Balancing increased capacity and flexibility with environmental values in a proposed redevelopment of an existing hydropower scheme

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ABSTRACT: The Tarraleah hydropower scheme is one of the oldest hydropower schemes in Tasmania, Australia. Water is diverted from Lake King William to the power station via two canals and bypasses 31 km of the River Derwent downstream of the lake. Much of the scheme is more than 80 years old and many of its assets are nearing the end of their operational life. The scheme needs significant investment to ensure it can avoid risk of failure and support the transition to a renewable dominated National Electricity Market reliably and safely well into the future.

The River Derwent downstream Lake King William has a highly regulated and reduced flow regime. The altered flow regime and the barrier of the dam has reduced the supply and mobilization of riverbed sediments. Reduced high flow events have also allowed terrestrial vegetation to encroach into the side and mid-channel bars. In combination, these factors have resulted in channel narrowing, armoring of the riverbed and a reduced area of active channel.

Hydrological modelling indicates that the spill regime downstream Lake King William would be further reduced in frequency and magnitude during operation of the proposed redeveloped scheme. The key environmental values protected by legislation identified for the river reach below Lake King William are a 23 km reach within the Tasmanian Wilderness World Heritage Area (TWWHA) and habitat for a threatened plant species *Barbarea australis* (native wintercress). *Barbarea australis* is an opportunistic riparian coloniser in the Brassicaceae family and is endemic to Tasmania. This species appears to rely on disturbance, particularly flow disturbance, to turn over riverbed sediments to create suitable conditions for its establishment. Without mitigation, a reduced spill regime could potentially impact TWWHA values, including habitat for *B. australis,* through reduced mobilisation of bed and bank sediments; increasing the rate of encroachment by terrestrial plants and accelerating contraction and armouring of the channel; and lower the quality of instream habitats for aquatic species. A hydraulic model was developed to determine the flow requirements to mobilise bed and bank sediments to maintain habitat for *B. australis* and slow terrestrial encroachment. The model outputs and historical spill data were used to propose flow releases to mitigate the impacts of the predicted reduced spill/high flow regime. The proposed mitigation measures increase the magnitude and frequency of spill events that are likely to maintain the existing TWWHA values and *B. australis* habitat requirements. The performance of the hydraulic model is currently being validated by field trials assessing rock movements under various flow events. It is also proposed to monitor and apply adaptive management relating to the size of the flow releases to ensure they are effective. These targeted mitigation measures offer a balance that allows more flexible operation without compromising existing environmental values in a regulated system.