

Before the Fast-track Panel

Under: The Fast-track Approvals Act 2024
In the matter of: FTAA- 2605-1238 Barrytown Minerals Project

Statement of advice Dr Richard Storey
Stream ecology
Independent consultant
28 September 2026



Department of
Conservation
Te Papa Atawhai

**Te Kāwanatanga
o Aotearoa**
New Zealand Government

Introduction

1. My full name is Richard Goodwin Storey.

Instruction

2. I have been instructed to provide expert advice on behalf of the Department of Conservation (DOC) on the Barrytown Minerals Project – Fast-track application.

Qualification and Experience

3. I am an Associate Principal Freshwater Ecologist employed by Wildland Consultants Limited. I have a Bachelor of Science in Botany and Ecology from the University of Auckland (1991), a Master of Science with Distinction in Zoology from University of Auckland (1995) and Doctor of Philosophy in Zoology from University of Toronto (2001). I have 15 years' experience as a scientist in the Freshwater Ecology group of NIWA (the National Institute of Water and Atmospheric Research), three years' experience as a scientific researcher at the Aquatic Ecology Centre of Kathmandu University, and three years' experience as a Senior/Associate Principal Ecologist at Wildland Consultants. My role in this project to date has included review of freshwater aspects of the Ecological Effects Assessment (Appendix L4 of the substantive application documents) and associated documents.
4. I have a good understanding of the freshwater ecology in various parts of New Zealand, based on the following experience and roles:
 - a. I have been a member of the New Zealand Freshwater Sciences Society since 2004.
 - b. I have advised the EPA-appointed Expert Consenting Panel on freshwater matters for six fast-track applications, and have provided evidence on behalf of Department of Conservation for an additional six fast-track applications.
 - c. I have written Ecological Impact Assessments for numerous development projects, and I have written and implemented several Fish Management Plans.

Code of conduct

5. Although it is acknowledged this is not an Environment Court Proceeding, I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023. I have complied with the Code of Conduct in the preparation of this advice. Unless I state otherwise, this advice is within my area of expertise, and I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

Scope of advice and expert opinion

6. My expert advice will address the following matters:
 - i. Adequacy of the Applicant's assessment of freshwater (stream) ecology values, including identification of any values that have not been assessed or have been insufficiently characterised.

- ii. Adequacy of the Applicant's assessment of effects on stream ecosystems with specific reference to any effects that are incomplete, understated, or not addressed.
- iii. Adequacy of the Applicant's proposed effects management measures regarding streams.
- iv. Alternative mitigation or management approaches, where appropriate, including my recommended or preferred measures where these differ from those proposed by the Applicant.
- v. Comments on conditions that relate to management of streams.

Sources

7. In preparing this advice I have reviewed:

- i. Appendix L4 Barrytown South Mineral Sand Project Ecological Effects Assessment by Ecological Solutions (March 2026).
- ii. Appendix L4B - Statement of evidence of Richard Montgomerie in relation to freshwater ecology (27 March 2026).
- iii. Appendix M4 - Native Freshwater Fish Capture and Relocation Plan
- iv. Appendix M6 - Rehabilitation Management Plan
- v. Appendix M7 - Water Management, Monitoring and Effects Management Plan
- vi. Appendix L3 - Hydrological Assessment
- vii. Appendix P1 - Proposed Resource Consent Conditions – District and Regional Council

Discussion

Project summary

8. The Project is to extend mining operations on the Barrytown Flats into an area known as the 'Southern Block' (SB), which is located between Canoe Creek and Fagan Creek and extends over an area of approximately 408 ha. Mining will occur over 69 percent of this area (280 ha). The land within the SB is currently used for dairy farming and mostly comprises highly modified 'humped and hollowed' ground vegetated with pasture. Canoe Creek Scenic Reserve adjoins the northern boundary of the site but is not within the mining footprint. The site contains three main natural streams: Granite Creek, Little Granite Creek, and Clarke Creek, along with four smaller natural streams (Northern Creek, Central Creek, Wasabi Creek, and Southern Creek), and a number of artificial drains. A number of small springs also occur on the site, including one that provides the source water for Wasabi Creek. Granite Creek, Little Granite Creek, and Clarke Creek originate in the hills east of SH6 and flow through the site before discharging to the sea. All other

watercourses originate within the SB. Granite Creek and Little Granite Creek have been fenced to prevent livestock access but most of the other watercourses within the site are unfenced and have little to no riparian vegetation. The banks of the unfenced streams are typically unstable and subject to erosion and/or pugging. Many of the watercourses, including Granite Creek, have been modified and/or diverted to varying degrees and are characterised by straightened channels.

9. Mining will be undertaken using a floating dredge within a dredge pond. The dredge will proceed in a north-south direction, creating a mined “strip” approximately 100 metres wide and up to 10 metres deep. Mining will not occur within a 20-metre setback from Granite Creek and Fagan Creek.
10. Dredged material (sand and water) will be piped to a Wet Concentrator Plant (WCP), and unwanted material from the WCP (processed tailings sand and water) will be returned to fill the dredge pit behind the dredge. “Slimes” (small particles such as clay) will also be added to this area without passing through the WCP. Tailings and slimes will be mixed with hydrated lime to neutralise pH and stabilise soluble metals and nutrients.
11. Watercourses within the mining path will be temporarily diverted via constructed channels around areas being mined. Exceptions will be Granite Creek and Little Granite Creek, which will not be diverted. Fish management (salvage and relocation) will be implemented prior to and during the diversion of watercourses.
12. After an area has been mined, creeks will be reconstructed in accordance with the conditions of consent and the Rehabilitation Management Plan (RMP). Some artificial drains may also be reinstated if contouring does not provide sufficient drainage. Reconstructed channels will have a more meandering planform than the existing channels. The Ecological Effects Assessment (EEA) also recommends extensive riparian planting as part of rehabilitation.
13. The Project also involves taking water from Canoe Creek, which is a short distance north of the SB.

Ecological values that could be affected

14. Within the SB there is a total of 3.98 kilometres of perennial streams, 1.48 kilometres of intermittent streams, and 13.62 kilometres of artificial drains. Within the mining footprint there is a total of 2.88 kilometres of perennial streams, 1.40 kilometres of intermittent streams, and 11.17 kilometres of artificial drains.

Stream physical habitat

15. Most of the streams and artificial drains have a variety of aquatic habitats, including pools, riffles and runs, but some have more uniform channels including only run habitat.
16. Riparian habitat is generally poor and provides little shading.
17. Most streams and artificial watercourses have hard streambeds comprised mainly of gravels and cobbles (hard substrates are usually considered as good habitat for aquatic fauna). However, Clarke Creek, Central Creek, and one artificial

watercourse have a soft streambed comprised of sand and silt. This type of substrate typically supports lower diversity of aquatic fauna.

18. Excessive growths of aquatic plants, which can cause a reduction in aquatic habitat quality, were not recorded in any watercourse except Central Creek. Excessive growths of periphyton, which can reduce aquatic habitat quality, were not observed in any watercourse.
19. The EEA rated the ecological value of habitat and aquatic flora as **Low** for the artificial watercourses and some of the natural streams, and **Moderate** for four of the natural streams (Northern, Granite, Little Granite, and Wasabi).

Freshwater fish

20. Eleven species of indigenous fish were found in electric fishing surveys and/or eDNA samples in watercourses, including three Threatened - Nationally Vulnerable (īnanga/*Galaxias maculatus*, shortjaw kōkopu/*Galaxias postvectis*, lamprey/*Geotria australis*), four At Risk - Naturally Uncommon (kōaro/*Galaxias brevipinnis*, banded kōkopu/*Galaxias fasciatus*, bluegill bully/*Gobiomorphus hubbsi* and redbfin bully/*Gobiomorphus huttoni*), and two At Risk-Declining (longfin eel/*Anguilla dieffenbachii*, giant kōkopu/*Galaxias argenteus*). Records from the NZ Freshwater Fish Database (NZFFD) close to the Project area confirm that shortjaw kōkopu is present in Granite Creek and may be present in other watercourses in the Project area. NZFFD records also showed that brown mudfish (*Neochanna apoda*; At Risk - Declining) has been found not far from the Project area. This species was not found by sampling in the Project area but can be difficult to detect and may move between watercourses and connected wetlands. The number of fish species detected in each stream individually was between five and ten. Artificial drains had similar diversity of fish species to natural streams. No exotic fish species were found by sampling.
21. The EEA rated the ecological value of freshwater fish as **Moderate** for two of the artificial watercourses and **High** for one artificial watercourse and the natural streams.

Benthic macroinvertebrates

22. Macroinvertebrate communities in the natural streams reflected good to poor water quality and habitat quality. Macroinvertebrate Community Index (MCI) values were mostly around 80 or below (poor condition), though Wasabi Creek and Upper Granite Creek had MCI scores slightly higher than 100 (good condition) due to the presence of various pollution-sensitive insect taxa. Artificial watercourses had similar scores to natural streams in various macroinvertebrate metrics.
23. The EEA rated the ecological value of macroinvertebrates as **Low** for the artificial watercourses and the natural streams.

Concerns with assessment of values

24. The ratings for the ecological value of the stream habitat and macroinvertebrate fauna in the EEA are considered to be reasonable.
25. The ecological value of the freshwater fish fauna in streams and artificial drains is considered to have been underestimated in the EEA. Given the number of Threatened and At Risk species present in watercourses in the Project area, the ecological value of the fish fauna should be rated as **Very high**.
26. Although the EEA (Section 9.4.4) acknowledges that wetlands may contain fish, no fish surveys were conducted in wetlands. Therefore, the information regarding the freshwater fish fauna of the SB is incomplete.
27. The EEA mentions that “a number of small springs... are located throughout the site.” Springs can support an unusual macroinvertebrate fauna, including some spring-specialist invertebrate species (Scarsbrook et al. 2007). It appears that these springs are accessed by stock, so may have low ecological values. However, an assessment of the ecological values of springs is required.

Summary of potential effects

28. Potential adverse effects on natural streams and artificial drains within the SB include:
 - i. Discharge of toxic contaminants and/or nutrients to watercourses from groundwater due to disturbance, processing and re-depositing of subsurface mineral deposits by mining.
 - ii. Fine sediment run-off to waterways resulting from nearby earthworks.
 - iii. Temporary loss or disturbance of aquatic habitat in the SB watercourses prior to watercourses being re-established at their final location.
 - iv. Disturbance and/or mortality of native fish during in-stream works as part of site management during mining.
 - v. Impeded passage for indigenous fish resulting from site management during mining.
 - vi. The potential for reduced flows in Canoe Creek as a result of the proposed water take.
 - vii. The potential for altered flows in watercourses due to re-working of sand deposits in the mine area.
 - viii. Permanent loss of spring habitats
29. Potential positive effects on watercourses in the SB result from re-establishing the stream channels with more natural meandering flow paths, greater habitat diversity and greater riparian shade than they had prior to the Project. A total of 3.83 kilometres of stream will be diverted and replaced with 4.35 kilometres of reconstructed stream.

Concerns with assessment of effects

Water quality effects

30. The Hydrological Assessment states (on page 62) “The agitation, abrasion and circulation of sediments, including organic components [in the dredge pit], would change the water chemistry, including elevating dissolved concentrations in groundwater and down-gradient surface water.” Further, the Water Management, Monitoring and Effects Management Plan states (on page 11) “An increase in the discharge of... metals and phosphorus to surface waters could have an adverse impact on downstream aquatic life.” In the EEA the assessment of effects on water quality involves various assumptions and relies on groundwater quality modelling to determine the concentrations of contaminants in watercourses during and after mining. These assumptions and the modelling method and outputs require an independent review by a technical expert in geochemistry and groundwater quality modelling.
31. Tables 28 and 29 show the expected concentrations of various contaminants in SB watercourses in relation to guideline values. The guideline values in these tables come from a variety of sources, e.g. USEPA 1986, USEPA 2007, ANZECC 2000, ANZECC 2018. The reasons for using several different sources are not explained, but in some cases the choice of guideline makes a material difference to the outcome. For example, for iron, the guideline value (1.0 mg/L) comes from USEPA (1986) and the modelled values for iron concentration in SB watercourses comply with this guideline. But the default guideline value from ANZG (2026) (at the 95 percent species protection level) is 0.28 mg/L, with which modelled values do not comply. The Applicant should justify the use of older guideline values or reassess compliance using current guidelines.
32. One of the main concerns with iron oxyhydroxides entering surface waters is smothering of streambeds with “iron floc”, which can severely reduce habitat quality for aquatic fauna. The EEA states that “there will likely be some appearance of iron oxyhydroxides in surface waters but this should not result in smothering of surface water beds.” No evidence is provided that the amount of iron oxyhydroxide deposition on stream beds will remain below levels of concern. This evidence should be provided.
33. The EEA states that the water quality in watercourses is “assumed” to return to its pre-mining condition after a plume of affected groundwater passes through. Evidence to justify this assumption is required, for example, reference to scientific literature or to a comparable mining operation where relevant monitoring has been done. Further, the EEA states that the return to pre-mining water quality will occur in “the short to medium term” but provides no estimate to describe the meaning of “short to medium term” in quantitative terms. In order to appropriately assess the magnitude of effect, an estimate in terms of months or years is needed. It is noted that the mine will be operating for 14 years, so presumably the plume would be present for at least 14 years. According to the EIANZ guidelines (Roper-Lindsay et

- al. 2018) a long-term effect is 15 years or longer. Therefore, it appears likely that the effects of the mining on surface water quality should be assessed as long-term.
34. The EEA does provide an assessment of the magnitude of effect but assesses the level of effect of the mining on surface water quality as **Very low**. This assessment is based on the assumption that the treatment of tailings is effective in neutralising pH and reducing contaminant concentrations, and on the duration of the plume as short- to medium-term. Even if the treatment is effective, the level of effect should be at least **Low** based on the duration of the effect.

Water quantity effects

35. The Hydrological Assessment (page 2) states “Creeks and farm drains on the coastal plain are strongly connected to the underlying shallow groundwater system, which provides a degree of re-balancing of hydrological patterns surrounding the active dredge pond.” This indicates that when the water level in the dredge pond is below the surrounding water table, the water table will lower and water from the creeks and artificial drains on the SB will drain into the water table. This could have an adverse effect on the ecology of the creeks and artificial drains.
36. According to the Hydrological Assessment (page 2), “groundwater properties would not go through any significant changes following deposition of tailings to the mine void and land rehabilitation, so pre-existing groundwater flow patterns would re-establish in the wake of active sand mining.” The EEA and RMP also assume that after the mining and land rehabilitation, flow in the reconstructed streams will be equivalent to pre-mining. However, the Hydrological Assessment also notes that the deposits underneath the SB contain some alluvial fans with complex, unsorted geology and some clay deposits that alter groundwater flow rates and flow directions in places. Consistent with these observations, it is noted that there are springs present on the site (including a spring that provides the source water for Wasabi Creek), which indicates the presence of localised upwellings. Based on the method for returning mine tailings and separated fines into the dredge void, it seems likely that post-mining the deposits underneath the SB will be uniform and will not contain springs or other localised upwellings. Therefore, the conclusion that “pre-existing groundwater flow patterns would re-establish in the wake of active sand mining” is questioned. These aspects of the hydrological assessment require a review by a hydrologist. The results have implications for restoring flow in the creeks post-mining.
37. Given that “creeks and farm drains on the coastal plain are strongly connected to the underlying shallow groundwater system”, restoration of flow in the reconstructed stream channels must depend strongly on the elevation of the channels. According to Figures 5-8 in the RMP, the land surface topography post mining will be significantly different to pre-mining. Any land recontouring must ensure that the beds of creeks and drains intersect the groundwater table, otherwise these creeks and drains will not carry water.

Review of proposal to manage effects

38. The Project appears to have followed the effects management hierarchy in relation to stream extent and values. The largest creeks (Granite and Little Granite) have been avoided although they cross through the middle of the mining area. No minimisation of effects seems possible for the other creeks, which will be lost completely. However, the Project proposes to remedy the loss of extent and values of these creeks by reconstructing the channels after the dredge has passed through. The aim of increasing stream extent establishing meanders in reconstructed creeks appears achievable, noting the concerns raised in the previous section. The aim of improving stream ecological value by providing diverse in-stream habitat and planting riparian vegetation also seems achievable for streams originating in the hills behind the SB, (however noting the following concerns), but is less certain for streams originating on the SB.
39. For ecological values in the creeks and artificial watercourses to be restored, the flora and fauna of the original watercourses must recolonise the reconstructed watercourses. In creeks that originate in the hills behind the SB, fish and macroinvertebrates can recolonise relatively easily by swimming and passively drifting (respectively). In creeks that originate in the SB, there is no upstream source of fish and macroinvertebrates. Fish can recolonise by swimming upstream from the sea, but macroinvertebrates cannot. Ecological functioning cannot resume in a stream until macroinvertebrates are present. Macroinvertebrates are likely to recolonise slowly by various means such as (for those with winged adults) flying from nearby watercourses. However, recolonisation by these pathways may take many years. This time lag between the effect and remediation must be taken into account, for example by ensuring that the gain in ecological values is greater (or is done over a greater length of stream) than is being lost due to the mining. A standard compensation ratio often used in such situations is ensuring that enhancements at a restoration site represent a gain in ecological function 1.5 times greater than the loss of ecological function at the impact site (Storey et al. 2011). Demonstrating a quantitative gain in ecological function requires a system for quantifying stream ecological function. The main system in use in New Zealand is the Stream Ecological Valuation (Storey et al. 2011), which is appropriate for this context.
40. At present the EEA, RMP and Water Management, Monitoring and Effects Management Plan (WMMEMP) include no criteria and no standard for assessing the ecological condition or functioning of the restored streams. The EEA states in section 9.3.3.1 that “Post-mining reconstruction will focus on achieving no net loss in stream extent and enhancing freshwater values through improved channel alignment, riparian fencing and planting”, but does not provide measures by which to assess whether freshwater values have been enhanced. Consent condition 24.6 Water Monitoring requires monitoring of macroinvertebrates and fish, but the conditions (e.g. Condition 28) provide no performance standard. See comments on Condition 28 below.

41. The EEA states that riparian planting along rehabilitated watercourses will be five metres wide (on each bank) along Granite Creek and three metres wide along all other watercourses. Three metres is considered insufficient to provide the benefits to the stream ecosystems stated in the EEA. Further, three-metre-wide buffers will require regular maintenance as they will be continually invaded by pest plants. For the riparian buffers to be self-sustaining and provide the expected benefits to aquatic ecology, they should be at least ten metres wide (Parkyn et al. 2000).
42. The Native Freshwater Fish Capture and Relocation Plan (NFFCRP) is generally well-written and comprehensive. However, the proposed method for capture will occur before flow has been diverted. But according to the RMP, fish capture within the original channel will occur after flow has been diverted to the new channel. The method in the NFFCRP is much preferred as it results in less stress on fish. This discrepancy between the two plans should be resolved.
43. The WMMEMP specifies limits to the water take from Canoe Creek. As well as a limit to the instantaneous and daily rate of abstraction, I would expect to see a “cease take” threshold, i.e. a flow level in the creek which, if crossed, would trigger the Project to cease taking water from the creek in order to protect instream ecology.
44. With respect to water quality, the method for reducing concentrations of toxic contaminants and nutrients in groundwater is treatment of tailings and slimes by mixing with hydrated lime. It appears that this method has been tested at a laboratory scale but not a field scale, and therefore appears to be still somewhat experimental. As such, a review of this method by an expert in geochemistry is required to determine whether this treatment is likely to be effective in achieving the water quality targets.
45. The proposed water quality monitoring programme in the WMMEMP appears to be adequate in terms of the number of monitoring sites, frequency, and duration of sampling, and the collection of baseline (pre-impact) data.
46. The range of water quality parameters to be monitored, as specified in the WMMEMP is assumed to be sufficient. However, the range of parameters and the thresholds (Table 4) should be reviewed by a geochemist. The threshold for electrical conductivity (3500 mS/cm) seems extremely high.
47. In WMMEMP Table 7, the thresholds for most of the water quality parameters are based on annual medians and 95th percentiles. This means a year’s worth of data is required to determine if a threshold has been crossed. Thresholds should be reworded so that it can be determined within three months if a threshold has been crossed.
48. In WMMEMP Section 7.6.2 “Water quality threshold exceedance actions”, a toxicant management plan is only prepared after a threshold has been breached. Given that the treatment method for removing toxicants from tailings water appears to be somewhat experimental, this is considered insufficient to manage the risk of toxic contaminants from mine tailings affecting instream ecology. The WMMEMP

should describe remedial actions that could be implemented if thresholds are breached.

49. The proposed groundwater monitoring programme in the WMMEMP appears to be adequate.
50. The proposed flow monitoring in Canoe Creek in the WMMEMP appears to be appropriate, though a cease-take level is expected.
51. In WMMEMP Section 7.5.2 “Canoe Creek flow threshold actions”, the meaning of the sentence “the rate of flow augmentation will be increased...” is unclear.

Review of consent conditions

15 Native Freshwater Fish Management

52. 15.2 In the contents of the NFFCRP, reporting should specify “reporting of fish species and numbers caught, and species and numbers of fish killed.” In addition to the contents listed, the NFFCRP must also include:
 - a. a list of fish species potentially present in the waterways, with their threat status.
 - b. permits from MPI, DOC, and Fish and Game required for the capture and relocation of aquatic fauna.
 - c. biosecurity measures, i.e. measures to ensure that fish management does not result in the spread of pest plants or animals.

21 Erosion and Sediment Control Plan

53. 21.2 This condition should include trigger levels (thresholds) for turbidity in streams and drains, and actions required if turbidity exceeds the specified trigger levels.
54. 21.3 Requires inspection “on a regular basis and within 24 hours of each rainstorm event that is likely to impair the function or performance of the erosion and sediment controls.” For the avoidance of doubt, the size of rainfall event (in millimetres) should be specified, e.g. 25 millimetres in 24 hours as in 21.2 n.

22.0 Water Management Plan

55. 22.1 a. This condition should include all creeks crossing the SB, not only Granite Creek and Canoe Creek. For Canoe Creek it should also include a cease-take level, i.e. a river flow at which the water take must cease in order to reduce the risk of adverse effects on ecological values in Canoe Creek. See comments for Condition 29 below.
56. 22.1 b. The term “adverse effects on creek ecology or visual clarity” must be defined. The definition must include use of particular metrics, such as Macroinvertebrate Community Index (MCI) and ASPM (Average Score per Metric) for macroinvertebrates, and species richness or Fish Index of Biotic Integrity for fish. Trigger levels (thresholds) that define “adverse effect” for each metric and for water clarity must be specified. The monitoring locations and methods also need to

be specified. For locations and methods, reference to Condition 24.5 would be sufficient.

57. 22.1 c. As above, “potential adverse water quality” must be defined by identifying specific contaminants and ecological metrics, and specifying a trigger level for each. Reference to Tables A and B in Condition 23.1 would be sufficient, but noting concerns with Table A described below. The phrase “where possible, or minimised” should be removed. Meeting the specified guideline values in watercourses should be a condition of consent.
58. 22.1 d. It is not sufficient to restore the catchment areas of the natural watercourses, as changes to surface topography and subsurface hydrology may result in significant changes to water flows in the watercourses. This condition should require water flows (measured in litres per second) in all natural watercourses to be restored to not less than 10 percent below pre-mining flows.
59. 22.2 h. This condition requires the WMP to describe actions to be taken if water quality thresholds are exceeded, but does not specify these water quality thresholds or require the WMP to specify them. The water quality thresholds must be specified in the consent condition and in the WMP. In the consent conditions, reference to 23.1 Tables A and B is sufficient, but noting concerns with Table A described below.

23 Method of Discharge during mining activity

60. 23.1 Tables A and B provide thresholds for various contaminants.
 - a. The thresholds apply to concentrations in receiving waters (creek monitoring sites), which are relevant for ecological effects in the creeks. However, setting the condition in this way is impractical because the relationship between concentrations in mine discharge water and concentrations in the creek monitoring sites is not accurately known. Therefore, an additional condition is needed that specifies the threshold concentrations for contaminants in mine discharge water. Because the relationship between concentrations in discharge water and the creeks is uncertain, thresholds for the discharge water should be set conservatively. In addition, they should be accompanied by a note saying that they may need to be revised if they result in failure to meet the thresholds at the creek monitoring sites.
 - b. Some of the threshold values in Table A are significantly higher than ANZG (2026) default guideline values (at the 95 percent species protection level). Examples are aluminium (0.62 vs. 0.055 mg/L), copper (0.0039 vs. 0.00073 mg/L), iron (1 vs. 0.28 mg/L), nickel (0.011 vs. 0.0023 mg/L) and zinc (0.008 vs. 0.0041 mg/L). No justification has been provided for using higher threshold levels. Justification is required, or the ANZG (2026) default guideline values should be used.
 - c. The final column in Table A, and the footnotes, are not helpful. If the relevant guideline values vary with factors such as water hardness, pH, and dissolved

organic carbon level, the footnotes should state how to adjust the guideline values according to these factors, e.g. by referring to ANZG technical briefs.

24 Water monitoring

61. 24.6 a. This condition should specify that results will be reported using the fish and macroinvertebrate metrics in the National Policy Statement for Freshwater Management (NPS-FM) National Objectives Framework (Fish Index of Biotic Integrity, Macroinvertebrate Community Index and Average Score Per Metric) and interpreted in relation to the relevant NPS-FM attribute bands. The conditions should also specify that monitoring must begin with at least one year of baseline (pre-mining) data collection.
62. 24.6 b. This condition must specify that sampling sites must be located within a section of each stream that will be diverted during mining and restored after mining. It must also state that the sampling location must not be shifted between pre-mining (baseline) and post-mining (impact) monitoring.

28 Diversions

63. 28.2 a. This condition does not contain any performance measures for restoring stream ecology. It should include a condition that macroinvertebrate and fish metrics (as described in Condition 24.6) should return to the same attribute band as pre-mining. It should also include measures of stream ecological function such as the Stream Ecological Valuation (Storey et al. 2011). Further, a condition is required to ensure that new creeks convey approximately the same flow as the original creeks. In addition, to account for the time lag expected for macroinvertebrate recolonisation of watercourses that originate within the SB, it should be demonstrated that the ecological functioning of these watercourses post-mining is at least 50 percent greater than their ecological functioning pre-mining.
64. 28.2 a. ii. This condition states that new creeks must convey clean water. However, no definition of clean water is provided. Consent conditions must include trigger levels for concentrations of potential contaminants. Reference to Tables A and B in 23.1 would be sufficient (but note concerns with Table A).
65. 28.2 b. i. and ii. Require riparian planting to be five metres wide along Granite Creek and three metres wide along other reconstructed creeks. As explained above, the minimum width should be 10 metres. Also, attention should be given to the wording, ensuring that it is clear that these figures refer to the width of riparian buffers.
66. 28.2 b. iv. Requires the consent holder to maintain riparian planting for two years and to eradicate woody weed species. This is insufficient. The standard time for post-planting maintenance is five years, and maintenance should include all weed species (not only woody species). It must also include a performance standard; the recommended standard is 80 percent canopy cover. Conditions should state that if

80 percent cover has not been achieved after five years, maintenance should continue.

67. 28.3 a. This condition requires monitoring of riparian planting, fish, and macroinvertebrates in the new channels. Monitoring should also include the physical habitat features described in the RMP, including widths, depths and presence of pools, riffles, runs, and large wood. This condition should also clarify that monitoring requirements (and the conditions 28.2 b. and c.) apply to all natural streams that have been diverted and reconstructed.
68. 28.3 b. This condition requires that each reconstructed stream must achieve a “pre-works equivalent state of ecological health”, and defines this by reference to condition 24.5. However, condition 24.5 does not provide a definition of ecological health. A clear definition is required, either in this condition or in condition 24.5. An appropriate definition could include returning to the same attribute state as before works, with respect to macroinvertebrate and fish attributes described in the NPS-FM (i.e. MCI and ASPM for macroinvertebrates, and Fish IBI for fish).

29 Canoe Creek water take

69. 29.0 The Canoe Creek water take conditions do not include a “cease take” level, i.e. a flow at which the water take must cease. This is allowed under Policy 7.3.1 of the West Coast Regional Land and Water Plan, but only if the total allocation for the creek remains below 20 percent of 7-day mean annual low flow (MALF₇). In case other water takes increase the total allocation above 20 percent (now or in future), it is recommended to set a cease-take level at 75 percent of MALF₇, in accordance with Policy 7.3.2. This means that water abstraction from Canoe Creek should cease if flow in the river falls below 473 L/s.

Conclusions

70. The freshwater fish fauna includes a high number of threatened and at-risk species, therefore should be assessed as **Very high** ecological value.
71. Spring habitats have not been assessed for their ecological value, and have not been included in effects assessments.
72. The plume of poor-quality groundwater is expected to take more than 15 years to pass through the area, therefore should be regarded as a long-term effect.
73. One of the main potential impacts of the Project is its effect on water quality. Extracting, processing, and redepositing the mineral sands may result in mobilisation of various contaminants including heavy metals and nutrients into the watercourses, with impacts on aquatic fauna (fish and macroinvertebrates). The relevant assessments describe the potential contaminants, threshold concentrations for the contaminants, the treatment method to reduce discharge of the contaminants, and their expected concentrations in surface waters. Because of the importance of water quality effects, these aspects of the assessments require a

review by a specialist geochemist to determine whether the effects are likely to be as stated.

74. Another potential effect is change to subsurface water flow patterns, and hence, changes to flow in surface watercourses as a result of the mining. These aspects of the assessment require a review by a specialist hydrologist.
75. The methodology for diverting and restoring streams, and avoiding direct harm to indigenous fish appear adequate overall, though some minor additions to the Native Freshwater Fish Capture and Relocation Plan are recommended.
76. The proposed width of riparian buffers is insufficient to achieve the expected benefits to instream ecology and to resist invasion by weeds. The buffers should be ten metres wide. Conditions for maintaining the buffers also require some improvement.
77. The consent conditions for the water take on Canoe Creek should specify a cease-take level.
78. Consent conditions are lacking performance measures and remedial actions in a number of places. For example, conditions associated with erosion and sediment control should include threshold values for turbidity and remedial actions if they are breached. Conditions for restored watercourses should specify the metrics to be used for monitoring their ecological condition (specifically macroinvertebrates, fish, physical habitat, flow and riparian condition) and performance standards to be achieved.

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