12 May 2025

File Ref: OIAPR-1274023063-38917

[redacted]
By email: [redacted]

Tēnā koe [redacted]

## Request for information 2025-135

I refer to your request for information dated 23 April which was received by Greater Wellington Regional Council (Greater Wellington) on 23 April. You have requested the following:

- *I really would like to see a schematic of how this proposed facility **(the Pakuratahi Lakes)** is laid out and how it connects to existing pipes. I suspect that the outlet from the proposed lakes would have to cross the fault, possibly in a tunnel, which would be a challenging repair project after fault rupture.*
- *When Greater Wellington submitted this project to the Government's Infrastructure Priorities Programme there must have been some documentation and details supporting the submission. I would like to have a copy of **the executive summary** of this submission.*

### Greater Wellington's response follows:

Officers contacted you on 28 April 2025 to discuss the scope of your request. You agreed to refine your request to the executive summary of the submission.

In response, the information submitted as part of the Infrastructure Pipeline Priorities (IPP) application was in accordance with Te Waihanga - NZ Infrastructure Commission's requirements. Under the format requirements, there was no single executive summary supplied. However, the submission included various reports that included maps and schematics, along with content regarding the fault and seismic risks. A summary of these is supplied:

**Maps**

1. Overview for the IPP application

Additional schematic maps are included also in the material below.

**Fault and seismic risks**

**Source: Report 1** – *"Water Source Options Assessment for Welington Metropolitan Supply Options Assessment Report - Phase 1-4"* (Connect Water, 2023) provided a summary of the longlist options considered. Section 8.9 discussed the proposed Pakuratahi Water Storage Lakes.

Refer attachment Report 1 Schematic (p. 58).

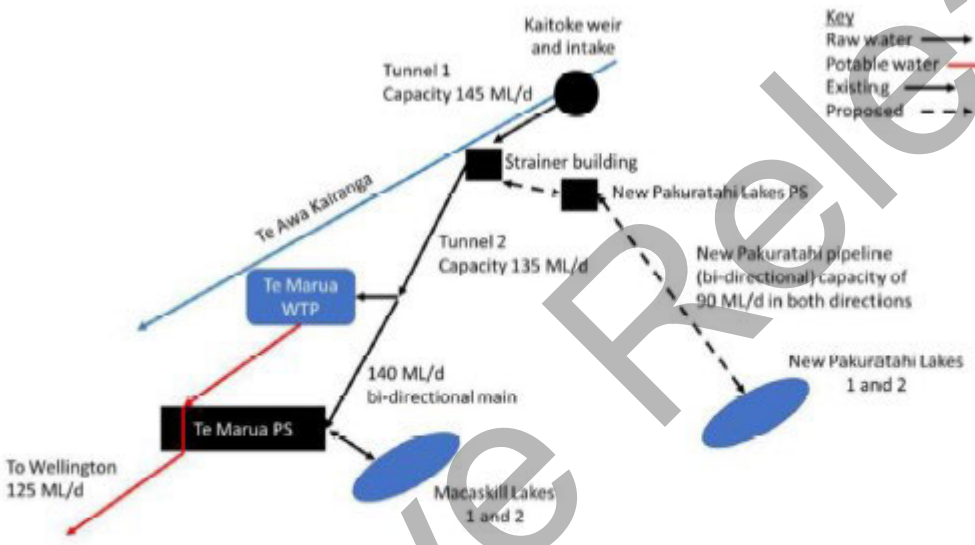



**Figure 8-11**. Schematic showing the Te Marua raw water network with Pakuratahi Lakes / Kaitoke Lake 3

The best route to move the water from the river, to lakes, to treatment plant is undecided. One idea is proposed on **Figure 8-11** above, but the other that should be considered further is a potential tunnel connecting the Pakuratahi Lakes and the Te Marua WTP directly.

The risks and uncertainties discussed (p. 60) included the following:

The optimum route for conveying e raw water from the river to the storage lakes and then to Te Marua WTP should be investigated further. There are several risks associated with the two main options (bi-directional pipeline or tunnel):

- The pipeline route from the lakes to the existing pipeline near Kaitoke weir will cross the Wellington Fault line and is likely to be disrupted during a seismic event. This should be investigated further to understand the impact of this and timeframe to fix in the event of an earthquake.
- There are several risks associated with the potential tunnel including construction of a tunnel that crosses splinters of the Wellington Fault and potential debris blocking the tunnel during a large flood.

**Source: Report 2** – *"Water Source Options Assessment for Wellington Metropolitan Supply - Options Assessment Report Phase 5A"* (Connect Water, 2023) provided a summary of the shortlist options considered. Section 9 discussed the proposed Pakuratahi Water Storage Lakes combined with the additional Lake 3. The Wellington Fault is mentioned as part of the review of Hazards (Sect. 9.2).

## 9.2 Hazards

The proposed Pakuratahi storage lakes lie within a flat valley and are separated by a tributary stream leading to the Pakuratahi River. As the reservoirs are located within a flat valley, they are less susceptible to the impacts of earthquake and storm induced landslides. However, there are steep valleys near the waterways that lead to the northern site. These valleys are susceptible to moderate-high impacts from slope failure, which could impact any pipelines leading to the reservoirs and debris flows into the Pakuratahi Lake 2 reservoir (**Figure 9-7**).

The land proposed for Kaitoke Lake 3 is located on a raised area of land between the Kaitoke Stream and a tributary.

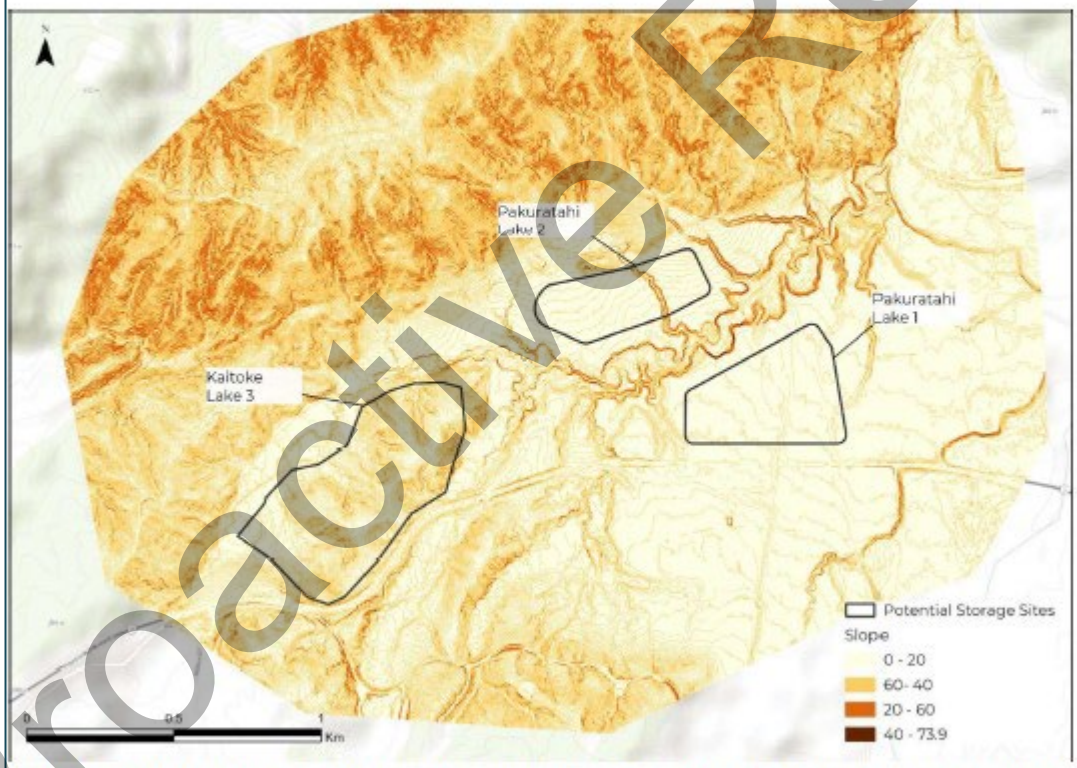



**Figure 9-7**. Pakuratahi Lake Reservoir and Kaitoke Lake 3 overlaid on a slope map produced from a digital elevation model

The Pakuratahi Lake 2 proposed reservoir is straddling the Wellington Fault, which is considered to have two strands in this area (GNS Science, 2022). The Wellington Fault has a recurrence interval of 600 to 900 years and a single displacement in the order of 5m (URS, 2011). Given the presence of alluvium, the fault rupture could be experienced over a wider area with distributed ground damage. Therefore,

Pakuratahi Lake 2 could experience severe damage and loss of functionality in a Wellington Fault rupture earthquake event, which is assessed to a have recurrence interval of just 800 to 1,100 years.

Pakuratahi Lake 1 and Kaitoke Lake 3 are not likely to be affected by primary fault rupture, but sympathetic distributed fault rupture cannot be ruled out. The reservoirs will be subject to strong near fault ground shaking (**Figure** 9-8).

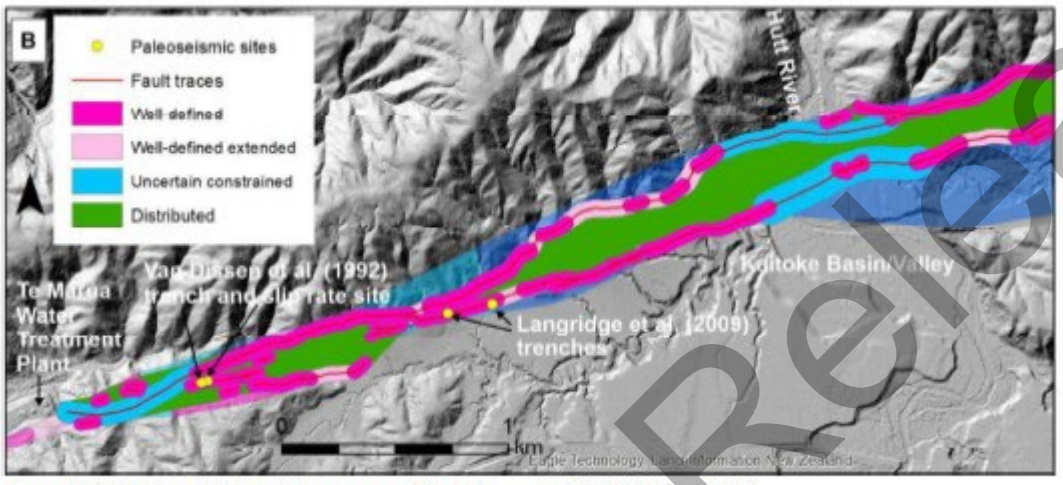



**Figure 9-8.** Faults and fault avoidance zones (van Dissen et al 2005 & GNS 2022)

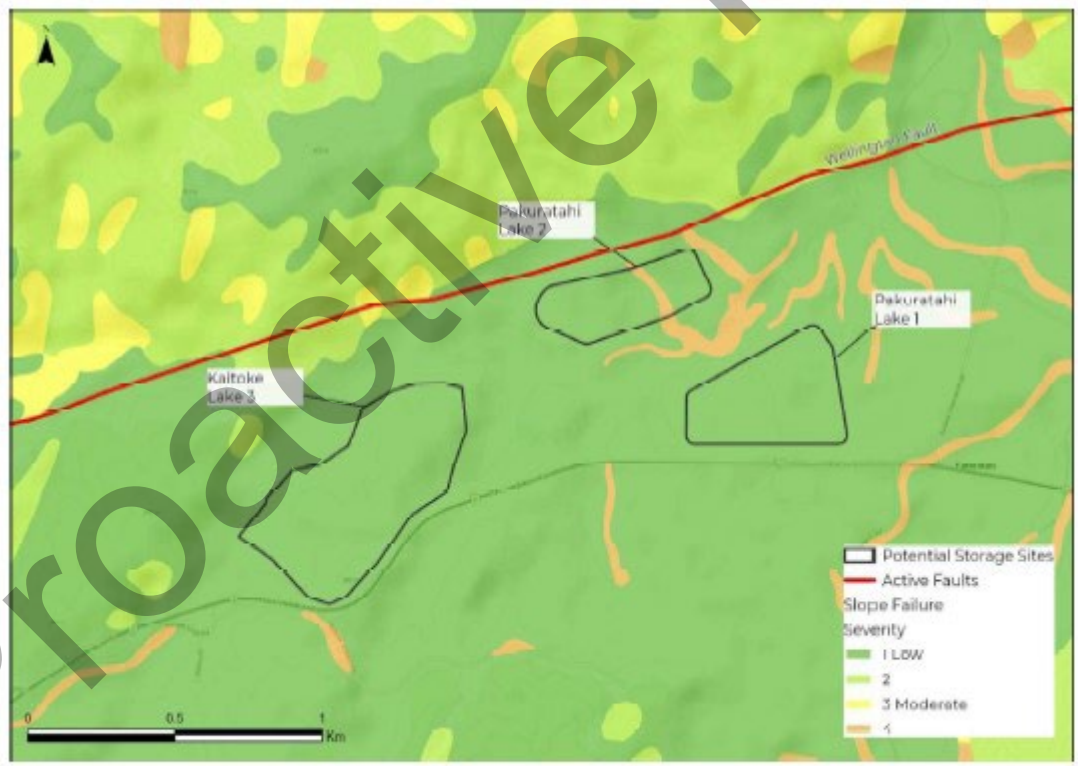



**Figure 9-9.** Kaitoke Lake 3 and Pakuratahi Lakes overlaid on slope failure and active faults

The pipelines may still be crossed by the Wellington Fault and associated splinter faults and may affect the resilience of water supply (**Figure** 9-9). The inlet/outlet pipeline or tunnel route proposed in the (URS, 2011) and (MWH, 2014) reports could be subject to ground rupture displacements in the order of 5m horizontal and 1m vertical during a Wellington Fault event, as well as high levels of seismic shaking. The

pipeline could additionally be subject to ground rupture from faults currently mapped as 'not active' depending on its alignment and the response of the faults toa Wellington Fault event.

The fine-grained alluvium sediments and cohesive fines are not expected to have a significant liquefaction hazard at the Pakuratahi reservoirs, but this needs to be considered. The north-west section of Kaitoke Lake 3 may be susceptible to low levels of liquefaction (**Figure 9-10**).

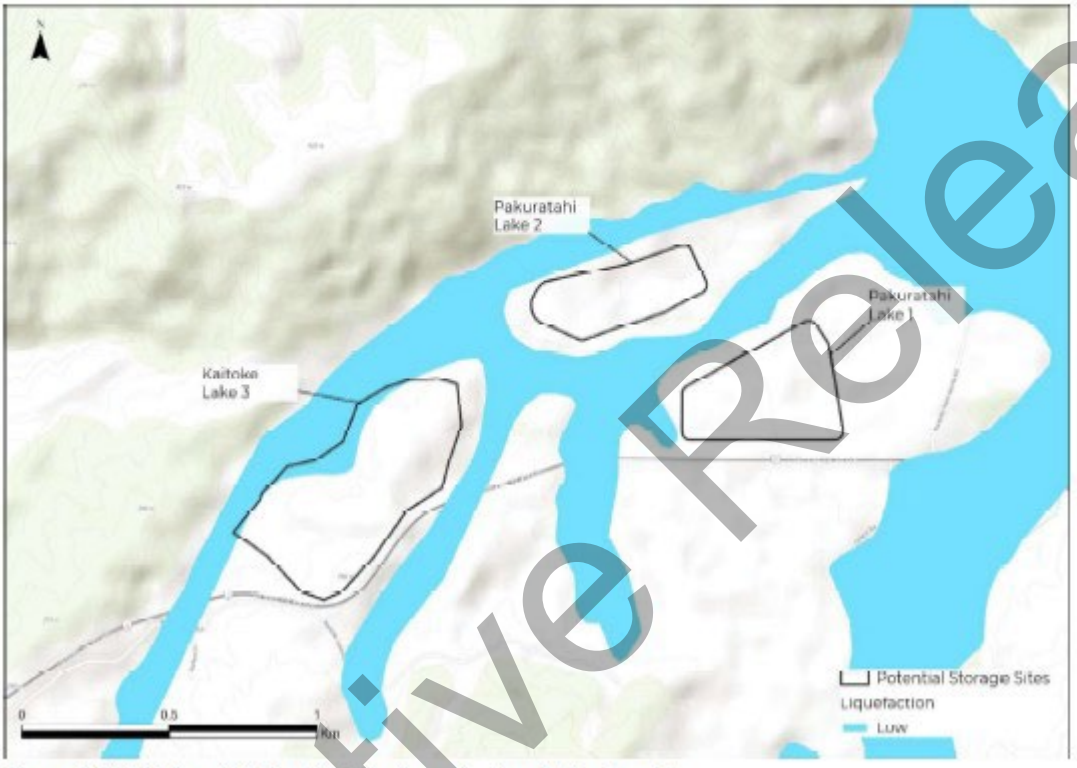



**Figure 9-10.** Kaitoke and Pakuratahi Lake Reservoirs liquefaction hazard.

**Source: Report 3** – *"Water Source Options Assessment for Wellington Metropolitan Supply - Shortlisted Options Assessment and Dynamic Adaptive Pathways Planning Report"* (Connect Water, 2023). Section 6 discussed the Pakuratahi Water Storage options, of which Lakes 1 and 2 are in Stage One. The seismic risk assessment included the following:

> The site is in close proximity to the active Wellington fault. The toe of Pākuratahi Lake 2 is located approximately 50 m from the fault trace, and the toe of Pākuratahi Lake 1 approximately 450 m away. The site would likely experience strong shaking and could be at risk of a dam breach. However, design and construction of the storage and dam wall in accordance with seismic design codes should help to mitigate this risk.

Source: p.105

**Source: Report 4** – *"Te Marua Scheme Expansion – Pre-Concept Report"* (Connect Water, May 2024)

The terms 'fault' and 'seismic' are mentioned 44 and 40 times respectively in this report.

For example, the Preconcept Design basis (p.19) addresses seismic loading:

| Design Element | Design Basis | Justification for Design Basis | Next Steps |
|---|---|---|---|
| | It is assumed that 30% of overall excavations are double handled (cut to stockpile and cut from stockpile). | | |
| **Contaminated soil** | 10% of overall footprint is contaminated material and this is to remain on site. | Assumption only. | Investigate on-site contaminated soil stockpile locations and if insufficient space then review off-site removal options. |
| **Liner** | High density polyethylene (HDPE) | Lowest cost of the 3 options identified in MWH feasibility report. | Confirm liner selection. |
| **Liner protection** | 300mm GAP20 layer over base and batter slopes with thick geotextile over the liner. | Assumption only, to provide UV and mechanical protection. | Confirm requirements for liner protection. |
| **Embankment protection** | 300mm of cobbles or boulders (D50=300mm to 500mm) with 40kN biaxial geogrid on batters. | Assumption only, to provide wave protection. | Confirm requirements for embankment protection. |
| **Seismic loading** | PGA values of:<br>• 0.37g for the Operating Basis Earthquake (OBE)<br>• 1.08g for the Safety Evaluation Earthquake (SEE or MDE)<br>Site Class C adopted (shallow soil).<br>Allowance for additional geogrid for embankments for possible seismic displacement due to revised seismic loads | Based on MWH seismic shaking values from a GNS Science study from 2008 for the seismic hazard at the Stuart Macaskill Lakes.<br>Noting that seismic values adopted my MWH values for design have been superseded, and based on preliminary assessments by Beca, displacements in OBE events may increase. | Undertake a Site-Specific Seismic Hazard Assessment. Determine the $V_{s30}$ for the Pākuratahi Lake site and use the National Seismic Hazard Model to confirm seismic loads.<br>Update embankment design and lake configuration to account for any seismic requirement changes.<br>Undertake a Dam Break Flood Hazard Assessment. |

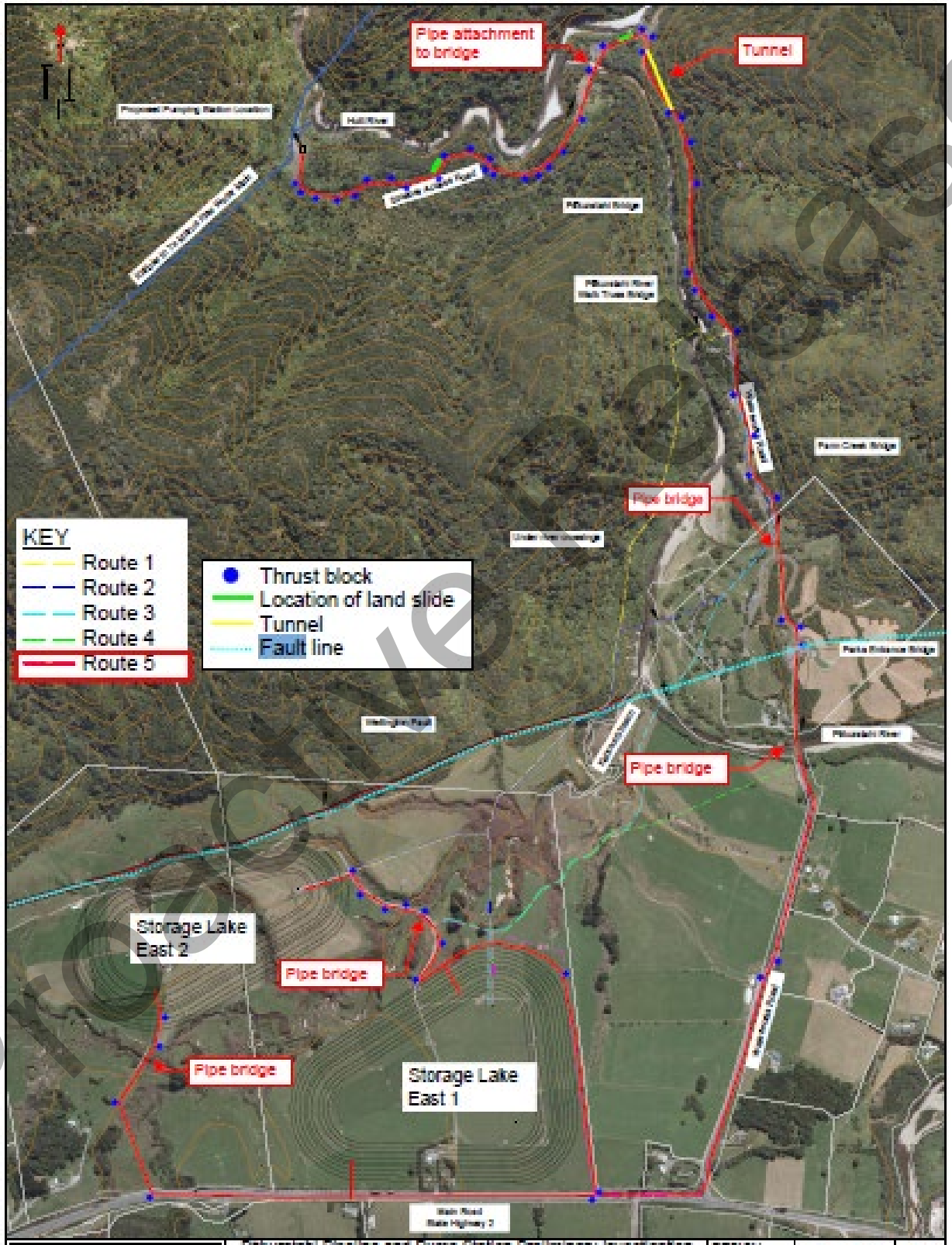
Allowance was made for line gate valves to be installed at each end of the pipe near the fault line to address seismic risks (p.15).

A review of seismic hazards is summarised in section 5.3.2.2 of this report.

The report recommended additional site investigation as part of the concept phase (p. 53).

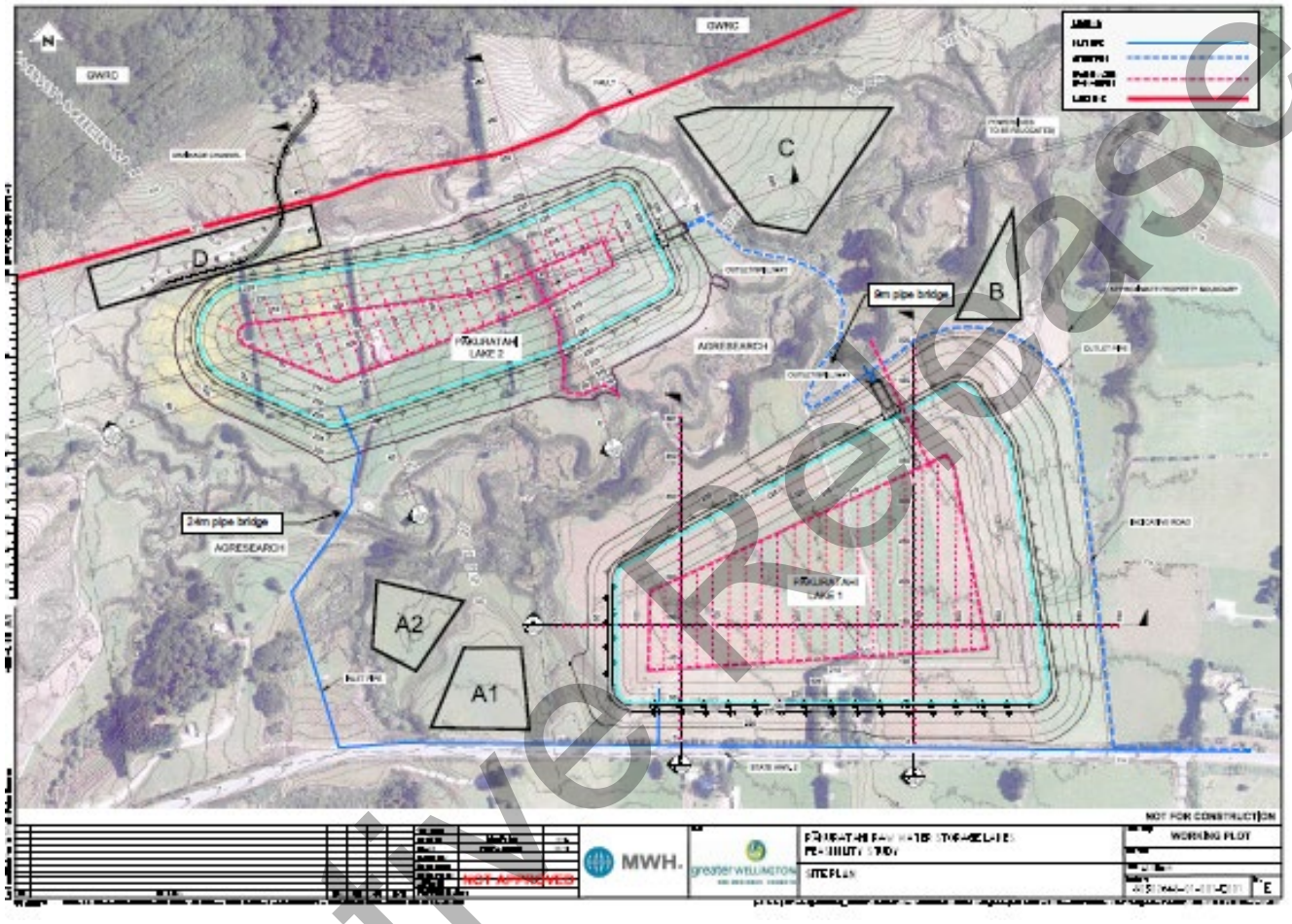
Cost estimates assumed the need for new bridging along the pipeline route to meet seismic requirements (p. 71). Seismic risks were considered as part of the Project Risk Register for the Te Marua Scheme Expansion (p. 359-363).

The Wellington Fault was identified in various maps and plans of the proposed scheme. For example (p. 95 – blue dotted line):




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Pakuratahi Pipeline and Pump Station Preliminary Investigation<br>Proposed Pipeline Alignments | | | | DESIGN | K. WENTWORTH-DAVIS | 4-2014 |
| | | | | | DRAWN | K. WENTWORTH-DAVIS | 4-2014 |
| | AMENDMENT | DWN | CHK | DATE | CHECKED | | |
| | | | | | APPROVED | | |
| | | | | | DWG No. | A3-10613/01-BS | |
| | | | | | FILE | D/01/10/08 | |

It also features below (bold red line – p.96)




**Source: Report 5 –** "Te Marua Scheme Expansion Stage 1 – Activity Brief" (Wellington Water Ltd. 15 May 2024)

Performance requirements for the Project include seismic resilience:

> *'The design shall align with the relevant Wellington Water seismic resilience strategy. Seismic design criteria shall include consideration of system-wide risks to service delivery when assessing post-event performance requirements (including redundancy, operational mitigations, reinstatement time, seismic repair stocks, etc).'* (p. 10).

Initial project risks assessed for the Storage Lakes include:

> *'Changes in seismic requirements for embankment designs could alter lake geometry and reduce storage capacity.'* (p. 17)

Seismic design criteria are identified regarding the design considerations for the Storage Lakes (p. 18-19).

If you have any concerns with the decision(s) referred to in this letter, you have the right to request an investigation and review by the Ombudsman under section 27(3) of the Local Government Official Information and Meetings Act 1987.

Please note that it is our policy to proactively release our responses to official information requests where appropriate. Our response to your request will be published shortly on Greater Wellington's website with your personal information removed.

Nāku iti noa, nā

**Julie Knauf**
Kaiwhakahaere Matua | Group Manager Corporate Services