WaterSmart Dams

Benchmarking evaporation

Introduction

The WaterSmart Dams project is a collaborative initiative to improve the resilience and performance of farm dams in Western Australia.

As part of the project, a benchmarking study evaluated evaporation and leakage losses at two sites: Duranillin and Hines Hill using real-time weather and water level monitoring with the General Lake Model (GLM). The aim was to better understand water loss from unmodified farm dams to guide future dam designs and improve water security for growers.

Overview & Objective

This study was conducted on two mixed farming enterprises in the Wheatbelt of Western Australia. Both properties experience seasonal dry spells and rely on farm dams for livestock and domestic supply. The aim was to benchmark water losses through evaporation and leakage from unmodified dams to inform future water security strategies.

Key Players

This project was conducted with the following partners:

- Jefferies Family – Landholders
- Leigh Giles – Landholder
- University of Western Australia (UWA) – Technical support
- Department of Primary Industries and Regional Development (DPIRD) – Technical support
- Grower Group Alliance (GGA) – Project management
- Compass Agricultural Alliance and The Merredin & Districts Farm Improvement Group (MADFIG) - Grower group support

Challenges

Landholders can better plan farm water needs when they account for the volume and proportion of water lost to evaporation and leakage. It is important to understand this in relation to how much water dams have before the dry season, to ensure actual water needs are met.

This project is jointly funded through the Australian Government's Future Drought Fund (FDF) and the Western Australian state government's Agriculture Climate Resilience Fund.

Solution & Approach

Weather stations were installed on-site to record climate conditions, while depth sensors monitored water levels and temperature. These data were used with the General Lake Model (GLM) to separate evaporation from leakage and simulate water availability during dry seasons.

Duranillin Upper Dam:

Cropping, sheep, and cattle across 3,000 ha.

Catchment type: Sandplain

Dam: 5.3ML, 5.13m deep

Duranillin Lower Dam:

Catchment type: Sandplain

Dam: 2.6ML, 4.06m deep

Hines Hill Dam:

Mixed cropping

Catchment type: The gravel and clay-lined excavated earth embankment dam

Dam: 5ML, 5.24m deep, 15,543m²

Feature: ~2-3m windbreak wall built into basin

The Process

01 **Site selection & preparation:**

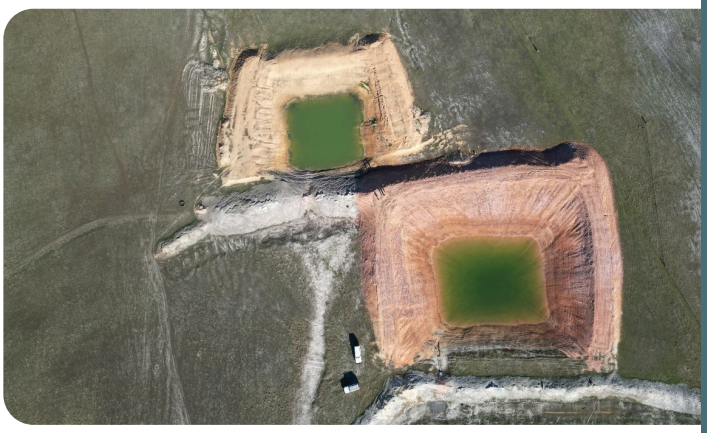
Targeted unmodified dams of varying shapes, depths, and landscape positions for meaningful comparisons.

02 **Equipment installation & data logging:**

Installed fixed and floating stations to log 10-minute meteorological and water level data.

03 **Modelling & analysis:**

Applied GLM to generate seasonal water balance, using the model and real data to measure evaporation and then estimate leakage losses. Evaluated average losses and future design options.



Duranillin dams

Rationale

Understanding and measuring evaporative and leakage losses provides evidence to guide cost-effective investments in water storage improvements.

This study shows that it is critical to have an adequately sized and high-performing catchment to ensure a dam is as full as possible before the dry season. Around 2-2.5m of water is lost from a dam each year through leakage and evaporation.

Results & Insight

Duranillin Site – Hosted by Jefferies Family

Upper Dam (5.3ML):

- Total annual loss: 2.53m (57% evaporation, 43% leakage)
- Starting the dry season at 50% capacity would leave only 13% of full storage as usable water

Lower Dam (2.6ML):

- Total annual loss: 2.09m (69% evaporation, 31% leakage)
- Same evaporation rate, but less total loss due to dam shape and size

Hines Hill Site – Hosted by Leigh Giles

5ML Dam:

- Total annual loss: 2.54m (64% evaporation, 36% leakage)
- Starting the dry season at 50% capacity would leave only 18% of full storage as usable water

Results showed that evaporation and leakage both contributed significantly to water loss, with dam shape and leakage rates driving major differences in stored water retention. This highlights that dam design and in particular a high-performing catchment is a critical part of improving water reliability.