In the matter of	an application for approvals under the Fast Track Approvals Act 2024
By	**Tāiko Critical Minerals**
	Applicant

Statement of evidence of Michael George Fitzpatrick in relation to Water Quality

17 March 2026

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Introduction

1 My name is Michael George Fitzpatrick.

2 My role in relation to the application (the application) by Tāiko Critical Minerals (TCM) for approvals relating to the Barrytown Mineral Sands – Southern Resources Block Project has been to provide expert advice in relation to water quality.

3 I contributed to the preparation of the 'Barrytown Mineral Sand Mine: Stages 2 and 3 Ecological Effects Assessment' (Ecological Solutions, 2026a), the Report. which has been provided in support of the application.

Scope of evidence

4 The purpose of this evidence is to:

(a) provide my qualifications and experience relevant to the Report;

(b) confirm my compliance with the Code of Conduct for expert witnesses, contained in the Environment Court of New Zealand Practice Note 2023;

(c) provide a brief summary of the key water quality aspects the Report and confirm its contents; and,

(d) comment on the proposed consent conditions.

Qualifications and experience

5 I hold the degrees of BSc in Chemistry from Waikato University (1985) and PhD in Chemistry from the University of Otago (1989).

6 I have been a scientific consultant for 33 years and work primarily in the areas of have been a director of Mike Fitzpatrick Consulting Ltd since 2003. I have been associated with Ecological Solutions Ltd since 2011 and I conduct all my environmental consulting via them.

7 My previous positions were Chief Scientific Officer at Feedback Research Ltd (2003-2011), Principal Environmental Chemist at Golder Associates (NZ) Ltd and Kingett Mitchell Ltd (1997-2011), Lecturer in Analytical and Environmental Chemistry at the University of Auckland (1995-1997), and Consultant Analyst at Grayson and Associates and Allan Aspell and Associates (1993-1995).

8 My work experience that is relevant to the proposed TCM project includes geochemical, water quality and aquatic toxicity assessments relating to

mineral extraction projects including those at Golden Cross (1997-2007), Mataura (1997-1998), Granity (1997-1998), Rotowaro (1998-2009), Benneydale (1999-2006), Macraes (1999-2010), Endako (Canada, 2000), Reefton (2000-2006), Te Kuha (2002), Stockton (2002-2006), Sadiola (Mali, 2003), Kapan (Armenia, 2006-2011), Waihi (2006-2010), Jinfeng (China, 2007-2009), Tsuneb (Namibia, 2009-2011), Greymouth (2014), and more recently at Coaldale (2021), Takitimu (2022), Maramarua (2022-2025), Barrytown (2023-2025), Rotowaro (2024-2025), Glencoal (2024-2025), and Mananui (2024-2025).

9 I have been involved in the water quality assessments of the Barrytown mineral sands proposals since 2023, and the current Barrytown South proposal since 2024.

10 My role in relation to TCM application, under the Fast-Track Approvals Act 2024 to establish and operate a mineral sands mine at Barrytown South (**application site**), has been to report on baseline water quality and to provide advice on the water quality related effects of the proposed project.

Expert witness Code of Conduct

11 While this application is not being considered by the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2023 and that I have complied with it when preparing this evidence. Other than when I state I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Summary of water quality

12 My evidence relates to baseline water quality and the effects of the Application on such, and includes:

(a) a review of the existing environment of the Application Site relating to surface water and groundwater quality;

(b) modelling of surface waters following mineral sand excavation and backfilling of slimes and tailings;

(c) an assessment of effects on surface water quality; and,

(d) comments on consent conditions.

The existing environment

13 I visited the application site in April 2024, when I made observations and field measurements, and collected samples for water quality analysis.

14 The several streams and drains at the application site generally exhibit near neutral pH, low to moderate electrical conductivity and total dissolved solids (TDS) concentrations, and low turbidity and total suspended solids (TSS) concentrations. Dissolved oxygen concentrations are moderate to high at surface water sites with visible flows. Stream and drain waters are low to moderate in alkalinity and major cation and anion concentrations, and are classified as soft (i.e., hardness <50 g/m3, as CaCO3).

15 Stream and drain nutrient concentrations are either low or moderate. Ammoniacal nitrogen (Amm-N) concentrations place stream and drain sites in either in the NPS-FM annual median A- or B- attribute states. Nitrate nitrogen (NO3-N) and dissolved reactive phosphorus (DRP) concentrations places stream and drain sites in the NPS-FM A-attribute state for both parameters. With respect to the NPS-FM the attribute bands act as standards for setting national freshwater objectives, with "A" being the healthiest state and "D/E" bands indicating a degraded state below the "national bottom line".

16 Concentrations of dissolved metals and metalloids are low across stream and drain sites and generally meet relevant guideline value concentrations. Total metals and metalloids concentrations are undetectable or low, with the exception of iron and manganese which are present in moderate concentrations in most streams and drains. Iron oxyhydroxide deposition is evident in some surface waters.

17 At wetland and pond sites, there is a tendency to higher turbidity, TSS, major cation and anion concentrations, which in turn results in greater total dissolved solids (TDS) concentrations and electrical conductivities. Total nitrogen (TN) concentrations are elevated versus the other surface water sites, due to organic nitrogen, and organic inputs are also evidenced by elevations in dissolved organic carbon (DOC). Metals and metalloids concentrations are undetectable or low at wetland and pond sites, apart from iron and manganese. Iron oxyhydroxide deposition is evident in some wetlands and ponds.

18 Groundwaters are mildly alkaline, of low alkalinity, and have low metal/metalloid concentrations, apart from iron and manganese. Groundwaters from eastern bores generally have a greater carbonaceous signature, contain higher concentrations of nutrients, and are more

oxygenated than western bore groundwaters. There is no evidence of significant seawater intrusion in groundwater from western bores.

Water quality modelling

19 I have constructed water quality models to conservatively estimate the changes that will occur to groundwater quality, and subsequently the quality of surface waters, following mineral sand excavation and backfilling of slimes and tailings.

20 The models incorporated baseline water quality data and relied on hydrological estimates, and the slimes and tailings geochemistry reported by Kōmanawa Solutions (2025).

21 The water quality models used a mass-balance approach followed by the determination of concentrations of relevant chemical species using ion-association aqueous modelling.

22 Initial model outputs indicated that surface waters receiving modified groundwater could potentially fail to meet surface water quality guidelines for pH and various metals/metalloids, since slimes and tailings porewater has lower pH, is less alkaline, has lower hardness, and has greater metal/metalloid concentrations than baseline groundwater.

23 I then conducted refined modelling, which included lime addition to tailings and slimes prior to deposition in order to raise porewater pH and increase alkalinity and hardness, and this indicated that recipient surface waters would meet relevant water quality guidelines for pH and metals/metalloids.

24 I have subsequently conducted aqueous leaching trials to assess the effectiveness of lime augmentation on Barrytown South minerals sand washed tailings, and to determine leachate quality that simulates post-deposition porewater (Ecological Solutions Limited 2026b).

25 Mixing of hydrated lime (Ca(OH)2) with dry washed tailings ratio of 1:750 (w/w) proved effective in raising hardness and reducing concentrations of metals in the simulated post-deposition porewater.

26 Further lime dosing trials are required to understand optimal treatment regimens. The trials will occur prior to mining as part of establishing operating conditions at the Application Site such that modified groundwater, on mixing with surface waters, meets relevant water quality guidelines for pH and metals/metalloids.

Assessment of effects

27 Conservative modelling of the quality of surface waters that will receive modified, lime augmented groundwater at the Application Site indicates that all relevant water quality guidelines will be met, which will in turn prove protective to aquatic biota.

28 There will likely be some appearance of iron oxyhydroxides in some surface waters, which is the baseline case, but this should not result in smothering of surface water beds.

29 Key to the surface water modelling is that tailings and slimes will require augmentation with lime prior to deposition in order raise porewater pH and hardness and facilitate demobilisation of metals and metalloids.

30 Surface water quality following the proposed mining is expected to be altered in the short to medium term as the plume of modified groundwater moves westward through the mined zone toward the coast, after which quality will revert to baseline as groundwater regains its pre-mining geochemical signatures.

Consent conditions

31 I provided recommendations and have reviewed the proposed consent conditions that relate to water quality, i.e., proposed condition 23 concerning treated mine water, and proposed condition 24 concerning surface water and groundwater.

32 I consider the thresholds that are detailed in Condition 23.1 Tables A and B are appropriate as both discharge and receiving water quality guidelines, and will not result (after reasonable mixing) in discharges that will not give rise to any of the following effects in receiving water:

(a) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:

(b) any conspicuous change in the colour or visual clarity:

(c) any emission of objectionable odour:

(d) the rendering of fresh water unsuitable for consumption by farm animals:

(e) any significant adverse effects on aquatic life.

33 In addition, I consider the establishment of receiving water attribute states for visual clarity and DRP (Condition 23.1 advice note), or the assumption of pristine water quality, prior to the start of mining operations as important, since it will provide sound basis for measurement of environmental performance for the said parameters.

34 I consider consent Condition 24, which relates to water monitoring at the stated key locations, is appropriate both in terms of the suite of parameters and sampling frequency.

35 Notably, I consider Condition 24.4, requiring annual hydrological and water quality reporting, will ensure an appropriate degree of review of ongoing environmental performance.

36 The proposed consent conditions are in accord with those for the mineral sands mine at SH6 Barrytown and another local West Coast sand mining dredge operation that I have been involved in, and I consider them also appropriate for the Southern Block Project.

Conclusion

37 The models I have constructed conservatively estimate the changes that will occur to groundwater quality, and subsequently the quality of surface waters, following the proposed mineral sand excavation and backfilling of slimes and tailings.

38 From my model outputs I conclude that the potential adverse effects of mining due to the discharge of mine water will be avoided both during the operations and upon completion. Critical to my assessment is the need for augmentation of mine water with lime.

39 The effects of the mine water discharge are appropriately managed by the proposed conditions of consent which include the establishment of receiving water attribute states for visual clarity and DRP, appropriate water quality monitoring for a broad suite of parameters, and annual hydrological and water quality reporting.

Michael George Fitzpatrick
Dated this 17 day of March 2026

References

Ecological Solutions Limited. 2026a. Barrytown Mineral Sand Mine: Stages 2 and 3 Ecological Effects Assessment. Report prepared for Tāiko Critical Minerals. March 2026.

Ecological Solutions Limited. 2026b. Lime augmentation trials. Letter report prepared for Tāiko Critical Minerals. March 2026.

Kōmanawa Solutions Limited. 2025. Barrytown South Mineral Sand Project - Hydrological Effects Assessment. Unpublished report prepared for TiGa Minerals and Metals Pty Ltd. Report No: Z24011BTS-Rev0. November 2024.