WaterSmart Dams

Sub-surface drain

Introduction

As part of the WaterSmart Dams project, three growers across WA's south-west Wheatbelt trialled sub-surface drainage systems to investigate whether paddock waterlogging can be turned into a valuable water resource. Field trials measured both the quantity and quality (salinity) of water to evaluate if this is an option to enhance or supplement runoff into dams. From DIY trenching to contractor-installed designs, the growers hosted and evaluated sub-surface drainage options and tested them in real-world conditions across multiple seasons.

Overview & Objective

This trial investigated whether sub-surface drainage could offer a dual benefit by turning a problem (alleviating waterlogging) into a solution (increasing water available for farm dams). Monitoring over two winter seasons focused on flow volumes, seasonal variability, and water quality (salinity) across three sites, providing insight into the viability and consistency of drainage water as a supplementary source. The findings offer practical evidence to guide future on-farm decisions and the climate conditions under which it may work (or not work) to provide additional runoff into dams.

Key Players

This project was conducted with the following partners:

- Ashton Family – Landholder (Kojonup)
- Webb Family – Landholder (Qualeup)
- South Family – Landholder (Darkan)
- University of Western Australia (UWA) – Technical support
- Department of Primary Industries and Regional Development (DPIRD) – Technical support
- Grower Group Alliance (GGA) – Project management
- Southern Dirt & Compass Agricultural Alliance – Grower group support

Challenges

Sub-surface drains are an option to address waterlogging, but their reliability as a water source is relatively unknown. They only yield water when the soil profile is saturated, so their suitability is limited to wetter times of the year and areas of SWWA with the climate and soil conditions that lead to waterlogged paddocks.

Key questions that this work focused on were the actual yield (volume) of water that came out of the drain, to compare this within (seasons) and between years. It was also unknown whether drained water might be too salty for stock drinking water quality.

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

Three sub-surface drainage systems were installed across the south-west Wheatbelt to investigate whether these systems could address waterlogging and also provide a supplementary water source for stock dams. Each system was instrumented to measure flow volumes, rainfall, and salinity (electrical conductivity), offering insights into both water quantity and quality.

While the installations varied from buried/insert socked AgPipe systems to open V-drains, all were designed to direct drainage into existing dams and were monitored to assess seasonal performance and consistency.

Results & Insight

Over two winter seasons, all three drainage systems consistently delivered relatively fresh water suitable for livestock, with salinity levels below the recommended threshold of <2,000 mg/L.

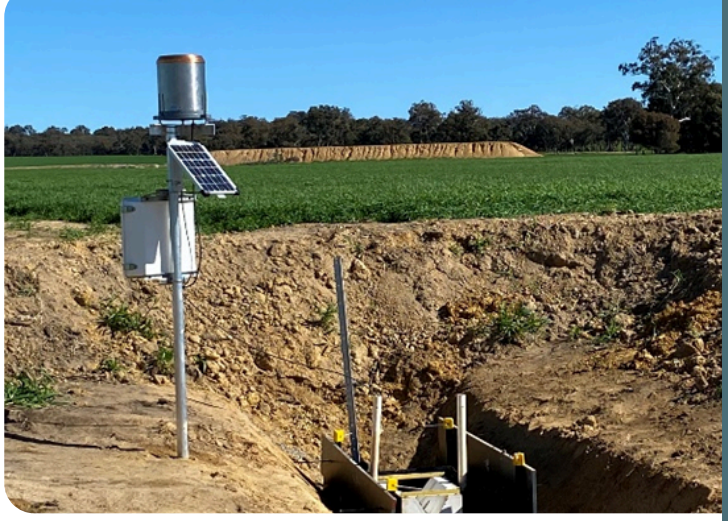
While the systems performed reliably in terms of water quality, discharge volumes varied significantly between 2023 and 2024, even at the same site and under similar rainfall. For example, the South site discharged 16 times more water in 2024 than in 2023, despite receiving less rain over the same period. This was likely due to one specific rainfall event and the more open design of these particular sub-surface drains.

These findings highlight the potential of sub-surface drains to support or supplement dam water supply in some years, while underscoring the need for dams to still have a reliable catchment that can deliver runoff in below-average and dry years.

Buried sub-surface drain - Kojonup (Ashton site):
1.64 ML over two winters from 507mm total rainfall, with 84% discharged in winter 2023 despite 8mm less total rainfall
Average salinity: 1,223 mg/L

Buried sub-surface drain - Qualeup (Webb site):
1.64 ML from 325mm total rainfall in winter 2024. Flow driven by a strong 18-day event in Aug/Sept. No other winter data for comparison.
Average salinity: 418 mg/L.

Open sub-surface drain - Darkan (South site):
2.47 ML over 13 months, from 533mm total rainfall. 94% of which occurred during 2024 winter period whereby the drain flowed almost continuously
Salinity: 279 mg/L.



The role of sub-surface drainage ?

- The open sub-surface drains intercept throughflow and also collect direct rainfall during heavy events, but at the penalty of trafficability.
- Buried sub-surface drains are better integrated with efficient tram-line farming systems, but they can only drain water when the soil profile is saturated.
- The average salinity of drainage water was very low for the systems that were monitored in this study (280 to 1,225 mg/l). Where sub-surface drainage is installed higher in the landscape and in areas where there is no surface evidence of salinity (e.g. it is a pure waterlogging and not a waterlogging plus salinity problem), sub-surface delivered high-quality (low-salinity) water inflow.
- Sub-surface drainage should be viewed as something that:
  - It is a high-quality water resource that should be captured and stored where possible.
  - Something that boosts runoff in average to above-average years so you have more water over summer, or before the next dry spell.
  - Not a replacement for having an adequate catchment for a dam that can capture water in below-average and low rainfall years, particularly high-performing catchments that capture lower-intensity rainfall events.

Take-home message

Sub-surface drains offer a practical way to manage waterlogging and use the “waste water”, to supplement dam inflows. A key limitation is that discharge is limited to wetter months, and will not occur reliably in dry years when dam inflows are critical. While water quality was good in this study, it is essential to monitor it closely, particularly for livestock, including salinity and other relevant parameters. Sub-surface drains will not drought-proof your property, but can deliver high-quality water to supplement dam inflows.