MEMORANDUM

To	Fast-track Substantive Application - Technical Discipline Leads
CC	
From	Meridian Energy Limited
Date	22 September 2025
Subject	**Lake Pūkaki hydro storage management: 2026 – 2029**

1 Introduction

Meridian is seeking approval under the Fast-track Approval Act to temporarily remove restrictions on Lake Pūkaki contingent storage, allowing it to operate between 518 above mean sea level (m RL) and 513 m RL over the next three years (2026, 2027 and 2028), without Security of Supply Alert (SSA) or Official Conservation Campaign (OCC) triggers.

Meridian has undertaken modelling to inform operational decisions regarding the management of water stored in Lake Pūkaki, comparing the current restricted operating regime to the proposed regime with the SSA and OCC triggers removed. The modelling will be used to help inform the legal and planning advice and provide a basis for the technical assessments to consider the material changes that have occurred in the Lake Pūkaki catchment since 2012 when Plan Change 1 (PC1) came into effect.

In addition, the modelling looked at market outcomes, comparing eased and restricted access to discretionary storage.

Merdian's modelling approach and modelled outcomes are detailed below.

2 Background

The Waitaki Power Scheme (WPS) is a key component of the NZ power system. The power system today is highly renewable at around 85-90%, with hydro energy making up around 60% (25TWh) of total energy. Of this, the WPS generates around 8TWh per year, but with significant volatility in the scale and timing of the arrival of inflows into the catchment.

Lake Pūkaki is managed by Meridian as part of the WPS and is the largest hydro storage lake in New Zealand. The lake holds contingent storage between lake levels 518 m RL and 513 m RL which equates to approximately 545 GWh of realisable energy.

The New Zealand power system is becoming increasingly renewable reflecting economic trends as well as efforts to decarbonize the wider economy. Combined with this, we are seeing increased decommissioning of thermal plant and challenges in managing thermal fuel supplies that have traditionally been used for short and longer-term flexibility, particularly in response to extended periods of low inflows into hydro lakes.

The ability to access Lake Pūkaki contingent storage either, as per the current situation, or with less strict access to the lower ranges of the lake, as Meridian are advocating for, will have significant beneficial impacts on the ease and cost of managing the entire New Zealand electricity system over the next few years. This holds true until more generation is built and likely beyond that.

The increase of intermittent sources of new generation and the retirement of older, conventional thermal generation, along with on-going challenges in managing up-stream thermal fuel supplies, will have significant implications for outcomes in the future power system and in particular, for how the Waitaki power scheme is managed.

3 Future power system forecast assumptions

Meridian maintains a range of views of how the future power system might evolve over time.

These scenarios focus on the economically efficient delivery of power services to meet the future needs of consumers, given various constraints on what is possible or desirable.

In evolving from today's power system, the key drivers of how the future might occur include:

- demand growth and plant retirement,
- costs and technologies available to meet future energy and flexibility needs,
- physical impacts of climate change,
- local and global policy response to climate change,
- new, consumer-led technologies.

In the long-run we concentrate on scenarios that allow us to explore various issues in the market, the power system, the economy, and the climate between today and 2050.

For this work we focus only on the next few years when there is limited opportunity to affect investment decisions largely already made.

Over 2026-29 we expect significant investment in new generation while demand growth will remain modest, and plant retirement likely. This will remain true regardless of the nature of storage access over the next few years. In the long-term, we would also expect to see changes in investment in the market as result of storage availability, but this is not examined here.

4 Modelling overview

The modelling was based on 91 years of catchment hydrological and meteorological data, using the current understanding of the New Zealand energy system (supply and demand analysis) and applying this to the forecast period between January 2026 and 2029 (the period of interest for the Fast-track application).

The two scenarios presented below are:

1. Restricted access to Lake Pūkaki storage below 518.0 m RL (status-quo)
2. Eased access to Lake Pūkaki storage below 518.0 m RL (the outcome sought in Meridian's application).

All power system assumptions are the same in these two scenarios except for the assumed attitude of operators to low storage levels. The restricted scenario reflects a risk-adverse attitude to using low lakes, in case external enabling rules do not line up with their own forecasts, and the eased scenario prudently uses the full lake range within the limits that engineering allows. The price of water is the only lever we have available and is used to achieve these behavioural changes in lake management.

Meridian commissioned a peer review of the modelling, which has now been completed by Sapere Research Group (attached to this memo).

Sapere finds that while there may be factors not fully captured by the modelling, a benefit from enabling access to contingent storage can still be relied upon. They also state that:

"Conceptually the modelling of the two scenarios makes sense. The general conclusion is also logical from a mathematical modelling point of view: easing the constraint results in a more optimised/lower cost solution."

The modelling outcomes are summarised below.

5 Pūkaki contingent storage 2026-2029 - Restricted access (status-quo)

Figure 1 below shows modelled weekly outcomes ordered from highest to lowest, compared to history. Figure 2 shows modelled weekly outcomes arranged seasonally, showing the distribution of outcomes from the minimum through to the maximum observed across the year, and compared to recent historical seasonal average.

The continuation of restricted access to contingent storage means that there are few instances when contingent storage is used. This reflects the risk-adverse attitudes of operators who are required to assume that contingent storage would not necessarily become available and therefore plan on the basis that the lake level would potentially have to remain at or above 518 m RL.

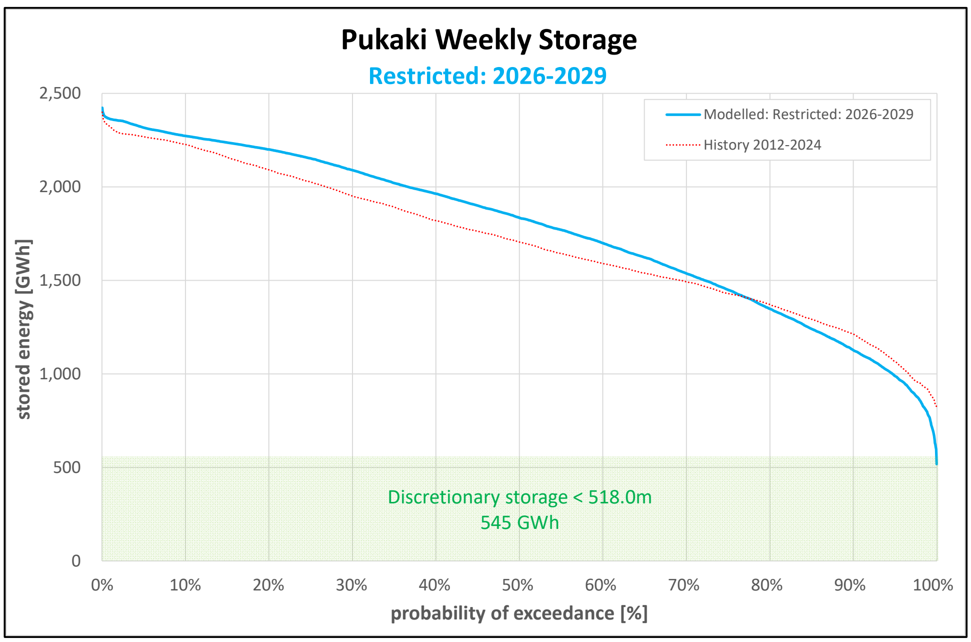

Figure 1: Pūkaki Weely Storage - Restricted access 2026 - 2029

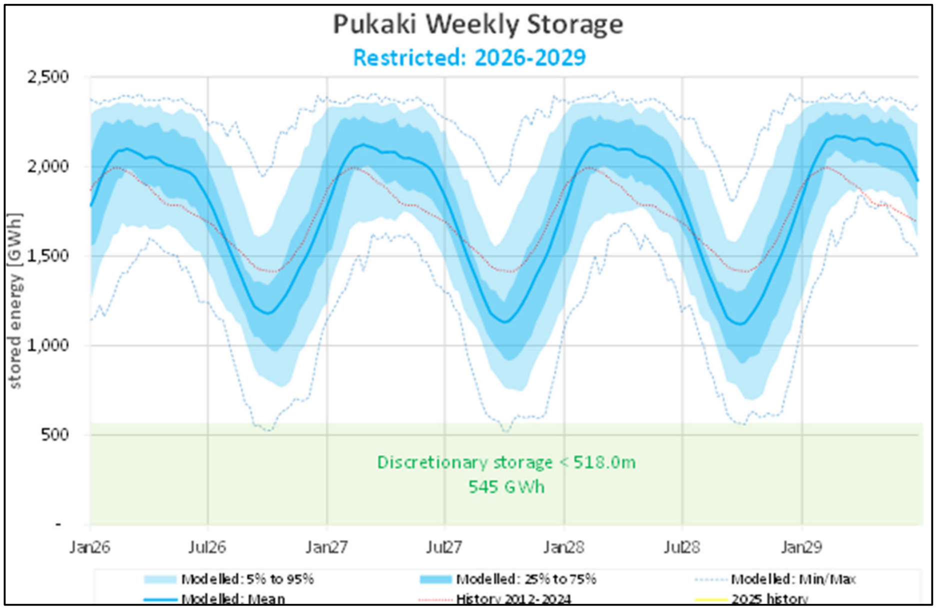

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Figure 2 Pūkaki Weekly Storage – Restricted access 2026-2029

6 Pūkaki contingent storage 2026-2029 - Eased access

Figure 3 below illustrates the modelled weekly outcomes ordered from highest to lowest, compared to history. Figure 4 is the modelled weekly outcomes arranged seasonally, showing the distribution of outcomes from the minimum through to the maximum observed across the year, and compared to recent historical seasonal average.

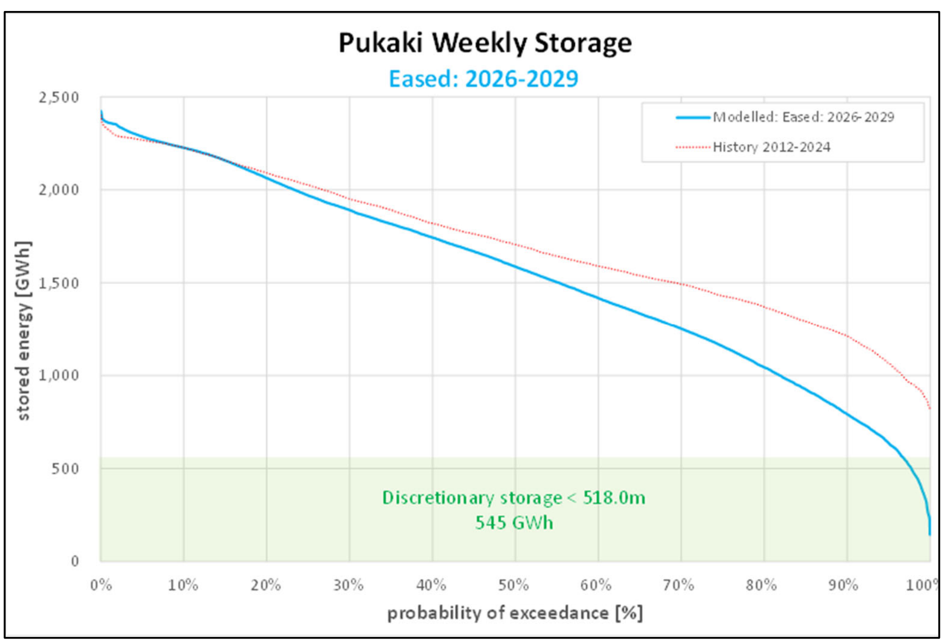

Figure 3: Pukaki Weekly Storage – Eased access 2026-2029

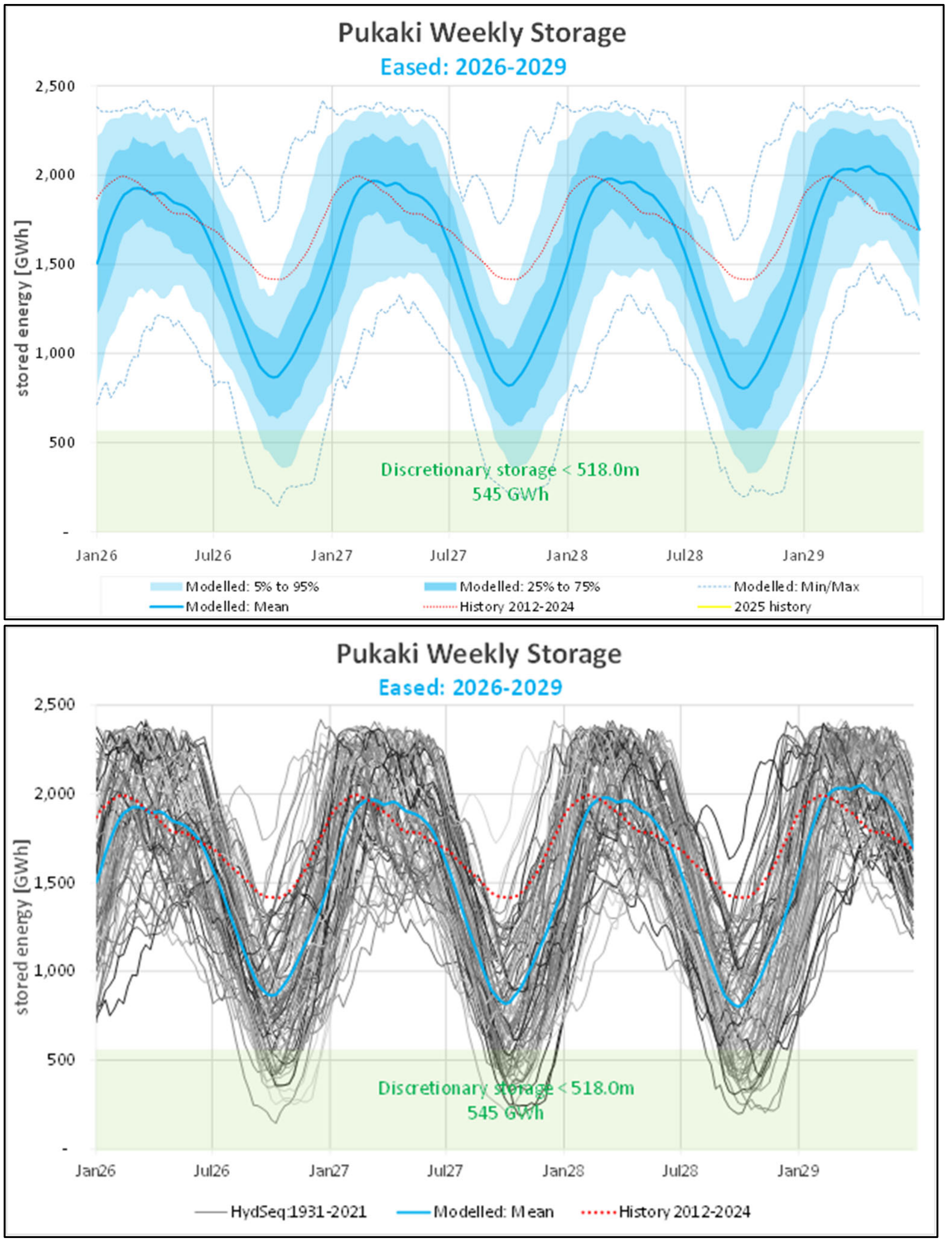

Figure 4: Pūkaki Weekly Storage – Eased access 2026-2029

Key outcomes from the modelling are:

- Under eased operation, typical lake levels are held lower (but still in the permitted normal operating range), but still only falling below the current normal operational minimum (518 m RL) on occasion, following periods of prolonged drought.

- Across all the 91 hydrological sequences modelled, the model predicted that in the first year of eased operation, there is approximately 3% probability that the lake level in any given week will be below 518 m. Therefore, on average the lake level will be below 518 m RL for approximately 1.5 weeks in the first year of eased operation.

- In a worst-case scenario, the lake level falls below 518 m RL in early September and does not return above 518 m RL until December. However, the likelihood of this scenario is extremely low – approximately 1% (1 of the 91 hydrological sequences modelled).

- In the first year of eased operation, 23% of the historical modelled hydrological sequences dip below 518 m RL. However, most of these instances are short duration and not deep. Of the 91 hydrological sequences modelled, the lake level for 21 sequences falls below 518.0 m RL and of these 21 sequences:
  - 9 sequences (10%) fall between 518 – 517 m
  - 6 sequences (7%) fall between 517 m – 516.5 m
  - 3 sequences (3%) fall between 516.5 m – 516 m
  - 2 sequences (2%) fall between 516 m - 515 m
  - 1 sequence (1%) falls below 515 m

- In subsequent years of eased operation, even allowing for those sequences when lake levels are low due to drought in the first year, the same general pattern of lake level distribution is repeated, with most dips below 518 m RL being short in duration and not deep:
  - The metrics for following years are influenced by what happens in the preceding year and by the level of supply and demand in the power system, for instance: as demand grows, as power plant are retired, or as new power projects begin operation.
  - As can be seen from the storage charts, a little more demand is placed on the use of storage below 518 m RL in subsequent years, reflecting a power system under stress, growing from a 3% probability of being below 518 m RL in the first year (2026) to 3.5% in year two (2027), and then 4% in the third year (2028).

7 Market outcomes compared: 2026-2029

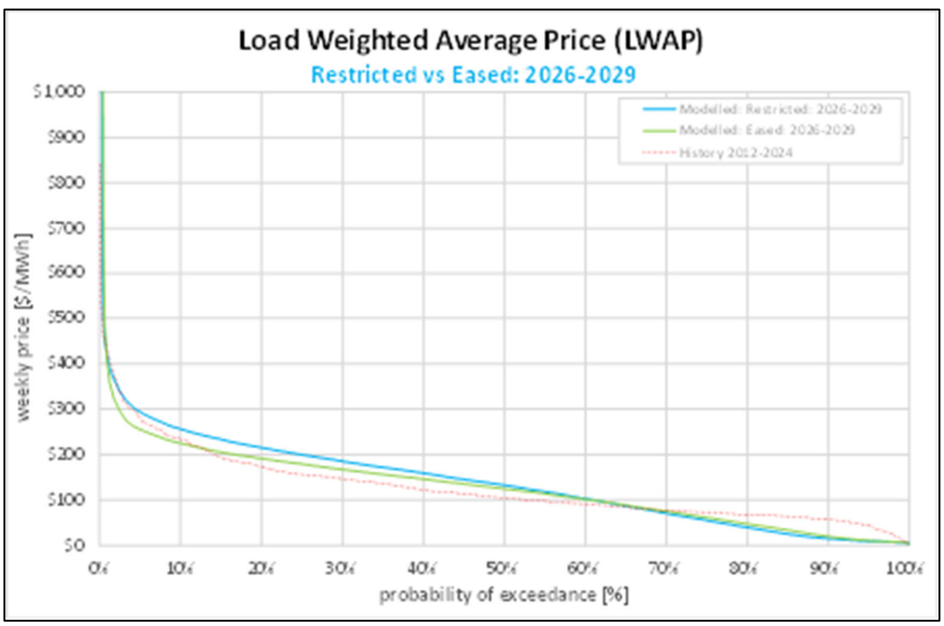

Figure 5: Loaded Weighted Average Price Restricted Vs. Eased: 2026-2029

		Annualised History 2012-24 mean	Restricted vs Eased Lake Access Sustained results 2026-2029; annualised Restricted p50	Eased p50	Restricted->Eased delta	%
LWAP	$/MWh	$ 127	$ 142	$ 132	-$ 10	-7%
Hydro	GWh	24,593	24,296	24,555	259	1%
Thermal	GWh	6,208	2,166	1,865	-301	-14%
Non-Hydro RE	GWh		16,649	16,749	100	1%
Hydro spill	GWh		1,509	1,162	-346	-23%
Dem Resp	GWh		267	111	-157	-59%
VoLL	GWh		-	-	0	-
CO2 Emissions	kT	4,500	2,226	2,029	-196	-9%
Load Cost	$M	$ 5,567	$ 6,372	$ 5,935	-$ 437	-7%

Figure 6: Sustained Results 2026-2029 Restricted vs. Eased Lake Access

Comparing eased and restricted access to discretionary storage, we see differences across a range of market outcomes, both physical and pricing. This reflects risk adverse attitudes of operators who avoid low lakes in case external enabling rules do not line up with their own forecast expectations. For example, in Figure 5, forecast weekly LWAP is shown for the next 3½ years, repeating all historical hydrologies seen over 1931-2022, ordered from highest to lowest

Comparing typical (P50) results (Figure 6), we see:

- Hydro spill, renewable spill, thermal generation, CO2, LWAP, price volatility, demand response, and load costs are all higher if access is restricted.
- Sustained prices over 3.5 years are 7% ($10/MWh) higher because of restricted access.
- Sustained load costs over 3.5 years are $437m pa higher with restricted access.

On this basis, the current contingent storage restrictions can be seen as having a significant adverse impact on New Zealand electricity consumers. In the context of continued tight market conditions and other upwards pressures on electricity prices, enabling access to contingent storage is a simple step that can be taken now to support better consumer outcomes.

8 Summary

Eased access to Pūkaki contingent storage has physical benefits that reflect a larger operational lake able to absorb more inflow variation and power system and market uncertainty.

Meridian expects to see Lake Pūkaki held lower if access is eased, but with excursions below 518 m RL still not a common event.

Lower lake levels mean an increased ability to capture high rainfall events that avoid wasteful spill i.e. energy that must otherwise be made up for elsewhere.

Low river flow management is unlikely to change, reflecting unchanged management of consents on the lower Waitaki river.

Eased access to Lake Pūkaki contingent storage has benefits for New Zealand that help partially offset the diminishing capabilities of thermal generation. Failure to allow the WPS scheme to fully contribute what the engineering allows will impose significant cost for electricity users.