waste rock will result from open-pit mining alone. Based on the preceding values for open-pit waste rock and ore production, the stripping ratio will be 15.2, which will probably be the highest stripping ratio for an individual mine in the history of open-pit mining. It should be noted that Fig. 5 indicates that a total of 3.741 million metric tons of ore will be produced from the Rise-and-Shine Underground Mine, so that the stripping ratio for underground mining will be only 0.43.

15. From another perspective, assuming a gold grade of 2.4 grams per metric ton (Matakanui Gold Limited, 2026b) and typical gold concentrator and refinery recovery rates of 83% and 90%, respectively (Nassar et al., 2022b), the Bendigo-Ophir Gold Project will produce 8,458,035 tons of mine waste for every ton of refined gold. Since the global average ratio of waste to metal for gold mining is 3,046,349 (by far, the highest for any common commodity) (Nassar et al., 2022b), the Bendigo-Ophir Gold Project will be an unusually inefficient producer of gold.

16. Matakanui Gold Limited has presumably carried out an internal economic analysis and has concluded that they can carry out a profitable mining operation, even with such a high production of waste rock. However, with regard to the five disadvantages of excessive production of waste rock that were listed above, only the excessive fuel consumption would be reflected in the balance sheet of the company. The remaining four disadvantages are all costs and risks that will be borne by society and the environment.

17. Based on the analysis of Question #1, the following recommendations are made to the Panel:

    a. The Panel should request that Matakanui Gold Limited provide mining feasibility information demonstrating the feasibility of underground mining only, and the implications of that option: (i) for ore production; and (ii) in terms of environmental impacts.

    b. The Panel should take into account the excessive nature of the Project's fuel consumption, greenhouse gas emissions, risk of mining-induced seismicity, permanent alienation of land from any beneficial use, and risk of surface water and groundwater contamination when assessing those impacts in comparison with the Project's benefits.

Question 2: Consideration of alternatives to permanent aboveground tailings storage facility

Summary

18. Based upon the very large void space created by an open-pit stripping ratio of 15.2, the obvious alternative to the construction of a permanent aboveground tailings storage facility is the backfill of the tailings into the exhausted open pits. Consideration of this alternative is required by the Global Industry Standard on Tailings Management (GISTM). There is no evidence of this alternative having been considered by Matakanui Gold Limited.

Discussion

19. The backfill of mine tailings into exhausted open pits is regarded as a best practice throughout the mining industry. The most important advantage of open-pit backfill is that it removes the permanent threat of catastrophic failure of an aboveground tailings storage facility, as well as the costs of permanent monitoring, inspection, maintenance, and review of an aboveground tailings storage facility. The second most important advantage is that open-pit backfill can prevent the generation of acid mine drainage by permanently submerging tailings beneath a pit lake. In addition to the prevention of catastrophic failures of aboveground tailings facilities and the long-term costs of preventing such failures, as well as the risks and costs of prevention of acid mine drainage, open-pit backfilling can facilitate the return of the surface to its pre-mining state with less risk of permanent alienation of the land from a useful or natural purpose. Open-pit backfilling also reduces the risk of seepage of contaminated mine water to surface water bodies or aquatic ecosystems. Along the same lines, open-pit backfilling has more, and safer, options for the permanent physical and chemical isolation of hazardous materials. Open-pit backfilling can even improve the physical and chemical stability of the pit and stabilize the pit walls. For the above reasons, the maximum backfilling of mine tailings into either open pit or underground mine workings is currently regarded as a best practice (Mudd et al., 2011; Independent Expert Engineering Investigation and Review Panel, 2015; Morrill et al., 2022). According to Independent Expert Engineering Investigation and Review Panel (2015), "The overarching goal of BAT [Best Available Technology] is to reduce the number of tailings dams subject to failure. This can be achieved most

directly by storing the majority of the tailings below ground—in mined-out pits for surface mining operations or as backfill for underground mines."

20. Open-pit backfilling is contraindicated under only three circumstances (Arcadis, 2015). Sometimes the exhaustion of an open pit is followed by the opening of underground mine workings below the pit. In that case, open-pit backfilling can be too hazardous for the stability of the underground mine. On the other hand, the Marlin gold-silver mine in Guatemala was able to backfill the open pit with filtered, compacted tailings by sealing the contact between the open pit and the underlying underground mine with a grout barrier (Montana Exploradora de Guatemala, S.A., 2012). The second contraindication is that, under some circumstances, greater physical and chemical stability could be achieved through aboveground storage of mine waste. For example, the base and walls of an open pit could be heavily fractured (perhaps as a result of blasting), so that groundwater contamination could be less likely if the mine waste were stored on the surface above a low-permeability soil. Another example is that, without backfilling, the exhausted pit could develop a pit lake. One advantage of a pit lake is that it acts as a hydraulic sink with all groundwater flowing toward the pit, thus preventing the seepage of contaminated water out of the pit. In that case, if there were a strong pre-existing hydraulic gradient, the complete backfilling of the pit could result in a rapid flow of groundwater through the pit, thus facilitating the seepage of contaminants out of the pit. Even under those circumstances, the partial backfill of the pit to just above the water table can retain the pit as a hydraulic sink without the detrimental impacts (such as impacts on wildlife) of a potentially contaminated pit lake (Johnson and Carroll, 2007). From a financial standpoint, the third contraindication is that backfilling the pit could prevent the future mining of additional ore that might be present below the pit. However, the mere possibility of additional ore (that might be economically mineable at some future time) would have to be balanced against all of the previously mentioned benefits of open-pit backfilling. Those benefits can be social, environmental and economic.

21. The Global Industry Standard on Tailings Management (GISTM) was released on August 5, 2020, in response to the catastrophic failure of a tailings storage facility at Brumadinho, Brazil, in January 2019, which resulted in 272 deaths, including 258 mineworkers (ICMM-UNEP-PRI, 2020). Although the three official authors were the International Council on Mining & Metals (ICMM), the United Nations Environment Programme (UNEP), and Principles for Responsible Investment (PRI), a book by two of the authors of the draft standard (Hopkins and Kemp, 2021) clarified that the contributions of UNEP and PRI to the GISTM were minimal. In addition, the various

follow-up documents (such as ICMM (2021)) were written by ICMM alone, with no participation by UNEP or PRI. Thus, the GISTM should be regarded as minimum good practice standards acceptable to the mining industry, rather than best practice.

22. Member Companies of ICMM have been obligated to fully implement the GISTM by 5 August 2023 for tailings storage facilities with failure consequences rated as Very High or Extreme (ICMM, 2021, 2023), and by 5 August 2025 for all tailings storage facilities. Although neither Santana Minerals nor Matakanui Gold Limited are Member Companies of ICMM, Association Members include the Australasian Institute of Mining and Metallurgy (AusIMM), the Minerals Council of Australia (MCA), and the World Gold Council (ICMM, 2026). Thus, compliance with the GISTM is widely expected within Oceania and the gold mining industry.

23. Matakanui Gold Limited has committed to complying with the GISTM, but only in terms of "general alignment." According to EGL (2025b), "The design of the proposed Shepherds TSF also aims to achieve general alignment with guidance recommendations contained within the Global Industry Standard for Tailings Management (GISTM) published by the International Council on Mining and Metals (ICMM), United Nations Environment Programme and Principles for Responsible Investments in August 2020 (Ref. 21)."

24. The key characteristic of the GISTM is the emphasis on safety. The first paragraph of the Preamble of the GISTM states, "The Global Industry Standard on Tailings Management (herein 'the Standard') strives to achieve the ultimate goal of zero harm to people and the environment with zero tolerance for human fatality. It requires Operators to take responsibility and prioritise the safety of tailings facilities, through all phases of a facility's lifecycle, including closure and post-closure" (ICMM-UNEP-PRI, 2020).

25. Safety is promoted through the rigorous application of a multiple accounts analysis (called a multi-criteria alternatives analysis in the GISTM) that has only two purposes: minimizing the risk to people and the environment, and minimizing the volume of tailings and water stored in aboveground facilities. Requirement 3.2 of the GISTM states, "For new tailings facilities, the Operator shall use the knowledge base and undertake a multi-criteria alternatives analysis of all feasible sites, technologies and strategies for tailings management. The goal of this analysis shall be to: (i) select an alternative that minimises risks to people and the environment throughout the tailings facility lifecycle; and (ii) minimise the volume of tailings and water placed in external tailings facilities" (ICMM-UNEP-PRI, 2020).

26. The SME (Society for Mining, Metallurgy and Exploration) Tailings Management Handbook clarifies that Requirement 3.2, as well as other requirements, unequivocally require the serious consideration of either open-pit or underground backfill. According to the SME Tailings Management Handbook, "[Requirement 3.2] inherently indicates that operators should be seeking to place tailings in mined-out pits or underground workings. Further, Requirement 6.6 … indicates that operators should 'include new and emerging technologies and approaches and use the evolving knowledge in the refinement of the design, construction and operation of the tailings facility.' Recognition is growing that for certain geologic and hydrogeologic conditions, in-pit TSFs represent best available technologies (BATs), and the inherent geotechnical stability of the tailings solids below grade is a major motivator for greater consideration of the in-pit tailings management design option" (Gabora and Fuller, 2022).

27. The GISTM further explains that the alternatives analysis "should objectively and rigorously consider all available options and sites for mine waste disposal. It should assess all aspects of each mine waste disposal alternative throughout the project life cycle (i.e. from construction through operation, closure and ultimately long-term monitoring and maintenance). The alternatives analysis should also include all aspects of the project that may contribute to the impacts associated with each potential alternative. The assessment should address environmental, technical and socio-economic aspects for each alternative throughout the project life cycle" (ICMM-UNEP-PRI, 2020). The important point is that cost is not one of the "aspects" (also called one of the "accounts" in a multiple accounts analysis) that should be considered, which is consistent with the primacy of safety in the GISTM. The usage of the word "economic" throughout the GISTM clarifies that it refers to the local economy, not to the economics of the mining company. For example, Requirement 2.1 states that operators should "develop and document knowledge about the social, environmental and local economic context of the tailings facility, using approaches aligned with international best practices" (ICMM-UNEP-PRI, 2020).

28. There is no information in the Fast-Track Application that would make it possible to compare the volume of void space in the exhausted open pits with the expected volume of tailings. However, besides the very large stripping ratio discussed under Question #1, there are sufficient indications that the exhausted open pits will have more than enough space to accommodate the tailings. First, although the project will produce 203.7 million metric tons of waste rock, the plan is to backfill a maximum of 10.6 million metric tons of waste rock, or only 5% of the total (EGL, 2025a; see Fig. 6). Second, there are

numerous mentions of the pit lakes that will fill the exhausted open pits, corresponding to space that could have been filled by tailings. According to Matakanui Gold Limited (2026b), “While a full description of the various activities that comprise the construction, operation, maintenance, rehabilitation and closure of the BOGP [Bendigo-Ophir Gold Project] is provided in section 3 of this report, the project is made up of the following key activities: … The staged establishment of the RAS Open Pit and Underground Mine, and SRX Open Pit, which will remain as pit lakes at closure.” According to Matakanui Gold Limited (2026a), “The RAS [Rise-and-Shine] Open Pit will remain as an open pit in closure, with a pit lake forming over time achieving a stable condition within 25 years … Modelling indicates the pit lake will form within 5 years and eventually overflow to Rise and Shine Creek at its northwestern extent.”

29. There is no indication that the alternative of open-pit backfill was ever considered. It was mentioned above that, in some circumstances, open-pit backfill might not be preferred if there were less risk of groundwater contamination if the tailings were stored in an aboveground location. However, there is no indication that such a study has ever been carried out. As a result, it is not possible to reach a conclusion on whether open pit backfill could have been adopted instead of a permanent aboveground tailings storage facility.

30. In terms of the analysis of open-pit backfill as an alternative to a permanent aboveground tailings storage facility, I reiterate that, according to the GISTM, the cost to the company cannot be one of the criteria. As already mentioned, the GISTM does not include the cost of the alternative as one of the accounts and states that only the environmental, technical and socioeconomic aspects of the alternatives should be considered (ICMM-UNEP-PRI, 2020). In fact, the inclusion of cost as a consideration would be inconsistent with the two purposes of a multiple accounts analysis, which are the minimization of risk to people and the environment and the minimization of the aboveground storage of tailings and water (ICMM-UNEP-PRI, 2020). The consideration of cost would certainly be inconsistent with the “ultimate goal of zero harm to people and the environment with zero tolerance for human fatality” and the obligation to “prioritise the safety of tailings facilities” (ICMM-UNEP-PRI, 2020), as stated in the first paragraph of the Preamble to the GISTM.

31. A similar approach is taken in the Guidelines for the Assessment of Alternatives for Mine Waste Disposal by Environment Canada (2013), which is the basis for the discussion of multiple accounts analysis in the SME Tailings Management Handbook (Malgesini and Chapman, 2022). According to Environment Canada (2013), “A project proponent

seeking to use a natural water body as a TIA [Tailings Impoundment Area] must conduct an assessment of alternatives for mine waste disposal … This alternatives assessment must objectively and rigorously assess all feasible options for mine waste disposal. The project proponent must demonstrate through the EA [Environmental Assessment] and this assessment that the proposed use of the water body as a TIA is the most appropriate option for mine waste disposal from environmental, technical and socio-economic perspectives. It should also be demonstrated that the option offers the greatest overall benefit to current and future generations of Canadians …" Thus, Environment Canada (2013) also does not include cost as one of the relevant perspectives. Environment Canada (2013) clarifies that "socio-economic perspectives" does not refer to the cost of the alternative, but that "this account focuses on how a proposed TIA may influence local and regional land users. Elements that are considered here include characterization and valuation of land use, cultural significance, presence of archaeological sites and employment and/or training opportunities."

32. It is noteworthy that the description of multiple accounts analysis in Environment Canada (2013) explicitly includes the consideration of mine backfill as an alternative. According to Environment Canada (2013), "In some cases separation of the float tailings (which typically represents the largest fraction of the tailings volume) from the leach residue tailings would result in the larger volume of float tailings being geochemically benign, which greatly reduces any potential impacts … Mine backfill is often required as part of the mine plan. It may be advantageous to consider tailings as a backfill material to achieve two goals. Firstly, it may offer a logical rationale to separate the leach and float tailings, and secondly, by reducing the volume of tailings that needs to go to the TMF [Tailings Management Facility], the potential impacts are reduced."

33. It is now a well-established concept in the areas of both tailings dams and water-retention dams that safety is the priority and that there can be no trade-off between safety and any other benefits, including costs. According to the U.S. Army Corps of Engineers (USACE, 2014), "A key mission of the USACE dam safety program is to achieve an equitable and reasonably low level of risk to the public from its dams. USACE executes its project purposes guided by its commitment and responsibility to public safety. Since 'Life Safety is Paramount,' it is not appropriate to refer to balancing or trading off public safety with other project benefits. Instead, it is after tolerable risk guidelines are met that other purposes and objectives will be considered." According to the expert panel that investigated the Mount Polley tailings dam failure, "Safety attributes should be evaluated separately from economic considerations, and cost should not be the determining factor

… Future permit applications for a new TSF [Tailings Storage Facility] should be based on a bankable feasibility that would have considered all technical, environmental, social and economic aspects of the project in sufficient detail to support an investment decision, which might have an accuracy of ±10%–15%. More explicitly, it should contain the following: … b. Detailed cost/benefit analyses of BAT [Best Available Technology] tailings and closure options so that economic effects can be understood, recognizing that the results of the cost/benefit analyses should not supersede BAT safety considerations" (Independent Expert Engineering Investigation and Review Panel, 2015). The preceding quote should also help to clarify the purpose of a cost/benefit analysis, which is most certainly not to enable a trade-off between safety and cost. Thus, any discussion of cost in Environment Canada (2013) or the SME Tailings Management Handbook (Malgesini and Chapman, 2022) should be understood in light of the preceding quote.

34. A report by UNEP in response to the failure of the tailings dam at the Samarco mine in Brazil further confirmed that safety must be evaluated separately from cost. According to Roche et al. (2017), "The approach to tailings storage facilities must place safety first by making environmental and human safety a priority in management actions and on-the-ground operations. Regulators, industry and communities should adopt a shared zero-failure objective to tailings storage facilities where 'safety attributes should be evaluated separately from economic considerations, and cost should not be the determining factor' [Independent Expert Engineering Investigation and Review Panel, 2015]." Finally, the first guideline in Safety First: Guidelines for Responsible Mine Tailings Management is to "Make safety the guiding principle in design, construction, operation, and closure" (Morrill et al., 2022). Morrill et al. (2022) further explained, "Specifically, tailings management must ensure zero harm to people and zero tolerance for human fatalities … Safety must be evaluated by independent third-parties, such as an Independent Tailings Review Board, to ensure that cost reduction is not prioritized at the expense of people and the environment. Operating companies must document that, at all points of design, operation, closure, and post-closure of tailings facilities, protecting human and environmental health and safety is the primary concern … If a mining project is uneconomic due to the costs of a safe tailings disposal system, then it is uneconomic — costs and risks must not be transferred to the environment, communities or host governments."

35. In summary, based on the analysis of Question #2, the following recommendations are made:

a. The Panel should require Matakanui Gold Limited to produce a feasibility study for open-pit backfill of the tailings as an alternative to a permanent aboveground tailings storage facility.

b. For consistency with the GISTM, the feasibility study should take into account only technical aspects, environmental aspects, and socioeconomic aspects (referring to the local economy, not the balance sheet of the company), and not the cost to the company.

Question 3: Adequacy of controls to prevent neutral or acid mine drainage and metal leaching from mine waste

Summary

36. The controls listed in the Fast-Track Application are not adequate to prevent surface water and groundwater contamination from acid or neutral mine drainage and metal leaching from the waste rock and tailings.

Discussion

37. The Fast-Track Application acknowledges the numerous potential sources for surface water and groundwater contamination from the Bendigo-Ophir Gold Project. According to Matakanui Gold Limited (2026a), "Mining activities within the BOGP are expected to influence water quality across the Project Site. These impacts will result in the generation of Mine-Impacted Water ('MIW') - a term used to describe water that has been affected by mining processes and infrastructure. MIW includes several distinct types of water, each with specific characteristics and environmental considerations:

a. Surface water runoff with elevated Total Suspended Solids ('TSS'), primarily resulting from earthworks and disturbed land surfaces;

b. Neutral Metalliferous Drainage ('NMD'), which may contain elevated concentrations of Potential Constituents of Concern ('PCOCs') such as arsenic, sulfate and trace metals due to interaction with waste rock and tailings; and

c. Nitrate-rich drainage, associated with the use of ammonium nitrate fuel oil ('ANFO') explosives and cyanide in gold recovery processes, which may also include ammoniacal nitrogen. These water types originate from different sources - surface runoff, seepage from engineered landforms, and process-related discharge - but collectively these waters are referred to as MIW to acknowledge the different contributions to potential reductions in water quality within the Project

Site … NMD will present as seepage from various mine components including the Shepherds ELF [Engineered Landform], SRX ELF, Western ELF, CIT [Come-in-Time] backfill and TSF [Tailings Storage Facility]."

38. Matakanui Gold Limited (2026c) is more detailed in stating, "The key PCOC that are likely to be associated with MIW include: TSS, aluminium (Al), antinomy [antimony] (Sb), As, cobalt (Co), copper (Cu), chromium (Cr), iron (Fe), molybdenum (Mo), nickel (Ni), lead (Pb), SO_4 [sulfate], strontium (Sr), zinc, (Zn), cyanide (CN), ammoniacal nitrogen (Amm-N) and nitrate nitrogen (NO_3-N)."

39. Hydro Geochem Group (2026) concludes, "Without mitigation, generation of Acid and Metalliferous Drainage (AMD) seepage from these MWSFs [Mine Waste Storage Facilities] has the potential [to] negative[ly] impact downstream receptors." Hydro Geochem Group (2026) then concludes that the use of control measures will prevent any negative impacts. According to Hydro Geochem Group (2026), "In the author's experience, the examples described above have been successfully used to control seepage migration from MWSFs at many mine sites globally. Examples where these have been employed (or identified as selected contingencies) include the Faro Mine Complex and Myra Falls in Canada, Resolution Copper in the USA, and McArthur River in Australia, among many others not publicly available."

40. The preceding list of allegedly successful examples is not encouraging. The Faro Mine Complex is widely regarded as one of the most contaminated mine sites in Canada. According to Government of Canada (2025), "Faro Mine is one of the largest and most contaminated sites in Canada. The site consists of waste-rock dumps, ore-processing facilities, water-treatment plants, tailings-disposal facilities, offices and other buildings. There are approximately 70 million tonnes of tailings and 320 million tonnes of waste rock across the mine complex. These materials have the potential for both metal release and acid rock drainage, which occurs when sulphide-containing waste rock and tailings are exposed to air and water. This will become more problematic as the acid concentrations reach saturation and begin releasing in high concentrations into the environment. If unchecked, this would make the waters downstream in the Pelly River watershed highly toxic to fish. Orange-red precipitate from sulphide oxidation would coat stream beds, making them inhospitable to aquatic organisms and fish spawning. The tailings are contained behind three impoundments, but these are physically unstable. If the main tailings impoundment fails, the damage downstream could be irreparable."

41. Myra Falls has also not been free from environmental contamination. In 2016 the mine was fined for the release of untreated acidic wash water into downstream waterways (Government of Canada, 2017). The example of Resolution Copper is entirely irrelevant because the mine will not be constructed for another 10 years and, because it is a block caving operation, there will be no production of waste rock (USFS, 2025). Finally, with regard to the McArthur River mine, there are numerous reports regarding acid mine drainage and salt and metal leaching into surface water and groundwater (Vanovac and Breen, 2017), elevated concentrations of lead and other metals in downstream fish and other aquatic species (Hydrobiology, 2016), and even toxic smoke resulting from the spontaneous combustion of waste rock (Everingham, 2016).

42. In the interest of time and space, no attempt has been made in this memo to fully document environmental pollution from the Faro Mine Complex, Myra Falls Mine, and McArthur River Mine. However, the important point is that, thus far, surface water and groundwater contamination has been universal in mines that exploit sulfide-ore deposits (Emerman, 2023), such as the deposit that will be exploited by the Bendigo-Ophir Gold Project, even with controls similar to those proposed to be employed at the Project. In fact, the only controls that are proposed for the Bendigo-Ophir Project are seepage collection systems (Hydro Geochem Group, 2026) and the environmental pollution from the Faro Mine Complex, Myra Falls Mine, and McArthur River Mine have all been related to failures and inadequacies in the seepage collection systems.

43. In summary, based on the analysis of Question #3, the following recommendations are made:

    a. The Panel should require Matakanui Gold Limited to produce a report showing multiple examples of mines that have exploited deposits similar to the deposit that would be exploited by the Bendigo-Ophir Gold Project under similar climatic conditions and using similar controls, and that do not have a record of surface water and groundwater contamination.

    b. In the absence of any such examples, the Panel should require Matakanui Gold Limited to produce a report that realistically predicts the surface water and groundwater contamination that will result from the Bendigo-Ophir Gold Project, based on historic examples of mines that have exploited similar deposits under similar climatic conditions using similar controls.

The three conclusions of this memo are repeated below:

1) The Bendigo-Ophir Gold Project will involve an excessive production of waste rock, leading to excessive fuel consumption, excessive greenhouse gas emissions, excessive risk of induced seismicity, excessive permanent alienation of land, and excessive risk of contamination of surface water and groundwater.
2) Based upon the very large void space created by an open-pit stripping ratio of 15.2, the obvious alternative to the construction of a permanent aboveground tailings storage facility is the backfill of the tailings into the exhausted open pits. The consideration of this alternative is required by the Global Industry Standard on Tailings Management. There is no evidence of this alternative having been considered by Matakanui Gold Limited
3) The controls listed in the Fast-Track Application are not adequate to prevent surface water and groundwater contamination from acid or neutral mine drainage and metal leaching from the waste rock and tailings.

The six recommendations of this memo are repeated below:

1) The Panel should request that Matakanui Gold Limited provide mining feasibility information demonstrating the feasibility of underground mining only, and the implications of that option: (i) for ore production; and (ii) in terms of environmental impacts.
2) The Panel should take into account the excessive nature of the Project's fuel consumption, greenhouse gas emissions, risk of mining-induced seismicity, permanent alienation of land from any beneficial use, and risk of surface water and groundwater contamination when assessing those impacts in comparison with the Project's benefits.
3) The Panel should require Matakanui Gold Limited to produce a feasibility study for open-pit backfill of the tailings as an alternative to a permanent aboveground tailings storage facility.
4) For consistency with the GISTM, the feasibility study should take into account only technical aspects, environmental aspects, and socioeconomic aspects (referring to the local economy, not the balance sheet of the company), and not the cost to the company.
5) The Panel should require Matakanui Gold Limited to produce a report showing multiple examples of mines that have exploited deposits similar to the deposit that would be exploited by the Bendigo-Ophir Gold Project under similar climatic conditions and using similar controls, and that do not have a record of surface water and groundwater contamination.
6) In the absence of any such examples, the Panel should require Matakanui Gold Limited to produce a report that realistically predicts the surface water and groundwater contamination that will result from the Bendigo-Ophir Gold Project, based on historic

examples of mines that have exploited similar deposits under similar climatic conditions using similar controls.

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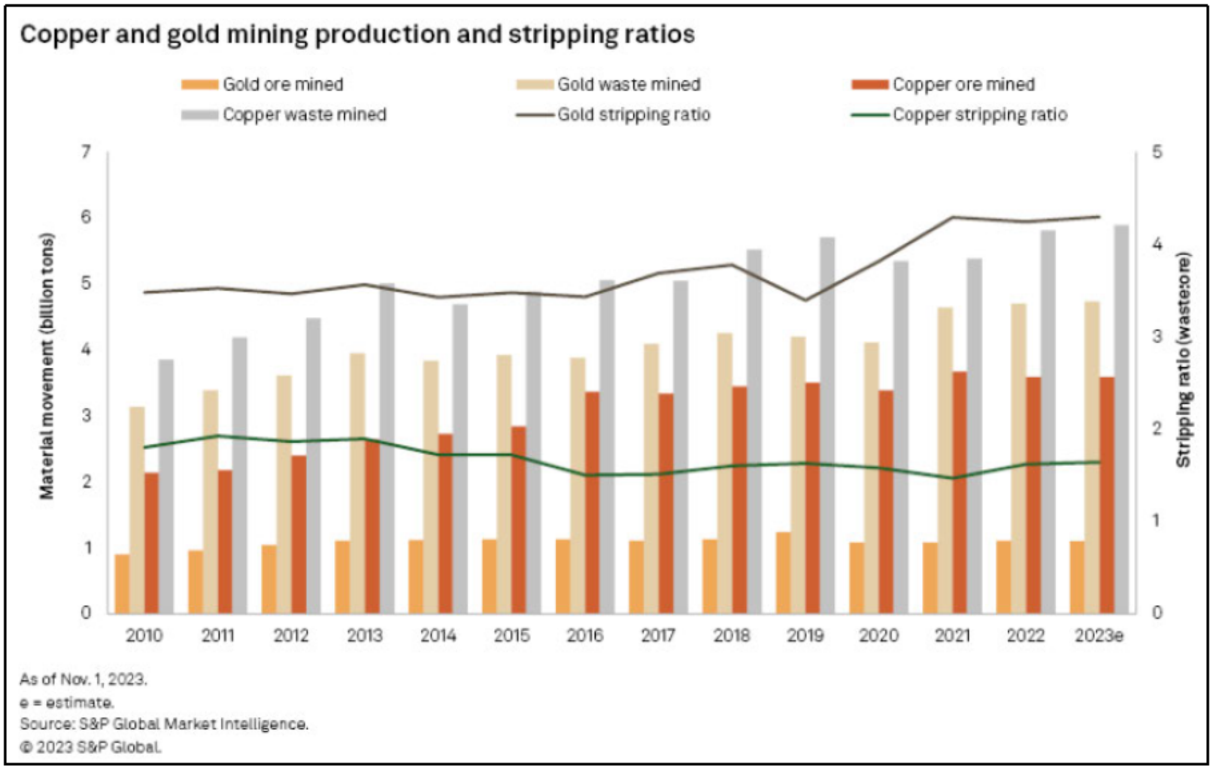

Figure 1. The ratio of the mass of waste rock to the mass of excavated ore is called the stripping ratio. S&P Global Market Intelligence reported that, in 2022, the global average stripping ratio for open-pit gold mines had dropped slightly to 4.24, down from 4.29 in 2021, which was the highest global average stripping ratio for open-pit gold mines ever recorded. Based on an open-pit stripping ratio of 15.2 (compare Figs. 2, 3 and 4a-b), the Bendigo-Ophir Gold Project will probably have the highest stripping ratio in the history of open-pit mining. Figure from Holden (2023).

Table 1: Waste rock production summary

Location	Estimated waste rock tonnage (Mt)
RAS Open Pit	193.8
RAS Underground	1.6
Srex	4.2
Come In time	3.9
Srex East	0.2
Total non-ore bearing rock produced	**203.7**

Figure 2. The Bendigo-Ophir Gold Project will produce 203.7 metric tons of waste rock, including 202.1 million metric tons from open-pit mining. Based on the open-pit production of 13.328 metric tons of ore (see Figs. 3 and 4a-b), the open-pit stripping ratio will be15.2, which will probably be the highest stripping ratio in the history of open-pit mining. Table from EGL (2025a).

Table 3-2: Indicative Pit Stage Inventories at the Rise and Shine Open Pit[40]

RAS Open Pit Stage	Total Tonnes (Mt)	Ore Tonnes (Mt)	Waste Tonnes (Mt)
Stage 1	46.8	1.4	45.4
Stage 2	29.2	3	26.2
Stage 3	40.4	3	37.4
Stage 4	57.6	2.4	55.2
Stage 5	40	2.1	37.9
Total	**214**	**11.9**	**202.1**

Figure 3. The Rise-and-Shine Open Pit will produce 11.9 million metric tons of ore. Combining the ore production of 1.428 million metric tons from the Srex and Srex East Open Pits yields a total open-pit ore production of 13.328 million metric tons. The Fast-Track Application does not state the ore production from the Come-in-Time Open Pit nor the total ore production. Table from Matakanui Gold Limited (2026a).

Table 3-3: Combined Srex and Srex East Open Pit Inventories[41]

	Quantity	Unit
Total Rock Mined	**7,344**	**(kt)**
Total Waste	**5,916**	**(kt)**
> TZ3 Tonnes	4,376	(kt)
> TZ4 Tonnes	710	(kt)
> Soil	626	(kt)
> Transition Mineralisation (> 0.3 g/t Au)	204	(kt)

[41] In accordance with the *Bendigo-Ophir Gold Project Pre-Feasibility Study*, dated 15 November 2024.

Figure 4a. See continuation of table in Fig. 4b. Table from Matakanui Gold Limited (2026a).

	Quantity	Unit
Ore	**1,428**	**(kt)**
> Gold Grade	0.68	(Au g/t)
> Contained Gold	30,674	(oz Au)
> Stripping Ratio	4.1	(waste t: ore t)

Figure 4b. The Srex and Srex East Open Pits will produce 1.428 million metric tons of ore. 11.9 million metric tons of ore. Combining the ore production of 11.9 million metric tons from the Rise-and-Shine Open Pit yields a total open-pit ore production of 13.328 million metric tons. The Fast-Track Application does not state the ore production from the Come-in-Time Open Pit nor the total ore production. See beginning of table in Fig. 4a. Table from Matakanui Gold Limited (2026a).

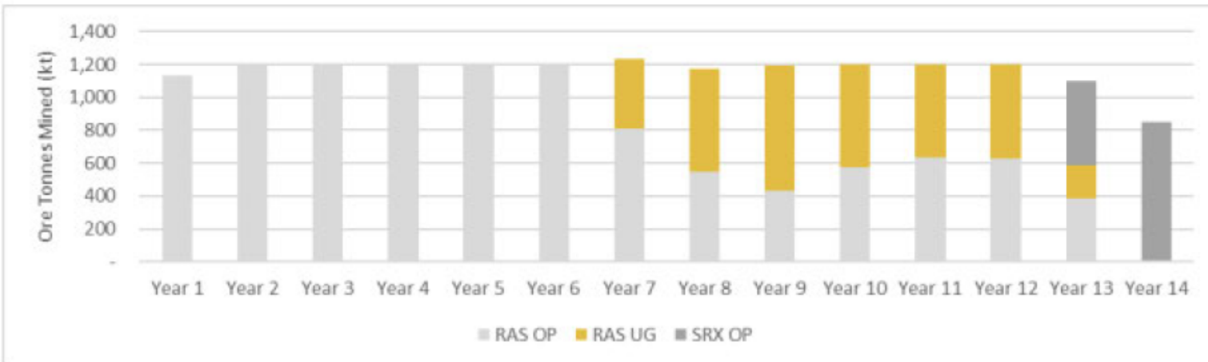

Figure 3-38: Overview of Material Processed by Source

Figure 5. A bar chart of ore production per year includes only the Rise-and-Shine Open Pit, the Rise-and-Shine Underground Mine, and the Srex Open Pit, but not the Come-In-Time Open Pit, so that the total ore production is unknown. Digitizing the above bar chart yields a total ore production of 3.741 million metric tons from underground mining, so that the stripping ratio for underground mining will be only 0.43 (compare with Fig. 2). Figure from Matakanui Gold Limited (2026a).

Table 2: Waste rock storage summary

Location	Estimated backfill tonnage (Mt)
Srex ELF	9.2
Back fill of Come in Time Pit	8.6
Back fill of Srex East Pit	2.0
Western ELF	11.4
Construction of Shepherds Creek TSF Embankment	4.9
Shepherds ELF	187
Total non-ore bearing rock stored	**223.1**

Note: Storage capacity exceeds production quantity

Figure 6. Although the project will produce 203.7 million metric tons of waste rock (see Fig. 2), the plan is to backfill a maximum of 10.6 million metric tons of waste rock, or only 5% of the total. Thus, besides the very large stripping ratio of 15.2, there are sufficient indications that the exhausted open pits will have more than enough space to accommodate the tailings. Table from EGL (2025a).