Before the Independent Hearing Panel

In the Matter	of the Resource Management Act 1991 (**RMA**)
And	
In the Matter	of an application to the Gore District Council and Environment Southland for resource consents to establish and operate a gold mining activity near 972 Waikaka Road, Chatton North, Southland
Reference	APP-20242608 (Environment Southland) LU 24035 (Gore District Council)

Evidence of Paul Antony Weber on behalf Waikaka Gold Mines Limited

For Acid and Metalliferous Drainage Effects

Dated 19 November 2025

Introduction

1. My full name is Paul Antony Weber.

2. I have over 25 years' experience in the field of environmental geochemistry. I hold a I hold a B.Sc. in geology and a M.Sc. (Hons) in environmental science from the University of Canterbury. I have a Ph.D. in applied science from the University of South Australia on prediction of acid and metalliferous drainage (AMD) and I am a member of the Australian Institute of Mining and Metallurgy having chartered professional status for the environment discipline.

3. I am the Principal Environmental Geochemist and the Managing Director for Mine Waste Management Limited (MWM). MWM is part of the Green Road group of companies (45 employees) that provides practical, innovative, and sustainable solutions to the international resources industry. I am a co-founder of the Green Road group of companies. Prior to this role I worked at O'Kane Consultants Limited for 5.5 years as a Director for New Zealand and as a Principal Environmental Geochemist. Both companies provide advice on AMD and closure planning for mining operations. I have also worked as the R&D Manager – Environment for Solid Energy (NZ) Limited for ~9 years investigating beneficial reuse of waste streams and options to manage and treat AMD at its coal mining operations. In this regard I am conversant with AMD from coal measures. Additionally, I worked in the Western Australian mining industry for 5 years as a geologist / environmental geologist and understand the process of mining.

4. My previous work experience includes research and operational management of AMD. I have worked with mining companies to deliver sustainable management approaches for AMD over this time. I have been engaged by a number of international companies and regulators (West Coast Regional Council, Waikato Regional Council), as a subject matter expert, to review mine closure plans regarding AMD and the assessment of environmental effects associated with AMD.

5. I was instructed by Waikaka Gold Mines Limited (WGML) (the Applicant) to provide AMD and environmental geochemistry evidence in relation to their application for resource consents from the Gore District Council (GDC) and Environment Southland (ES).

6. I have not yet visited the site, as the current study was completed as a desktop assessment supported by laboratory testing. However, I am familiar with the geology of the area and the stratigraphic units that can contribute to AMD. Should we be engaged to prepare the AMD Management Plan (**AMD MP**), a site inspection will be essential to ensure that our recommendations are site-specific and appropriately tailored to the identified AMD risks.

7. In preparing this evidence, I have reviewed the following documents:

    a. Application for Resource Consent to Environment Southland and the Gore District Council: Waikaka Gold Mines Limited (Town Planning Group, August 2024).

    b. Attachment K: Waikaka Gold Limited Technical Assessment of Proposed Groundwater Take and Discharge (Environmental Associates Limited, March 2024).

    c. Attachment T: Water Settlement Report. Waikaka Gold Mines Ltd. (Becker, 2022).

    d. Response to Further Information Request App-20242608 – Waikaka Gold Mines Limited (Town Planning Group, 8 April 2025).

    e. Response to Outstanding S92 Items Raised in Respect of Waikaka Gold Mines Limited, Application for Resource Consent(s) APP-2024608 (Environmental Associates Limited, 3 October 2025).

    f. Form 13: Submission on application concerning resource consent Resource Management Act 1991 to Environment Southland by the Director-General of Conservation (Department of Conservation 23 June 2025).

g. Environment Southland Officer's Report by Alexandra Smith, Senior Consents Officer for Resource Consent Application No: APP-20242608.

h. Evidence of Alexandra Badenhop dated 13 November 2025 for Resource Consent Application No: APP-20242608.

8. Although this is not a hearing before the Environment Court, I record that I have read and agree to and abide by the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2023. This evidence is within my area of expertise, except where I state that I rely upon the evidence of other expert witnesses as presented to this hearing. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

Glossary

9. A glossary of term used in my evidence is provided in **Error! Reference source not found.**.

Table 1 *Glossary of Terms*

Abbreviation	Explanation
AMD	Acid and metalliferous drainage
AMD MP	Acid and metalliferous management plan
ANC	Acid Neutralisation Capacity
ANZG	Australian and New Zealand Guidelines for Fresh and Marine Water Quality
OBDA	Overburden Disposal Area (backfill)
CLT	Column Leach Test
DFAT	Department of Foreign Affairs and Tourism - Australia
EC	Electrical conductivity
ES	Environment Southland
GDC	Gore District Council
GLM	Gore Lignite Measures

Abbreviation	Explanation
MWM	Mine Waste Management Limited
MPA	Maximum Potential Acidity
NAF	Non-acid forming
NAPP	Net Acid Producing Potential
NTU	Nephelometric Turbidity Unit
PAF	Potential acid forming
PCOC	Potential constituents of concern
QA/QC	Quality Assurance / Quality Control
ROM	Run-of-mine
SOP	standard operating procedure
SP01	Stockpile SP01 (a temporary ex-pit stockpile)
TARP	trigger action response plan
TPG	Town Planning Group
TSS	Total suspended solids
WGML	Waikaka Gold Mines Limited
W01	Water monitoring location 10 m upstream of the WVP discharge.
W02	Water monitoring location 60 m downstream of the WVP discharge.
W03	Water monitoring location at the outlet of the Terminal Sediment Pond
WGML	Waikaka Gold Mines Limited
WVP	Waikaka Valley Project

Project Involvement

10. I was responsible for providing two technical assessments for the proposed Waikaka Valley Project (**WVP**). It should be noted that these documents were prepared based on an early, larger project design / footprint. The change to the design of the WVP does not impact on the conclusions presented as the project occurs within the spatial extent considered by my

reports. Furthermore, I assume the relative material proportions (and hence risk) remain the same (i.e., relative quantities of potential acid forming (PAF) and non-acid forming (NAF) materials are comparable).

11. The MWM reports that I will reference include:

    a. Assessment of Environmental Effects – Acid and Metalliferous Drainage. MWM Report: J-NZ0194-001-R-Rev0 (MWM, 2022a). Dated June 2022.

        i. Waikaka Column Leach Test Results for the Proposed Waikaka Valley Project. MWM Report: J-NZ0194-002-M-Rev0 (MWM, 2022b). Dated September 2022.

Scope of Evidence

12. My evidence will address the following:

    a. Provide a plain-language summary of AMD hazards and management opportunities for the WVP to minimise AMD effects on the receiving environment (i.e., the Waikaka Stream).

    i. Confirm my assessment of the identified AMD risks associated with the proposed WVP.

    j. Outline the proposed management processes that will be implemented at the WVP during development, operational, and closure phases to address AMD risks including the proposed performance monitoring to assess the effectiveness of those measures.

    k. Respond to the relevant parts of the Council officers' Section 42a Reports.

    l. Respond to the relevant parts of John McCarroll's queries presented in Submission – Department of Conservation – APP – 20242608.

13. For brevity, I do not repeat matters already adequately addressed in the Section 42A report. Similarly, I will cross reference the contents of my

report which formed part of the application for consent and/or my responses to requests for further information where appropriate, rather than repeating it here.

Summary

14. My evidence focuses on what I consider the relevant potential effects of AMD associated with the proposed WVP and how they will be managed.

15. With regard to the AMD studies completed I note:

    a. Some materials (e.g., the Gore Lignite Measures (GLM) and other carbonaceous units) that will be excavated as part of the WVP may be PAF. These materials have a low capacity (e.g., DFAT, 2016) to generate acidity (i.e., the measured maximum potential acidity (MPA) is 6.8 kg H2SO4/t equivalent).

    b. The Acid Neutralisation Capacity (ANC) of the GLM materials is also low (< 5 kg H2SO4/t equivalent).

    c. The net acid producing potential (NAPP[1]) for the GLM is 4.39 kg H2SO4/t equivalence (a positive NAPP is acid forming), which means the sample is classified as PAF. As indicated by the Column Leach Test (CLT) these materials can generate low pH conditions and AMD upon oxidation and wetting (MWM, 2022b).

    d. The ore zone (wash) will contain ~ 200 mm of GLM (pers. comm. Noel Becker: email dated 28 October 2025). Town Planning Group (TPG, 2024) note that the total wash thickness will be 2.8 m thick, hence the GLM represent < 10% of the ore zone. Analysis of the NAPP data for the wash is provided in **Error! Reference source not found.** and indicates that overall, the wash is NAF with a negative NAPP of -2.04 kg H2SO4/t.

[1] where NAPP = MPA – ANC (all units in kg H_2SO_4/t equivalence).

***Table 2** Wash Zone Acid Base Accounting Data.*

	MPA	ANC	NAPP	Thickness	Weighted Wash (NAPP)
units	*kg H_2SO_4/t*	*kg H_2SO_4/t*	*kg H_2SO_4/t*	*m*	*kg H_2SO_4/t*
Gravel Wash	0.077	1.2	-1.123	2.6	-2.92
GLM	6.79	2.4	4.39	0.2	0.88
Overall NAPP					**-2.04**

*Note: data in **Error! Reference source not found.** are based on GLM contact acid base accounting data for 1 drillhole. Variance is likely.*

e. Studies indicate that the process residues (containing GLM) can be classified as both NAF and PAF (MWM, 2022b), which is a function of whether lignite / carbonaceous materials are present (carbonaceous materials are a key requirement for forming diagenetic sulfides). Hence not all process residues will be PAF. The dominant lithology of the GML is quartz lithic conglomerate (likely to be NAF) with only minor lenses of carbonaceous clay and lignite (likely to be PAF).

f. The Applicant (pers. comm. Noel Becker: email dated 28 October 2025) notes that only 3.1% of the GLM samples contained lignite. This suggests only a minor fraction of the total wash has the potential to generate AMD. Further acid base accounting (**ABA**) testing is recommended (i.e., geochemical characterisation) and this will be part of the AMD MP requirements (see Appendix A).

g. Overall, the NAPP for the all the project materials is (negative) at -140,000 tonnes of H_2SO_4 equivalence meaning in totality the project materials are classified as NAF. However, poor management of a small amount of PAF materials could lead to AMD. Hence, AMD management processes are required.

h. Three CLTs were undertaken to understand the reaction kinetics of the materials and identify potential constituents of concern (**PCOC**). Analysis of CLT data relative to the ANZG[2] (2018) water quality (95% species protection) criteria identified elevated PCOC

[2] Australian and New Zealand Guidelines for Fresh and Marine Water Quality

where: Co >> Al >> Cu, Pb, Zn > Ni, As, Cr, Mn, Se, and Cd. Fe is also significantly elevated. It should be noted that these laboratory scale tests do not represent field reaction rates and water quality. Rather they provide an indication of the risks for AMD and the geochemical signature of AMD. Furthermore, AMD risks are higher in lower pH waters as low pH increases sulfide oxidation rates. Low pH waters are not expected at the WVP.

i. ABA data indicates that whilst some materials such as the GLM can generate AMD (and only 3.1% of these materials are carbonaceous) and are classified as PAF, the wash and the total project materials can be classified overall as NAF. Hence, only localised pockets (carbonaceous lenses) of AMD are expected at the project. Furthermore, Mr Heller in his evidence notes that dewatering rates, driven by groundwater flows will be 21.5 – 34.7 L/s. This groundwater will also provide alkalinity that will contribute to neutralising any acidity generated by the GLM. An alkalinity value of 50 mg $CaCO_3$/L was used (Liquid Earth, 2010) as an estimate of groundwater alkalinity in the area, which is supported by the evidence of Mr Heller as being reasonable. Based on the lower flow rate of 21 L/s this equates to an annual alkalinity of ~34 tonnes per year, which would contribute towards the neutralisation of any acidity generated by the GLM and other carbonaceous materials.

16. If AMD was to occur, it is likely to be minor provided suitable management processes are undertaken. In this regard an AMD MP is recommended, which was also requested by the Department of Conservation (DOC, 2025).

17. The AMD MP should include:

a. Water quality objectives.

b. Materials characterisation to identify higher risk AMD materials. Confirmation studies may lead to the ability to visually identify materials that could be problematic for AMD (e.g., dark carbonaceous material).

c. Integration of materials scheduling, management practises, and engineering controls to manage higher AMD risk materials (e.g., placement of PAF materials within the backfill below the long-term water table).

d. Performance monitoring of key project risks to support adaptive management (e.g., monitoring of water quality across the WVP).

e. Development of trigger action response plans (TARPs) in case adaptive management processes need to be implemented. These TARPS will be part of the AMD MP (Appendix A).

18. Water quality monitoring needs to be developed:

a. WGML proposes continuous turbidity measurements in the Tertiary Sediment Pond outlet and upstream and downstream in the Waikaka River for compliance monitoring purposes to confirm total suspended solids (TSS) are < 50 mg/L (based on turbidity relationships).

b. Mr Heller states in his evidence that Fe and As should be monitored in discharge from the project area. This is based on his assessment of groundwater data. CLT data suggests that it is unlikely to be an issue. Fu;rthermore, there is likely to be significant adsorption of As onto Fe hydroxides that will form as the Fe in groundwater oxidises within the sediment ponds thereby reducing the As concentration in discharge waters.

c. The ES Officers Report (Paragraph 3.3.43) considers it appropriate to monitor for electrical conductivity (EC), magnesium, dissolved iron, arsenic, pH, temperature, and aluminium.

d. Based on these recommendations, and our CLT studies that indicate certain PCOC are likely to be elevated, I recommend the following parameters be monitored (**Error! Reference source not found.**).

Table 3 *Proposed (Dissolved) Water Quality Monitoring Parameters.*

Parameter	**Monitoring Type**	**Monitoring Fequency**
Turbidity	Compliance	Continuous
TSS	Compliance	Weekly
pH	Compliance	Continuous
Temperature	Compliance	Continuous
EC	Performance	Continuous
SO_4	Performance	Weekly
Fe	Compliance	Weekly
Co	Compliance	Weekly
Al	Compliance	Weekly
Cu	Compliance	Weekly
Pb	Compliance	Weekly
Zn	Compliance	Weekly

e. The following notes are provided for **Table 2**.

i. Compliance monitoring should be against the proposed resource consent conditions for water quality. Compliance monitoring should be undertaken at the proposed monitoring site 60 m downstream of the WVP (identified as water monitoring location W02).

ii. Performance monitoring should be undertaken at the Tertiary Settlement Pond outflow (water quality monitoring location W03) and confirmation testing of effects at the downstream monitoring location (W02) after mixing (i.e., 60 m downstream as proposed by TPG (2024)).

iii. Additional performance monitoring should be for EC and sulfate.

19. A relationship between turbidity and TSS will need to be developed for the WVP to calculate the TSS in mg/L from turbidity measurements

(NTU[3]). Compliance monitoring should be based on TSS measurements, which provides ongoing corroborative data for this relationship.

a. TSS compliance limits should acknowledge upstream effects and should be based on the difference between upstream (W01 and downstream (W02).

b. Continuous monitoring of pH and EC will be advantageous as an early indicator of AMD and can be nested with the turbidity meter. This should be located at the Tertiary Settlement Pond outflow (W03) and at the proposed downstream compliance monitoring location (W02).

c. Compliance monitoring for metals is based on CLT data for metals that are 10x higher than the ANZG (2018) water quality (95% species protection) criteria for that metal (see MWM (2022b) for further details) given the dilution that is expected from groundwater and then in the Waikaka Stream (i.e., the Waikaka Stream mean annual low flow is 277 L/s, which is approximately an order of magnitude higher than the proposed discharge of all waters (21 – 34 L/s) from the project – hence a 10x threshold was applied).

d. Additional testing should be undertaken by WGML to confirm relationships between EC, SO4, and metals so that EC provides a guide to potential issues (i.e., performance monitoring).

20. Any deterioration in water quality will be addressed by the AMD MP TARPs. In this instance adaptive management could include water treatment.

21. If water quality remains unimpacted by AMD after the first 12 month of ore recovery, then the frequency of monitoring could be reduced, to be relied upon by continuous turbidity, pH, and EC of the Terminal Sediment Pond overflow.

[3] Nephelometric Turbidity Unit

22. I believe the evidence provided demonstrates that, with site-specific materials management processes and engineering controls, the AMD risks identified at the WVP can be minimised such that the effect on the receiving environment is less than minor.

Detailed Evidence

Introduction to AMD

23. AMD is a general term used to describe waters impacted chemically by mining activities and can contain significant quantities of metals, salts, and acidity. AMD can be divided into three water types:

    a. acid rock drainage having low pH, elevated metals, and acidity.

    b. neutral metalliferous drainage having circum-neutral pH, low acidity, and elevated metals.

    c. saline drainage, which is circum-neutral to alkaline in pH with elevated sulfate (> 1,000 mg/L).

24. ABA data provides an indication of the potential for acid generation and neutralisation within disturbed materials. Acid generation typically results from the oxidation of sulfide minerals, while neutralising minerals such as carbonates can buffer acidity and mitigate acid formation when present in sufficient quantities. The balance between the MPA, which represents the total acid that could be produced from sulfide oxidation, and the ANC, which reflects the available neutralisation potential, determines whether a material is classified as PAF or NAF. Materials at the WVP are classified as PAF and NAF based on internationally accepted criteria (AMIRA, 2002; Price, 2009).

25. Mine drainage chemistry is controlled by the mineralogical composition of rocks disturbed by mining. CLT simulate the natural weathering and leaching processes that occur when mine materials are exposed to water and oxygen, providing insight into how PCOC may be mobilised if materials are disturbed. By continuously percolating water through a column of material over time, these tests can identify the rates of metal release and

acidity generation. This helps identify which materials pose a higher risk to water quality or require special management if excavated, rehandled, or exposed during mining activities.

26. Minimising the exposure of PAF materials to oxygen is a fundamental strategy for preventing the generation of AMD. When sulfide-bearing materials are exposed to oxygen and water, oxidation reactions produce acidity and mobilise metals; therefore, reducing oxygen access directly limits these reactions. Preventing disturbance of PAF materials where possible is the most effective approach. Where disturbance is unavoidable, exposure duration should be minimised through rapid handling and placement in a low oxygen environment. Long-term control can be achieved by encapsulating PAF materials within low-permeability clay layers or storing them below the permanent water table, where oxygen diffusion is severely restricted. Together, these practices significantly reduce the potential for sulfide oxidation and contaminant release, providing a long-term, stable barrier against AMD generation. Long-term storage below the water table is proposed at the WVP.

27. A field-based test of paste pH and electrical conductivity (EC) can be performed to assess the geochemical risk of overburden materials during operational excavation and backfilling. This involves mixing a representative sample of the material with deionized water to form a paste (1:2 or 1:5 ratio) and then measuring the pH and EC of the resulting solution. The pH provides an indication of the material's immediate potential acidity or alkalinity, while the EC reflects the concentration of soluble salts and ions that could contribute to acid generation or metal mobility. Regular testing of key overburden units, particularly those containing carbonaceous material, can help identify areas of higher geochemical risk and guide management strategies such as segregation, encapsulation, targeted monitoring, or limestone addition.

28. To manage the risks associated with AMD, as detailed above, the International Network for Acid Prevention (INAP, 2014) outlines six key steps of best practice for the management of AMD. These include:

a. Identification of closure goals (see the evidence below on Operational and Closure Objectives).

d. Prediction of potential environmental issues (see the evidence below on Prediction of AMD Effects).

e. Prevention of sulfide mineral oxidation (see the evidence below on Prevention and Minimisation Engineering Controls).

f. Minimisation of oxidation products being mobilised by water flow (see the evidence below on Prevention and Minimisation Engineering Controls).

g. Control and treat (see the evidence below on Water Management).

h. Performance monitoring (see the evidence below on Adaptive Management).

29. The following sections outline the proposed measures for AMD management at the WVP during the development, operation, and closure phases of the project. I consider this a robust practicable approach for the management of AMD.

Operational and Closure Objectives

30. The following monitoring plan is proposed (**Error! Reference source not found.**).

a. Three water quality monitoring locations are proposed:

i. **W01** – 60 m downstream of the WVP discharge: Compliance Monitoring

ii. **W02** – 10 m upstream of the WVP Discharge: Performance Monitoring.

iii. **W03** – Overflow from the terminal sediment pond – Performance Monitoring.

***Table 4** Water quality monitoring plan*

Parameter	Monitoring Type	Monitoring Frequency
Turbidity	Compliance	Continuous
TSS	Compliance	Monthly
pH	Compliance	Continuous
Temperature	Compliance	Continuous
EC	Performance	Continuous
SO_4	Performance	Monthly
Fe	Compliance	Monthly
Co	Compliance	Monthly
Al	Compliance	Monthly
Cu	Compliance	Monthly
Pb	Compliance	Monthly
Zn	Compliance	Monthly

31. Water quality limits need to be developed for the project.

Prediction of AMD Effects

32. Through characterisation of materials following industry best practise as detailed by AMIRA (2002) and Mine Environment Neutral Drainage (Price, 2009), an in-depth understanding of the potential for overburden materials to generate AMD has been developed, which is supported by the geological model.

33. Material characterisation indicates that only a small proportion of the site's materials are potentially acid-forming (PAF) and that the overall acid-generating capacity of the project is low. Calculations of NAPP and neutralisation potential ratio (NPR) classify the materials as predominantly NAF. I expect that with an appropriate AMD MP that any risks from AMD can be minimised.

34. CLT was conducted in accordance with modified AMIRA (2002) protocols to understand the reaction kinetics of the materials and identify PCOC. Analysis of CLT data relative to the ANZG4 (2018) water quality (95%

[4] Australian and New Zealand Guidelines for Fresh and Marine Water Quality

species protection) criteria identified elevated PCOC where: Co >> Al >> Cu, Pb, Zn > Ni, As, Cr, Mn, Se, and Cd. Fe is also significantly elevated. These laboratory scale tests do not represent field reaction rates and water quality. Rather they provide an indication of the risks for AMD and the geochemical signature of AMD. Risks are higher in lower pH waters as low pH increases sulfide oxidation rates. Low pH waters are not expected at WVP.

35. Compliance monitoring for metals is proposed when CLT data is >10x ANZG (2018) water quality (95% species protection) criteria given the dilution that is expected from groundwater and then in the Waikaka Stream (i.e., the Waikaka Stream mean annual low flow is 277 L/s, which is approximately an order of magnitude higher than the proposed discharge of all waters (21 – 34 L/s) from the project).

36. Only small volumes of PAF material are expected to be excavated as part of the WVP, so the potential for water impacts are limited. Ongoing performance monitoring of leachate from stockpiles should be undertaken. TARPs will use these monitoring data.

Prevention and Minimisation Engineering Controls

37. A number of engineering controls are available for the WVP to prevent and minimise potential geochemical risks during mining operations and post closure. These AMD management approaches will be imbedded in the WVP AMD MP and are explained further in the following paragraphs and include:

    a. AMD source management, and

    b. Materials handling and management.

38. Integration of ABA data into the geological block model will guide material scheduling and placement to manage AMD risk. This approach will ensure effective segregation, encapsulation, and handling of PAF materials, reducing environmental impacts during operations and post-closure. Key measures include:

a. Avoiding and/or minimising disturbance of the GLM.

b. Confirming the low quantities of PAF within overburden visually by the excavator operator, supporting appropriate handling and placement.

c. Minimising the exposure time of PAF overburden during excavation.

d. Ensuring no PAF material is scheduled for long term storage in the ex-pit Long-Term Stockpile (**SP01**).

39. QA/QC[5] of ex-pit stockpile materials to confirm they are NAF and validate the material handling schedule and geochemical model.

40. Encapsulation is a key engineering control for long-term AMD prevention, designed to isolate PAF materials from oxidation by placement below the long-term water table or through the use of low-permeability barriers such as compacted clay or inert cover materials. At the WVP, these material management controls include:

a. Placing all PAF materials as backfill below the long-term water table in the back-fill overburden disposal area (**OBDA**) and encapsulating them with clay-rich overburden.

b. Processing residues (including slimes, material from settling ponds, and tailings from the Gold Recovery Plant) will be transported from the Infrastructure Area by truck and placed back into the mine pit below the long-term groundwater level.

c. Backfill materials are placed in short lifts (< 4 - 6 m) or by paddock dumping, a method where material is placed in compacted thin, layers (or cells) as the pile is built up from the base. These methods will prevent grainsize segregation and minimise the advective ingress of oxygen into materials.

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[5] Quality Assurance / Quality Control

41. During the operational phase of the WVP, wash materials will be temporarily placed on the Run-of-Mine (ROM) pad. The ROM pad will be designed with low permeability to reduce water infiltration from PAF materials into the underlying alluvial sediments and limit the potential for contaminant migration to groundwater.

42. Any sulfide associated with GLM material that is mined with wash will report to heavy mineral concentrate at the gold plant and be removed from site for further processing to recover gold from concentrates; concentrate tailings (including sulfides, where present) will eventually be returned to be buried in backfill below the water table. If performance monitoring data (e.g., mercury (Hg) analysis) indicates there are unacceptable risks, then this material could be disposed offsite.

Water Management

43. Background surface and groundwater sampling conducted by WGML in 2021 (Table 1; MWM, 2022a) and Environmental Associates Limited (2025) indicates that metal concentrations within the aquifers are generally below the New Zealand Drinking Water Standards and Guidelines (Taumata Arowai, 2022). These results represent pre-disturbance conditions, where potentially acid-forming materials have not yet been exposed to oxygen. This background dataset provides an important reference for performance monitoring to verify that mining activities do not adversely impact surface and groundwater quality; however, it should not be used to infer the absence of risk associated with mining the WVP and potential AMD risks.

44. Water is the primary pathway for the mobilisation of contaminants from PAF materials. Proposed management methodologies, which will form an integral part of the site-specific AMD MP, include:

    a. Clean water diversion is proposed as part of the overall water management philosophy including minimising water ingress into the overburden that can mobilise potential contaminants of concern. Clean water will be diverted away from mining disturbance areas wherever possible to reduce the volumes affected, therefore requiring treatment. At the WVP this includes diversion of run-on water from key mine domains containing PAF materials (ROM Pad, OBDA, pit void).

b. Design of the OBDA area surfaces to shed water, where ponding of water on overburden is avoided (e.g., sediment sumps).

c. Flattening out paddock dumped materials to shed water before significant rainfall events.

45. It is presently proposed that all waters from pit dewatering and water used in the processing of wash materials are discharged to the treatment system comprising settlement ponds and the slimes treatment plant. Environmental Associates (2022) indicate that some interaction with natural groundwater may occur in final polishing areas and within conveyance (drains) to the Waikaka Stream; however, they state that any effect is most likely to be not measurable.

46. As discussed previously, the potential for AMD at the WVP is low; however, there is the potential for poor water quality due to AMD effects. Hence, in additional to the engineering controls proposed, consideration should be given to control and treatment of AMD through adaptive management processes. If required, a neutralisation step could be considered for integration to the water treatment system. Further recommendations for monitoring of water quality are discussed in Adaptive Management.

Adaptive Management

47. Adaptive management will be a central component of the project, supported by an AMD MP with standard operating procedures for critical risks. The AMD MP will be developed prior to the commencement of mining activities. It is expected the AMD MP will be certified by Environment Southland.

48. It is recommended that performance monitoring locations and schedules be established as part of the AMD MP to provide early indicators of AMD. Performance monitoring provides the data for TARPs in case there is a variance from the expected case and further actions are required to

minimise potential effects. I recommend that performance monitoring for the WVP include:

a. Geochemical characterisation (paste pH/EC) of materials (pre-excavation). Noting if materials are acidic, then the addition of limestone may be required to mitigate effects to groundwater (to be included in the AMD MP as part of the adaptive management approach).

b. Monitoring of water quality (EC/pH) within the pit sump.

c. Monitoring of water quality (EC/pH) at the Tertiary Settlement Pond outflow.

d. I also recommend that monthly performance monitoring of SO4 and metals: Co, Al, Cu, Pb, Zn, and Fe (metals that are likely to be most elevated based on CLT monitoring). Performance monitoring should be undertaken at the Tertiary Settlement Pond outflow and confirmation testing of effects at the downstream monitoring location after mixing (i.e., 60 m downstream as proposed by TPG (2024)). Continuous monitoring of pH and EC would be advantageous as an early indicator of AMD at the Tertiary Settlement Pond outflow.

49. Where elevated acidity or metal concentrations are observed in on-site waters, affected waters could be treated (e.g., the addition of calcium hydroxide (Ca(OH) 2) and/or lime ($CaCO_3$)) prior to discharge to ensuring compliance with environmental standards and protecting downstream water quality.

Key Risks

50. Based on the identification of AMD hazards for materials that will be excavated and produced at site a preliminary AMD risk assessment was undertaken by MWM (2022a) to understand potential risks and propose effective mitigations to reduce risk for the WVP. The primary risks and their proposed mitigation strategies include:

51. Placement of PAF materials (ROM pad, ODBA, SP01) in a manner that leads to oxidation of sulfides and mobilisation of AMD to surface waters and groundwater. This risk is mitigated through the proposed materials characterisation and materials handling methods, which will be documented in the AMD MP. Performance monitoring is proposed to assess the effectiveness of these mitigation measures. PAF materials should be placed as backfill as soon as practicable.

52. Surface/pit water could be affected by AMD, which could be released to groundwaters (seepage) and surface waters (pumping). This risk is mitigated through water management and will be monitored as part of the proposed AMD MP and adaptive management strategies.

Matters Raised by the Officer's Report

53. The receiving environment (Waikaka Stream) is considered degraded by the ES Officer's Report (**Paragraph 3.2.16**).

54. I note several concerns have been raised in the Officer's Report for ES provided by Alexandra Smith including:

    a. **Paragraph 1.5.1**: Management Plans. The SDC Officer notes there is uncertainty regarding the content of the management plans. An AMD MP is proposed for the project. This includes trigger action response plans (TARPs) for key risks that is supported by performance monitoring. The table of contents for this AMD MP is provided in Appendix A to this evidence, which clearly provides details on the draft content of the AMD MP.

    b. **Paragraph 3.3.29**: Groundwater monitoring after overburden has been returned to the pit void. It is highly unlikely that once PAF materials are saturated by groundwater that they would oxidise. However, any stored oxidation products (as a function of sulfide mineral oxidation) generated during mining could be mobilised. Any monitoring after the overburden has been returned would not address the issue. It is recommended that pH/EC monitoring of backfill is undertaken. If materials are acidic then limestone needs to be added to neutralise the acidity. The exact limestone application rate needs to be determined from ABA testing and should be a standard operating procedure (SOP). This will be included in the AMD MP (Appendix A).

c. **Paragraph 3.3.30**: Monitoring for PAF oxidation. I agree that performance monitoring is required for PAF materials. This has been discussed in Paragraph a and further details are provided in the table of contents for the AMD MP (Appendix A).

d. **Paragraph 3.3.54**: notes that mercury (Hg) can be elevated in alluvial gold in Southland. Groundwater quality data (MWM, 2022a) shows Hg is < 0.0004 mg/L and in column leach tests (MWM, 2022b) Hg is also less then detection (<0.00008 and <0.002 mg/L). Sulfide mineral oxidation is not likely to be a source of Hg. If Hg is elevated it will be concentrated into the Pan Tails along with the gold. These materials should be assessed after gold recovery. If the Pan Tails remain elevated, then other disposal options need to be considered as part of adaptive management approach – e.g., disposal to landfill (see Appendix A).

e. The ES Officer's Report (**Paragraph 3.3.43**) considers pH, electrical conductivity (EC), magnesium (Mg), dissolved iron (Fe), arsenic (As), pH, temperature, and aluminium (Al) as being important due to a variety of reasons provided in the report. I do not think As is necessary.

f. **Paragraph 3.3.5.5**: The Officer's report recommends further monitoring of Hg. I recommend this is covered in the AMD Management Plan as a TARP for the Pan Tails as the Hg is associated with the gold and WGML proposes to concentrate the gold (hence any Hg).

55. I note several concerns raised by Alexandra Badenhop in her evidence dated 13 November 2025 including:

a. **Paragraph 8.8:** that the AMD risk of the dredge materials present in the vicinity of the water table is unknown and MWM have recommended that this is assessed. These materials will not be disturbed as part of the project.

b. **Paragraph 10.2:** that additional effects on groundwater quality may be caused by the oxidation and storage of overburden materials outside of the mine pit, with seepage and recharge through these materials affecting primarily the shallow aquifer. To manage these risks associated with temporary ex-pit above ground PAF storage, it is recommended that these PAF materials (which are minor, i.e., only 3.1 wt% of the GLM are carbonaceous) will be encapsulated within low-permeability clay layers until placement as soon as practicable as backfill.

Matters Raised by Submitters

56. I have been asked to respond to the issues raised by John McCarroll for the Department of Conservation (DOC, 2025).

    a. In response to Comment 2 regarding potential adverse effects on the environment, or how the proposal will avoid, remedy, or mitigate potential adverse effects on surface waters and groundwater quality:

        i. ABA data suggests that AMD is likely from a small proportion of materials (GLM) and carbonaceous materials. Overall, the risks for AMD are low.

        ii. A management plan for AMD will be developed prior to mining commencing. This will ensure best practical management of AMD generating materials will be undertaken.

        iii. Performance monitoring will be undertaken as explained in my evidence and TARPS will be developed for key AMD risks.

    b. In response to Comment 4 regarding the presence of PAF materials associated with the WVP:

        i. An in-depth understanding of the potential for overburden materials to generate AMD has been developed, which is supported by the assessment of geoenvironmental hazards for the WVP (MWM, 2022a,b). As described in this evidence, these data will allow for material scheduling and placement to manage the AMD source hazard.

c. In response to Comment 7 regarding the potential effects of PAF materials on the site:

   i. Material characterisation indicates that only a small proportion of the site's materials have the potential to generate acid and/or mobilise PCOC. As a result, I expect that with an appropriate AMD MP that covers material and water management that any risks from AMD can be minimised. As the potential for poor water quality does exist during mining operations and into post closure, it has been recommended that performance monitoring locations and schedules be established to detect early indicators of AMD. This will be part of the AMD MP.

d. In response to Comment 10 regarding the potential effects of AMD impacts on freshwater species and habitat:

   i. As detailed in this evidence, on-site water management is an integral component of the AMD MP and will minimise the mobilisation of PCOC into the receiving environment. Additionally, it has been proposed that all waters used in the processing of wash materials are directed to the treatment system prior to discharge. Performance monitoring locations and schedules to detect early indicators of AMD have been recommended to trigger further actions, if required, to minimise risk.

e. In response to Comment 28 (ii) with regards to the proposed AMD MP:

   i. The evidence provided in this report and supported by the attached technical reports forms the foundation for the development a site-specific AMD MP. A framework for the AMD MP has been appended to this document (Appendix A).

57. I recommended that the AMD MP be developed and certified by Environment Southland prior to the commencement of mining activities.

   a. In response to Comment 28 (iv) with regards to the risk of untreated water discharges during high flow or flood events:

      i. On-site water management is an integral component of the AMD management. Monitoring of water quality at pit sumps and settling ponds will allow for early detection of AMD during operations. A TARP will be in place for elevated acidity and/or metal concentrations. These measures will allow for treatment of impacted waters prior to discharge if required.

      ii. During a high rainfall event any surface waters affected by AMD can be redirected to the sediment ponds and/or the pit. Groundwater pumps can be turned off.

Conclusions

58. I believe the evidence provided demonstrates that, with site-specific materials management processes and engineering controls, the AMD risks identified at the WVP can be minimised such that the effect on the receiving environment is less than minor.

59. A management plan for AMD is required to ensure the risks are managed such that the effects are less than minor. This needs to include performance monitoring, TARPS, and have adaptive management processes understood and ready. The table of contents is provided in Appendix A.

Paul Antony Weber

Dated 19 November 2025

Appendices:

[A] Table of Contents: AMD Management Plan

References

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Appendix A

A draft table of contents for the WVP AMD Management Plan is provided in this Appendix A. The structure may change slightly during its development. It is understood it will be certified by ES.

This provides clarification for the ES Officer's Report of what the management plan will include.

AMD Management Plan Table of Contents:

Section	**Contents**
1	Introduction
1.1	Purpose
1.2	Objectives and Scope
2	Project Description
2.1	Overview
2.2	Project Summary and Mine Plan
2.3	Environmental Setting
2.4	Water Quality Objectives (Consent Conditions)
3.0	AMD Management Approach
3.1	Summary
3.2	Standards and Guidelines
3.3	Geochemical Engineering Controls
4.0	Material Classification and Management
4.1	Material Summary
4.2	AMD Classification
4.3	Material Schedule
4.4	Material Management
4.5	Risk Assessment
4.6	Performance Monitoring
4.7	Trigger Action Response Plans
4.7.1	TARP #1: Elevated Hg in Pan Tails
4.7.2	TARP #2: Geochemical testing of materials (in-pit and backfill).