26th International Congress on Modelling and Simulation, Adelaide, SA, Australia, 30 Nov–4 Dec 2025
mssanz.org.au/modsim2025

Modelling the cost and viability of brackish groundwater desalination for agriculture in the Murray–Darling Basin

Peter Reeve [a], Julien Anese [b], Ben Mullins [c], Ilka Wallis [c], Okke Batelaan [c], Howard Fallowfield [c], Holger Maier [a], Seth Westra [a], Kym Walton [d], Enys Watt [e], Darren Graetz [f] and Michael Leonard [a]

[a] School of Architecture and Civil Engineering, University of Adelaide, Adelaide, SA, Australia.
[b] Osmoflo, Adelaide, SA, Australia.
[c] National Centre for Groundwater Research and Training, Flinders University, Adelaide, SA, Australia
[d] One Basin Cooperative Research Centre, Loxton, Australia
[e] Department for Environment and Water, Government of South Australia, Adelaide, Australia
[f] South Australian Research and Development Institute, Department of Primary Industries and Regions, Government of South Australia, Adelaide, Australia
Email: peter.reeve@adelaide.edu.au

Abstract: Brackish groundwater is the only alternative water source available at scale in the Murray–Darling Basin (MDB), yet its potential for agriculture has been underexplored. This work presents a modelling framework and accompanying online tool for assessing the cost and feasibility of inland brackish groundwater desalination, developed through the One Basin Cooperative Research Centre. The approach integrates engineering, economic, climatic, and agricultural models into a single transparent platform, enabling stakeholders to evaluate the levellised cost of water (LCOW) under diverse conditions.

The Cost Calculator for Desalination in Agricultural Contexts (https://brackish.au/app/calc/) implements a number of simulation modules that consider desalination plant capital and operating costs, feedwater salinity, brine disposal methods, and renewable or grid energy configurations. Coupled with a simplified irrigation model based on climate data and crop coefficients, the tool estimates location-specific LCOW values across the MDB. This modelling approach facilitates scenario exploration, such as grid-connected versus solar-battery powered systems, or aquifer injection versus evaporation pond brine management, and highlights sensitivities to scale, utilisation, and recovery rates.

Results demonstrate that high utilisation and economies of scale are critical: a 5 ML/day system operating year-round can achieve LCOW below $1/kL, whereas smaller or seasonally operated plants can face prohibitively higher costs. Brine management emerges as a key constraint; aquifer injection offers lower costs but is geographically constrained to regions with favourable hydrogeology and faces regulatory hurdles, while evaporation basins increase capital expenditure. Integration with renewable energy is viable in remote locations but adds cost compared to grid-connected systems.

The calculator operates as a platform where users can explore 'what if' scenarios and observe the implications for cost, energy demand, and water security. The tool enables stakeholders to test scenarios, update inputs, and adapt decisions over time.

There are multiple potential uptake pathways. Some pathways can justify higher expenses, such as for municipal supply in remote communities, but for agriculture the greatest cost-effectiveness is in high-value horticulture. The calculator demonstrates that high utilisation is essential, and that seasonal use of desalination is far less cost-effective. Greenhouses provide one option for enabling year-round operation, producing high-value crops that are well suited to desalinated water. For perennial horticultural crops that have a seasonal water demand such as almonds, aquifer storage and recovery is required to enable continuous operation. In this case, surplus desalinated water produced outside the irrigation season can be stored underground and later recovered.

Tools such as the calculator developed in this project help remove barriers to understanding the financial requirements of desalinated water. However, further work is needed to address other barriers, particularly regulatory settings relating to aquifer storage and brine disposal. By combining transparent cost modelling with improved regulatory and technical frameworks, brackish groundwater desalination can become a viable component of the Murray–Darling Basin's water security strategy.

Keywords: *Brackish groundwater, desalination, Murray–Darling Basin, cost modelling, brine management.*