

BULLER PLATEAUX CONTINUATION PROJECT

Independent peer-review of “Assessment of environmental effects: Aquatic Ecology”

Professor Emeritus Jon S Harding

6 May 2026

EXECUTIVE SUMMARY

- (a) I have reviewed the Earth Sciences NZ report on the “Assessment of environmental effects: Aquatic Ecology” by Drs Kristy Hogsden & Phillip Jellyman. In my opinion the report accurately describes the current ecology and effects of Acid Mine Drainage from long-term and current activities on waterways within the three catchments and related sub-areas, specifically, the Whareatea, Waimangaroa and Cascade on the Denniston Plateau. The ecology of waterways associated with the Stockton Plateau are covered in a separate Instream report also reviewed by me.
- (b) The ecological condition of 50 streams and river reaches have been identified. Some streams, primarily in the Upper Whareatea which are scheduled for mining are currently in good ecological health and have high biodiversity. Some of these will be destroyed by mining and it has been proposed they will be reinstituted elsewhere.
- (c) The ES NZ report assesses the current ecological status of waterways, based on water chemistry and on widely accepted key ecological values, including plant communities (bryophytes, periphyton), macroinvertebrates, kōura (freshwater crayfish), and fish.
- (d) All catchments have some streams/reaches that are currently moderately to severely impacted and are being treated or are planned to have remediation which should markedly improve their ecological condition.
- (e) The assessment of the effects of construction, operation, road construction and closure is detailed, and comprehensive. The report provides recommendations for mitigation, rehabilitation and compensation to minimize adverse effects and support ecological recovery. However, I have concerns about the challenges in the final section of the report which discusses measures to mitigate those effects. A number of these mitigation efforts depend on the success of tools and actions that (as far as I am aware) have not been rigorously tested at the scale seen in this operation.
- (f) The report briefly mentions Mahinga kai, however in my opinion more detail is needed. Currently I am not aware of any significant mahinga kai harvesting occurring in the study area due to the impacts of AMD on water quality. I would like to see discussion of what mahinga kai

species might be included, and which streams/waterways might be expected to support mahinga kai harvesting long-term.

INTRODUCTION

2. My full name is Jonathan Sutherland Harding. I am a Professor Emeritus at the University of Canterbury.
3. This peer-review addresses the “Assessment of environmental effects: Aquatic Ecology” by Drs Kristy Hogsden & Phillip at Earth Sciences NZ.

Qualifications and experience

4. I have the following qualifications and experience relevant to this assessment:
 - (a) DSc (Freshwater Ecology), University of Canterbury, 2018
 - (b) PhD (Freshwater Ecology), University of Canterbury, 1995
 - (c) MSc (hons, Zoology), University of Canterbury, 1991
 - (d) I am currently retired. From Dec 2000 - 2021 I was employed at University of Canterbury. Prior to that:
 - (i) I was an Aquatic Ecologist at the Cawthron Institute, NZ (1998-2000)
 - (ii) A Post-doctoral Fellow, then Fixed-term Assistant Professor at Virginia Polytechnic Institute & State University, USA (1995-1997)
 - (e) I specialise in freshwater ecology with expertise on the impacts of human activities on the ecology of freshwater ecosystems, particularly mining.
5. I have conducted Research and Consulting on the ecology of freshwater ecosystems impacted by Acid Mine Drainage on the Stockton & Denniston Plateaus for over 20 years. I have published one book, four book chapters and co-authored over 20 peer-reviewed scientific papers specifically on the effects of AMD and coal mining on the ecology of New Zealand streams and rivers. I have collaborated with six Post-doctoral researchers and supervised/co-supervised six PhD & Masters thesis students working on

AMD. My research group has conducted the majority of published research done in NZ on the impacts of AMD on the ecology of streams and rivers. We have conducted the only major research on AMD impacts on whole stream foodwebs, bacteria, algae (inc. developing two biotic indices), invertebrates (developed one biotic indices) and fish. I was the freshwater ecology lead in CMER (Centre of Minerals Environmental Research), the only mining focused science research consortium in NZ. I was a panel member on both Treasury Panels working on the Stockton Mine Closure. During my career I have published 121 peer-reviewed scientific papers.

Purpose and scope of review

6. The purpose of this document is to provide an independent review of and comment on:
 - (a) The report on the Earth Science NZ “Assessment of Environmental Effects: Aquatic Ecology” by Drs Kristy Hogsden & Phillip Jellyman

Assumptions and exclusions in this assessment

7. My review is based on the information provided by Mitchell Daysh and Earth Sciences NZ.
8. I am familiar with the statistical analysis used in this report, but I am not an expert on statistics.

THE BULLER PLATEAUX CONTINUATION PROJECT

9. The full description for the Project is provided in the AEE. I do not repeat it in my review.

METHODOLOGY

Introduction

10. My approach has been to review the primary report and any additional information that I have been given access to. I have visited and conducted freshwater ecological research in streams on the Denniston Plateau and surrounding catchments for over 20 years.
11. I read multiple drafts of Drs Hogsden & Jellyman's report and provided high level commentary and feedback, much of which has been incorporated into their report. I have also had several face-to-face meetings to discuss specific aspects with Dr Hogsden.

ASSESSMENT OF EXISTING AQUATIC ECOLOGICAL CONDITION OF SITES

12. The report draws on a significant amount of water quality and ecological data on 50 sites and streams collected over many years by Solid Energy (the previous mine operator), Bathurst Mining and numerous consultants, and provides a comprehensive summary of the freshwater ecology and ecological health of these systems.
13. I am satisfied that an appropriate and accurate approach to determine the current condition of the ecology of waterways in the Whareatea, Waimangaroa and Cascade Catchments has been conducted.
14. Macroinvertebrate diversity and communities have been compared using up to six metrics. Each metric provides a slightly different perspective. Two of the metrics (MCI and QMCI) used in the report, though widely used nationally, are not designed for use in acid mine drainage systems and can provide erroneous conclusions. I assume they have been retained because Local and Central Government widely use them.
15. The inclusion and emphasis on kōura is somewhat unusual, however they can be common and abundant on Denniston Plateau probably due to the lack of fish predators and they have the potential to be a source of mahinga kai for iwi.
16. The report includes a review of Bryophyte diversity and communities. Several potentially rare species have been identified; however, it is difficult to assess how significant this is, as in my experience bryophytes are not

commonly included in freshwater ecological surveys. There are no “ecological health” metrics for bryophytes.

ASSESSMENT EFFECTS OF CONSTRUCTION & OPERATIONAL MINING EFFECTS AND MANAGEMENT

17. The potential effects of construction and mining, and their residual effects have been presented as a Table (Table 5-2). This provides a comprehensive and fairly exhaustive attempt to identify all major issues. I have discussed this table and associated text multiple times with Dr Hogsden and am satisfied that this is an appropriate method to assess effects.
18. There is a comprehensive and detailed description of “Operational effects management”. The report states that a comprehensive mine water treatment system has been designed. Table 5-3 identifies potential effects, management and residual effects. The assumption is that this management (i.e., treatment and remediation) will provide the required results.
19. The challenge with the “Residual Effects” is that these are expert opinions. There is very little science to inform about likely effects. However, I believe the approach taken is appropriate given our current knowledge.
20. Similarly, I caution that a number of the “management” actions described here have not been rigorously tested at the scale of Denniston and Stockton Plateaus. In particular, the re-instatement of 20km of streams to compensate for the loss of high-quality waterways is ambitious. The report suggests an extensive list of remediation actions that will need to be undertaken to achieve healthy communities in these re-created waterways. If done properly these re-created waterways should develop relatively healthy ecological communities, however, attempts to “re-create” streams globally have shown that it is very unlikely they will return to the same level of biodiversity of the original streams.

ASSESSMENT MONITORING PLANS

21. Five different types of monitoring have been proposed. These seem appropriate and I am comfortable with the proposed ecological monitoring designed to track rehabilitation. I strongly support the use of Reference sites for these monitoring programs.

SUMMARY

22. This report is one of the most extensive and comprehensive documents on freshwater ecological health and possible large-scale remediation I have seen. The authors have attempted to cover a substantial range of issues, and I support the proposed approach .

Jonathan Harding

6 May 2026

BULLER PLATEAUX CONTINUATION PROJECT

Independent peer-review of “Aquatic Ecology Management Plan”

Professor Emeritus Jon S Harding

4 August 2026

EXECUTIVE SUMMARY

- (a) I have reviewed the Earth Sciences NZ “Aquatic Ecology Management Plan”. In my opinion the plan is a thorough and extensive review of all major issues. I have no significant concerns.
- (b) The Management Plan covers the objectives, risks, management, monitoring commitments, responsibilities and training to effectively manage the aquatic ecology in accordance with consent conditions. The Plan is based on information covered in the “Assessment of environmental effects: Aquatic Ecology” prepared by Earth Sciences NZ.
- (c) The Plan sits within a suite of management plans for the BPCP. I have not reviewed any of these other plans and cannot comment on gaps or inconsistencies with and between other plans.
- (d) The Plan only covers the aquatic ecology within and downstream of the Escarpment Extended, Mount Frederick South and Upper Waimangaroa Haul Roads Projects. Stockton and Cypress areas are covered in separate plans.
- (e) Management of actual and potential effects on the aquatic ecology focus on bryophytes, macroinvertebrates and fish as covered in detail in “Assessment of environmental effects: Aquatic Ecology” and include a comprehensive coverage of environmental effects and risks associated with all stages of mine development (e.g., construction, operations, road construction, and closure).
- (f) The Plan is comprehensive and I am satisfied that it covers a wide range of actual and potential issues based on the environmental effects and risks that have occurred and been identified over the last 30 years of mine development on the Buller Plateaux.

INTRODUCTION

- 2. My full name is Jonathan Sutherland Harding. I am a Professor Emeritus at the University of Canterbury.
- 3. This peer-review addresses the “Aquatic Ecology Management Plan” by Dr

Kristy Hogsden at Earth Sciences NZ.

Qualifications and experience

4. I have the following qualifications and experience relevant to this assessment:
 - (a) DSc (Freshwater Ecology), University of Canterbury, 2018
 - (b) PhD (Freshwater Ecology), University of Canterbury, 1995
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 - (f) I am retired.
5. I have conducted Research and Consulting on the ecology of freshwater ecosystems impacted by Acid Mine Drainage on the Stockton & Denniston Plateaus for over 20 years. I have published one book, four book chapters and co-authored over 20 peer-reviewed scientific papers specifically on the effects of AMD and coal mining on the ecology of New Zealand streams and rivers. I have collaborated with six Post-doctoral researchers and supervised/co-supervised six PhD & Masters thesis students working on AMD. My research group has conducted the majority of published research done in NZ on the impacts of AMD on the ecology of streams and rivers. We have conducted the only major research on AMD impacts on whole stream foodwebs, bacteria, algae (inc. developing two biotic indices), invertebrates (developed one biotic indices) and fish. I was the freshwater ecology lead in CMER (Centre of Minerals Environmental Research), the only mining focused science research consortium in NZ. I was a panel

member on both Treasury Panels working on the Stockton Mine Closure.
During my career I have published 121 peer-reviewed scientific papers.

Purpose and scope of review

6. The purpose of this document is to provide an independent review of and comment on:
 - (a) The Aquatic Ecology Management Plan prepared by Earth Science NZ.

Assumptions and exclusions in this assessment

7. My review is based on the information provided by Mitchell Daysh and Earth Sciences NZ.

PLAN DETAILS

8. Prior to receiving this final version, I read a draft of the Plan and provided commentary and feedback on a number of issues. All of those issues were minor and most have been incorporated into the final Plan.
9. The Plan includes significant sections on:
 - (a) Management measures – Table 4 lists likely potential effects in detail and includes text describing suggested management measures. The text here provides an important guide for actions that should to be considered during management.
 - (b) Monitoring – this section includes quite a bit of detail on sites, monitoring protocols and frequency. There are unknowns here, particularly in regard to the possible speed and extent of the recovery of waterways. As mine construction and operation progress some flexibility and adaption will probably be required.

SUMMARY

10. The plan covers a substantial range of issues and actions. Given that mine development may give rise to unforeseen issues there will be a need to remain flexible.
11. However, I am comfortable with the Aquatic Ecology Management Plan as presented.

Jonathan Harding

4 August 2026