

## Isotope and chemical characterisation for understanding seepage pathways at Arapuni Dam, New Zealand

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Water chemistry, isotope dating and stable isotope signatures plus temperature measurements provide up-to-date approaches to identify the origins and pathways of seepage flows under and around dams. This paper describes their use at Arapuni Dam, before and after the targeted grouting of a foundation fissure under the dam, in which high pressures had developed.

Water samples were taken from boreholes, weirs and drains at the toe of the dam, in the abutments and the reservoir. Three sources of seepage water were differentiated using signatures from chemistry (major ions and compounds), age (tritium and chlorofluorocarbon dating), stable isotopes (oxygen and deuterium) and temperature. Prior to grouting, seepage through the foundation fissure was primarily composed of lake water with small components of young groundwater. After the grouting water signatures for the residual flow showed a clear change to a mix of old groundwater and a lake water component with a greater residence time. In combination with the other sample sites remaining unchanged, this provided a measure of grouting effectiveness independent of flow reduction.