

Paradise Dam

Summary of interpretive report on Roller Compacted Concrete (RCC) Degradation

January 2024

GHD provided the *Paradise Dam Improvement Project – Preliminary Interpretive Report on RCC Degradation* to Sunwater in October 2023. It provides a detailed review into the different methods that could lead to potential degradation of Paradise Dam's concrete in the long term.

This summary provides key details from the report, noting that the report's Executive Summary delivers top-level findings from the testing undertaken.

The full report, with required redactions for privacy, can be found on the Paradise Dam Improvement Project [new dam wall webpage](#).

Key findings from the testing program can specifically be found in Section 6 of the report.

What was the purpose of the report?

Testing was undertaken on Paradise Dam to provide input into the design of the improvement project. This testing uncovered several anomalies which raised concerns and required further investigation. Materials were then assessed, indicating there was potential for degradation (long-term strength and quality loss) in the concrete.

As there was no precedent for testing concrete degradation, Sunwater, our partners and independent experts were required to develop a bespoke and world-first testing program for this work (an overview of the testing undertaken is provided in this [Fact Sheet: long-term concrete strength issues and replacement dam](#)).

From this testing the program, the interpretative report was produced and outlined:

- the potential for degradation of Paradise Dam's RCC over time
- the potential methods which could contribute to long-term strength and quality impacts
- the potential impacts to the existing dam assuming no mitigation is to be undertaken.

What methods were considered in the report?

A longlist of methods that could potentially degrade concrete were considered in the report and can be found in **Section 6**. Eight methods were then shortlisted as detailed in **Section 8**.

Section 8.3 of the report outlines the final factors which were determined to impact the long-term strength and quality of the dam's concrete, compared to the known current strength.

What were the results?

The concrete samples had compressive (crushing), direct tensile (pulling), indirect tensile (splitting) and modulus (stiffness and response to load) tests applied under accelerated timeframes to understand the degree of potential strength loss.

These tests were applied to the concrete cores following ethylene glycol application and wet and dry cycles.

At a high-level, results from the testing show:

- a reduction in strength of up to 75 per cent following compressive testing of the concrete cores that had wet and dry applications
- a reduction in strength of 37 per cent following direct and indirect tensile testing of the ethylene glycol applications
- a reduction in elasticity of the RCC to 47 per cent following ethylene glycol treatment and modulus testing.

Results from the testing are outlined in **Section 9** of the report and show that, for the concrete cores which received ethylene glycol and wet and dry applications, tests yielded a strength loss of approximately 75 per cent from compression testing (crushing) and 37 per cent from tensile testing (pulling).

Why are some parts of the report redacted?

Parts of the report have been redacted for the following reasons:

- Privacy – where requested, names of some professionals who provided input into the report, have been redacted.
- Third party investigations, projects and case studies – where requested, investigations and projects not carried out by GHD or Sunwater and case studies referring to assets not owned by Sunwater have been redacted.