Appendix 4: Lake ecosystems technical expert advice

Fast Track Approvals Act 2024 (FTAA) Technical Advice

Date	27 Feb 2026
To	Jeremy Ecker, Consent Planner
From	Tina Bayer, Environment Canterbury Senior Scientist Surface Water Ecology
Project advice provided for	RMA253705 - Meridian Energy Limited - Lake Pūkaki Hydrostorage and Dam Resilience Works
Documents referred to	Tonkin & Taylor Ltd Lake Pūkaki Fast-track Consent Substantive Application – Ecological Impact Assessment Meridian Energy Limited October 2025 NIWA (2011). Pūkaki Enhancement Project: assessment of effects on fish stocks and fisheries. Prepared for Meridian Energy Limited. Client report No. CHC2011-087. Aquatic Environmental Sciences (2012). Assessment of the impacts of lowering Lake Pūkaki below its consented level. Prepared for Meridian Energy Ltd. Statement of Evidence of Dr James Andrew Griffiths for Waitaki Power Scheme - Meridian Energy Limited, dated 28 May 2025 https://api.ecan.govt.nz/TrimPublicAPI/documents/download/5657974
Qualifications and Experience	MSc in Environmental Science and a PhD in Freshwater Ecology from University of Otago. With 9 years' experience.
Code of Conduct	I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. This technical report has been prepared in accordance with that Code. In particular, unless I state otherwise, the opinions I express are within my area of expertise, and I have not omitted to consider material facts that might alter or detract from the opinions that I express.

Executive summary/overview

1. A brief overview of this advice is provided in Table 1:

Table 1: outstanding areas of contention		
Outstanding area of contention	**Reason for significance**	**Solution**
Exposure of lakebed between 518m and 513m. Potential cumulative effects with already large lake level	Loss of habitat and lake littoral productivity. Minimum lake level between 1991-2023 was 519m, so	Control drawdown speeds to allow some acclimatisation A condition to ensure the 'worst-case' scenario (very low

variation and of repeated drawdowns.	drawdown to 513m is a large change (6m) to what aquatic communities are adapted to.	lake level Dec-April) cannot occur every year or set minimum number of days below 518m or 516m Consent is for a 3-year period. I caution against allowing drawdowns to 513m as long-term solution without the already consented/allowed under national energy alert/emergency triggers.
Exposure of lake-bed between 518m and 513m will affect benthic habitat and food source for fish.	Potential food source reduction for population of 'kōaro of significant scientific and conservation interest'.	Map affected habitat to assess if any / how much 'intact' littoral habitat is lost (as % of total 'intact' littoral habitat). Assess if and how much food sources for kōaro would be reduced.
Lack of clarity if assessments are against the 'worst case scenario'	Impacts may be larger than assessed	Provide assessments considering worst case scenario OR include conditions limiting extend and duration of levels below 518m to what was assessed.

Agreement with the applicant

2. I have not provided further discussion for where I agree with conclusions of the applicant.
3. While I agree with the applicant's conclusions regarding effects on water quality and aquatic ecology, I do wish to make the following comments:
    a. I generally agree with the applicant's description of the existing environment, which includes summary descriptions of the climate, hydrology, water quality and aquatic ecology Lake Pūkaki. I also agree that fish passage into the tributaries is unlikely to be impeded. However:
        i. Previous reports on fish in Lake Pukaki have mentioned an 'unusual population of exceptionally large, un-pigmented kōaro of significant scientific and conservation interest'[1]. NIWA (2011) also describes Lake Pukaki as one of the few lakes with 'good' kōaro populations with higher than usual catch

[1] NIWA (2011). Pūkaki Enhancement Project: assessment of effects on fish stocks and fisheries. Prepared for Meridian Energy Limited. Client report No. CHC2011-087.

rates. The ecological impact assessment[2] describes the fish values as of 'moderate value' but does not describe this rare kōaro population.

ii. I do not think the aquatic impacts are assessed in sufficient detail, and a more thorough assessment of effects on near-shore/shoreline and aquatic communities would be helpful. A more comprehensive assessment of effects of lake level range increase on lake aquatic ecology[3] was provided as part of the 2012 consent application to lower the lake level, but it was not referred to in the 2025 assessment. The 2011 and 2012 reports are listed in the 2015 assessment, but their content and conclusions not referred to. Therefore, I am unclear as to in how far this application relies of previous reports/assessments.

b. I agree that the lake ecosystem is already subject to the effects of large lake level variations, but this new minimum level will be a 5m increase in level range on top of the existing 14m. I note that between 1991 and 2023 Lake Pukaki was not drawn to below 519m[4] so this proposed change would signify a large change for the lake ecosystem. Dan Clark's advice points out that modelling shows greater variability in the mean storage than what was seen in the 2012-2024 period. And that storage and lake levels are predicted to be much lower between July and January than currently. There is a risk of cumulative effects of increases in operating range, as the larger the range, the less time and opportunity for littoral and shoreline communities to adjust. The larger the operating range, the lower the chances of benthic communities to (re)-establish and of ecosystem function to be maintained. I acknowledge that if the drawdown to 513m happens infrequently and for short periods of time as outlined in the application, then risks to aquatic life are reduced compared to longer, more frequent drawdowns.

Benefits of the project

4. I have not considered any benefits to lake ecosystems (my area of expertise) as none are evident to me. However, I acknowledge the benefits to dam infrastructure maintenance and the gained flexibility in renewable energy production.

Outstanding areas of contention and significance of these.

Discussions with applicant

5. The presentation by the applicant on 7th of Oct 2025 helped my general understanding of the proposal. In particular, it emphasized the short-term (3 year) nature of the proposal to lower the lake below 518m outside of the already consented situations. Beyond this I have had no expert discussions with the applicant, which would form part of my assessment.

[2] Tonkin & Taylor Ltd Lake Pūkaki Fast-track Consent Substantive Application – Ecological Impact Assessment Meridian Energy Limited October 2025

[3] Aquatic Environmental Sciences (2012). Assessment of the impacts of lowering Lake Pūkaki below its consented level. Prepared for Meridian Energy Ltd.

[4] Table 2 of the Statement of Evidence of Dr James Andrew Griffiths for Meridian Energy, dated 28 May 2025

Outstanding areas of contention

6. The assessment of ecological freshwater effects used model prediction of 'up to approximately 39 days between 2026 and 2028'[5] to assess impacts on littoral zones and fish communities. I note that the assessment provided is not an assessment of the impacts of the worst-case scenario. While there is an assessment against "lake levels drop for longer than the expected modelled period" but no information was given what that means in terms of how long and how low.
7. The 2025 Ecological Impact Assessment[6] report seems to suggest that an additional 5m of water level variability (on top of the consented 'normal' range of 14m) is not going to make a difference or reduce littoral habitat any further. "*The rate and / or magnitude of lake level variability will occur no matter the minimum operational level of the lake*". I disagree as the overall magnitude of lake level variation can increase under the eased access (in any year where the current exception for energy emergency is not triggered). This increase in lake level variation can make it more difficult for the aquatic ecosystem to adjust and maintain its function.
8. No detailed estimate of the size and 'habitat quality' of the littoral zone that may be temporarily exposed has been provided. The map provided as "Figure 1.2: Expected water level change at Lake Pūkaki, showing drawdown impacts on lake shoreline"[7] does not provide an indication of the area exposed along the southern, eastern and western shores of the lake. The 2012 report indicates that 'most of the eastern and western sides of Lake Pukaki are steep-sided'[8], thus limiting littoral habitat. But there may be small bays and areas on the southern end of the lake that are more gently sloped and thus likely to have larger areas exposed. A map with slope, area and predicted habitat quality would be helpful. In terms of littoral habitat quality, *"A higher value is attributed to areas where a stable, larger and more intact littoral zone can develop and is of lower value where a small littoral zone is present."*[9] This exposed habitat is important as it may contain food sources (e.g. benthic algae, aquatic insects, small fish) which cannot all readily migrate as water levels change.
9. Data presented by Meridian Energy[10] shows that minimum lake level in Lake Pukaki in the period 1-Jan-1991 to 31-Dec-2023 was 519m. It seems common practice not to draw the lake close to the minimum level: "*In practice the lake has never been managed below 518.2 masl and seldom goes below 520 masl*"[11]. Because the lake has not been drawn to below 519m for more than 20 years, aquatic communities will be adapted to lake levels above 519m. If the lake was drawn down to 513m that would represent a shift of possible habitat range by 6m. While effects on periphyton, macroinvertebrates and fish may be temporary, exposing large areas will likely result in (temporary) losses of ecosystem function particularly near the head of the lake (Tasman "delta"), especially if drawdown is fast. Most native fish are littoral (near shore) feeders and some of their food resources are likely to be lost, at least temporarily. Some of these food resources are unlikely to 'migrate' to deeper parts of the

[5] Tonkin & Taylor Ltd Lake Pūkaki Fast-track Consent Substantive Application – Ecological Impact Assessment Meridian Energy Limited October 2025

[6] Tonkin & Taylor Ltd Lake Pūkaki Fast-track Consent Substantive Application – Ecological Impact Assessment Meridian Energy Limited October 2025

[7] Tonkin & Taylor Ltd Lake Pūkaki Fast-track Consent Substantive Application – Ecological Impact Assessment Meridian Energy Limited October 2025

[8] Aquatic Environmental Sciences (2012). Assessment of the impacts of lowering Lake Pūkaki below its consented level. Prepared for Meridian Energy Ltd.

[9] As above

[10] Table 2 of the Statement of Evidence of Dr James Andrew Griffiths for Meridian Energy, dated 28 May 2025

[11] Aquatic Environmental Sciences (2012). Assessment of the impacts of lowering Lake Pūkaki below its consented level. Prepared for Meridian Energy Ltd.

lake, i.e. periphyton will take time to re-grow in deeper part of the lakes. The currently permitted range of lake level fluctuation is already likely to impact on benthic communities (e.g. no macrophyte establishment possible), and the larger the operating range, the less time and opportunity there is for littoral and shoreline communities to adjust. Impacts on benthic communities will also depend on ramping rates not exceeding ability of aquatic insects to migrate, as well as on duration and timing of low lake level. For instance, if low lake levels persist past October/November recolonisation and recruitment may be impaired[12]. In terms of draw down speeds "overseas research suggests that mobile littoral macroinvertebrates can keep pace with water level rises of 0.63 cm/hr but will get left behind at rates of 1.25 cm/hr (Winter 1964)."[13] Ramping rates for lowering of Lake Pukaki were predicted to be between 5 cm/d and 10 cm/d in the 2012 ecological assessment[14]. If that still holds under the eased storage scenario those rates should be sufficiently slow for mobile macroinvertebrates.

10. As outlined above, I do not think the importance of the lake as kōaro habitat has been sufficiently acknowledged. Lake Pukaki supports more kōaro than many other NZ lakes. Adult kōaro use the littoral (near-shore) habitat and this is where a large proportion of their prey can be found. Adult kōaro feed on bullies and insects. While adult kōaro were mostly observed below 4m depth, common bullies (one of the kōaros' food source) feed between 1-10m[15]. Therefore, dropping the lake level by several meters may temporarily impact the availability of food for the kōaro.

Significance of these matters

11. The proposal is likely to result in loss of additional benthic littoral (near-shore) habitat that may reduce lake ecosystem function. The extend and quality of this habitat has not been quantified/estimated in sufficient detail. The littoral is disproportionally important compared to the open water in deep, low nutrient lakes such as Lake Pukaki.
12. The lake is important as unique kōaro habitat. The food sources of their prey may be impacted by the lowering lake below its 'normal' range. Dropping the lake level by several meters may impact the temporary availability of food for kōaro. Effects will likely depend on timing, length, frequency and magnitude of drawdowns.

Solutions and/or Conditions sought

13. Table 2 provides a summary of solutions or conditions sought and reasons for these.

[12] Aquatic Environmental Sciences (2012). Assessment of the impacts of lowering Lake Pūkaki below its consented level. Prepared for Meridian Energy Ltd.

[13] James, M., Mark, A., & Single, M. (2002). Lake Manager's Handbook: Lake-level Management. Wellington: Ministry for the Environment.

[14] Aquatic Environmental Sciences (2012). Assessment of the impacts of lowering Lake Pūkaki below its consented level. Prepared for Meridian Energy Ltd.

[15] Aquatic Environmental Sciences (2012). Assessment of the impacts of lowering Lake Pūkaki below its consented level. Prepared for Meridian Energy Ltd.

Table 2: summary of solutions		
Issue	**Solution**	**Condition wording**
Exposure of lakebed between 518m and 513m. Loss of habitat and lake littoral productivity. Potential cumulative effects with already large lake level variation and of repeated drawdowns.	Expected duration at lower levels is likely to occur only for a few months and occur very rarely, and only over a period of three years.	Consent duration of 3 year with no option to extend. To prevent 'worst case scenario' to become a common occurrence, something along the line of: *Lake levels below 518m can only occur 39days in any 24months period.*
Exposure of lake-bed between 518m and 513m will affect benthic habitat and food source for fish. Potential food source reduction for population of 'kōaro of significant scientific and conservation interest'	Map affected habitat to assess if any / how much 'intact' littoral habitat is lost (as % of total 'intact' littoral habitat). Assess if and how much food sources for kōaro would be reduced. A monitoring and reporting system on littoral communities and/or fish populations could be proposed, esp. for kōaro Control drawdown speeds to allow some acclimatisation: ramping rates not exceeding ability of aquatic insects to migrate	Lake drawdown rates below 518m should not exceed.